

LIGHT UNFLAVORED MESONS

($S = C = B = 0$)

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

$f_0(500)$

or σ

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

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

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(400–550)–i(200–350) OUR ESTIMATE			
[(400–1200)– i (250–500) MeV OUR 2011 ESTIMATE]			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
(445 $\pm$ 25)– i (278 $^{+22}_{-18}$)	1,2 GARCIA-MAR..11	RVUE	Compilation
(457 $^{+14}_{-13}$)– i (279 $^{+118}_{-7}$)	1,3 GARCIA-MAR..11	RVUE	Compilation
(442 $^{+5}_{-8}$)– i (274 $^{+6}_{-5}$)	4 MOUSSALLAM11	RVUE	Compilation
(452 $\pm$ 13)– i (259 $\pm$ 16)	5 MENNESSIER 10	RVUE	Compilation
(448 $\pm$ 43)– i (266 $\pm$ 43)	6 MENNESSIER 10	RVUE	Compilation
(455 $\pm$ 6 $^{+31}_{-13}$)– i (278 $\pm$ 6 $^{+34}_{-43}$)	7 CAPRINI 08	RVUE	Compilation
(463 $\pm$ 6 $^{+31}_{-17}$)– i (259 $\pm$ 6 $^{+33}_{-34}$)	8 CAPRINI 08	RVUE	Compilation
(552 $^{+84}_{-106}$)– i (232 $^{+81}_{-72}$)	9 ABLIKIM 07A	BES2	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
(466 $\pm$ 18)– i (223 $\pm$ 28)	10 BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
(472 $\pm$ 30)– i (271 $\pm$ 30)	11 BUGG 07A	RVUE	Compilation
(484 $\pm$ 17)– i (255 $\pm$ 10)	GARCIA-MAR..07	RVUE	$K e 4$
(430)– i (325)	12 ANISOVICH 06	RVUE	Compilation
(441 $^{+16}_{-8}$)– i (272 $^{+9}_{-12.5}$)	13 CAPRINI 06	RVUE	$\pi\pi \rightarrow \pi\pi$
(470 $\pm$ 50)– i (285 $\pm$ 25)	14 ZHOU 05	RVUE	
(541 $\pm$ 39)– i (252 $\pm$ 42)	15 ABLIKIM 04A	BES2	$J/\psi \rightarrow \omega \pi^+ \pi^-$
(528 $\pm$ 32)– i (207 $\pm$ 23)	16 GALLEGOS 04	RVUE	Compilation
(440 $\pm$ 8)– i (212 $\pm$ 15)	17 PELAEZ 04A	RVUE	$\pi\pi \rightarrow \pi\pi$
(533 $\pm$ 25)– i (249 $\pm$ 25)	18 BUGG 03	RVUE	
517 – i 240	BLACK 01	RVUE	$\pi^0 \pi^0 \rightarrow \pi^0 \pi^0$
(470 $\pm$ 30)– i (295 $\pm$ 20)	13 COLANGELO 01	RVUE	$\pi\pi \rightarrow \pi\pi$
(535 $^{+48}_{-36}$)– i (155 $^{+76}_{-53}$)	19 ISHIDA 01		$\Upsilon(3S) \rightarrow \Upsilon \pi\pi$
610 $\pm$ 14 – i 620 $\pm$ 26	20 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 – i 235	HANNAH 99	RVUE	π scalar form factor
(523 $\pm$ 12)– i (259 $\pm$ 7)	KAMINSKI 99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
442 – i 227	OLLER 99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
469 – i 203	OLLER 99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
445 – i 221	OLLER 99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$
(1530 $^{+90}_{-250}$)– i (560 $\pm$ 40)	ANISOVICH 98B	RVUE	Compilation
420 – i 212	LOCHER 98	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
440 – i 245	21 DOBADO 97	RVUE	Compilation
(602 $\pm$ 26)– i (196 $\pm$ 27)	22 ISHIDA 97		$\pi\pi \rightarrow \pi\pi$
(537 $\pm$ 20)– i (250 $\pm$ 17)	23 KAMINSKI 97B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, 4\pi$
470 – i 250	24,25 TORNQVIST 96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
387 – i 305	25,26 JANSSEN 95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
420 – i 370	27 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 – i 356	28 ZOU 94B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
408 – i 342	25,28 ZOU 93	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
470 – i 208	29 VANBEVEREN 86	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta,$
(750 $\pm$ 50)– i (450 $\pm$ 50)	30 ESTABROOKS 79	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
(660 $\pm$ 100)– i (320 $\pm$ 70)	PROTOPOP... 73	HBC	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
650 – i 370	31 BASDEVANT 72	RVUE	$\pi\pi \rightarrow \pi\pi$

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- ¹ Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.
- ² Analytic continuation using Roy equations.
- ³ Analytic continuation using GKPY equations.
- ⁴ Using Roy equations.
- ⁵ 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.
- ⁶ Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.
- ⁷ From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.
- ⁸ From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPOPESCU 73, GRAYER 74, and ESTABROOKS 74.
- ⁹ From a mean of three different $f_0(500)$ parametrizations. Uses 40k events.
- ¹⁰ From an isobar model using 2.6k events.
- ¹¹ Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.
- ¹² Using the N/D method.
- ¹³ From the solution of the Roy equation (ROY 71) for the isoscalar S-wave and using a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.
- ¹⁴ Reanalysis of the data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.
- ¹⁵ From a mean of six different analyses and $f_0(500)$ parameterizations.
- ¹⁶ Using data on $\psi(2S) \rightarrow J/\psi \pi\pi$ from BAI 00E and on $\Upsilon(nS) \rightarrow \Upsilon(mS) \pi\pi$ from BUTLER 94B and ALEXANDER 98.
- ¹⁷ Reanalysis of data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.
- ¹⁸ From a combined analysis of HYAMS 73, AUGUSTIN 89, AITALA 01B, and PISLAK 01.
- ¹⁹ A similar analysis (KOMADA 01) finds $(580^{+79}_{-30}) - i(190^{+107}_{-49})$ MeV.
- ²⁰ 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.
- ²¹ Using the inverse amplitude method and data of ESTABROOKS 73, GRAYER 74, and PROTOPOPESCU 73.
- ²² Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- ²³ Average and spread of 4 variants ("up" and "down") of KAMINSKI 97B 3-channel model.
- ²⁴ 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.
- ²⁵ Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.
- ²⁶ Analysis of data from FALVARD 88.
- ²⁷ Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.
- ²⁸ Analysis of data from OCHS 73, GRAYER 74, and ROSSELET 77.
- ²⁹ Coupled-channel analysis using data from PROTOPOPESCU 73, HYAMS 73, HYAMS 75, GRAYER 74, ESTABROOKS 74, ESTABROOKS 75, FROGGATT 77, CORDEN 79, BISWAS 81.
- ³⁰ Analysis of data from APEL 73, GRAYER 74, CASON 76, PAWLICKI 77. Includes spread and errors of 4 solutions.
- ³¹ Analysis of data from BATON 70, BENSINGER 71, COLTON 71, BAILLON 72, PROTOPOPESCU 73, and WALKER 67.

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(400–1200) OUR ESTIMATE			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
513 ± 32	32 MURAMATSU 02	CLEO	$e^+ e^- \approx 10 \text{ GeV}$
$478^{+24}_{-23} \pm 17$	AITALA	01B E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
563^{+58}_{-29}	33 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon \pi\pi$
555	34 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	35 TROYAN	98	$5.2 n p \rightarrow n p \pi^+ \pi^-$
780 ± 30	ALDE	97 GAM2	$450 p p \rightarrow p p \pi^0 \pi^0$
585 ± 20	36 ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
761 ± 12	37 SVEC	96 RVUE	$6\text{--}17 \pi N_{\text{polar}} \rightarrow \pi^+ \pi^- N$
~ 860	38,39 TORNQVIST	96 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1165 ± 50	40,41 ANISOVICH	95 RVUE	$\pi^- p \rightarrow \pi^0 \pi^0 n,$ $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \pi^0 \eta, \pi^0 \eta\eta$
~ 1000	42 ACHASOV	94 RVUE	$\pi\pi \rightarrow \pi\pi$
414 ± 20	37 AUGUSTIN	89 DM2	

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→ NOT CHECKED ←

- 32 Statistical uncertainty only.
- 33 A similar analysis (KOMADA 01) finds 526^{+48}_{-37} MeV.
- 34 From the best fit of the Dalitz plot.
- 35 6σ effect, no PWA.
- 36 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 37 Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^- \pi^+ N$ on polarized targets. The fit does not include $f_0(980)$.
- 38 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.
- 39 Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays.
- 40 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.
- 41 The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.
- 42 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.

$f_0(500)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

(600–1000) OUR ESTIMATE

• • • We do not use the following data for averages, fits, limits, etc. • • •			
335 ± 67	43 MURAMATSU 02	CLEO	$e^+ e^- \approx 10$ GeV
$324^{+42}_{-40} \pm 21$	AITALA	01B E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
372^{+229}_{-95}	44 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon \pi \pi$
540	45 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	46 TROYAN	98	$5.2 n p \rightarrow n p \pi^+ \pi^-$
780 ± 60	ALDE	97 GAM2	$450 p p \rightarrow p p \pi^0 \pi^0$
385 ± 70	47 ISHIDA	97	$\pi \pi \rightarrow \pi \pi$
290 ± 54	48 SVEC	96 RVUE	$6\text{--}17 \pi N_{\text{polar}} \rightarrow \pi^+ \pi^- N$
~ 880	49,50 TORNQVIST	96 RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi, \eta \pi$
460 ± 40	51,52 ANISOVICH	95 RVUE	$\pi^- p \rightarrow \pi^0 \pi^0 n, \bar{p} p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \pi^0 \eta, \pi^0 \eta \eta$
~ 3200	53 ACHASOV	94 RVUE	$\pi \pi \rightarrow \pi \pi$
494 ± 58	48 AUGUSTIN	89 DM2	

- 43 Statistical uncertainty only.
- 44 A similar analysis (KOMADA 01) finds 301^{+145}_{-100} MeV.
- 45 From the best fit of the Dalitz plot.
- 46 6σ effect, no PWA.
- 47 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 48 Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^- \pi^+ N$ on polarized targets. The fit does not include $f_0(980)$.
- 49 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.
- 50 Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays.
- 51 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.
- 52 The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.
- 53 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.

$f_0(500)$ DECAY MODES

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

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DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

$f_0(500)$ 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	54 HOERICHTER11	RVUE	Compilation
3.08 ± 0.82	55 MENNESSIER 11	RVUE	Compilation
2.08 ± 0.2 $^{+0.07}_{-0.04}$	56 MOUSSALLAM11	RVUE	Compilation
2.08	57 MAO 09	RVUE	Compilation
1.2 ± 0.4	58 BERNABEU 08	RVUE	
3.9 ± 0.6	55 MENNESSIER 08	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
1.8 ± 0.4	59 OLLER 08	RVUE	Compilation
1.68 ± 0.15	59,60 OLLER 08A	RVUE	Compilation
3.1 ± 0.5	61,62 PENNINGTON 08	RVUE	Compilation
2.4 ± 0.4	62,63 PENNINGTON 08	RVUE	Compilation
4.1 ± 0.3	64 PENNINGTON 06	RVUE	$\gamma\gamma \rightarrow \pi^0\pi^0$
3.8 ± 1.5	65,66 BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
5.4 ± 2.3	65 MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
10 ± 6	COURAU 86	DM1	$e^+e^- \rightarrow \pi^+\pi^-e^+e^-$
54 Using Roy-Steiner equations with $\pi\pi$ phase shifts from an update of COLANGELO 01 and from GARCIA-MARTIN 11.			
55 Using an analytic K-matrix model.			
56 Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.			
57 Used dispersion theory. The value quoted used the $f_0(500)$ pole position of $457 - i276$ MeV.			
58 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.			
59 Using twice-subtracted dispersion integrals.			
60 Supersedes OLLER 08.			
61 Solution A (preferred solution based on χ^2 -analysis).			
62 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.			
63 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).			
64 Using unitarity and the σ pole position from CAPRINI 06.			
65 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 $f_2(1270)$.			
66 Supersedes MORGAN 90.			

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 $f_0(500)$ REFERENCES

GARCIA-MAR...11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)
HOERICHTER 11	EPJ C71 1743	M. Hoferichter, D.R. Phillips, C. Schat	(BONN+)
MENNESSIER 11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang	
MOUSSALLAM 11	EPJ C71 1814	B. Moussallam	
BATLEY 10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)
MENNESSIER 10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang	
MAO 09	PR D79 116008	Y. Mao <i>et al.</i>	
BATLEY 08A	EPJ C54 411	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)
BERNABEU 08	PRL 100 241804	J. Bernabeu, J. Prades	(IFIC, GRAN)
CAPRINI 08	PR D77 114019	I. Caprini	
MENNESSIER 08	PL B665 205	G. Mennessier, S. Narison, W. Ochs	
OLLER 08	PL B659 201	J.A. Oller, L. Roca, C. Schat	(MURC, UBA)
OLLER 08A	EPJ A37 15	J.A. Oller, L. Roca	(MURC)
PENNINGTON 08	EPJ C56 1	M.R. Pennington <i>et al.</i>	
UEHARA 08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM 07A	PL B645 19	M. Ablikim <i>et al.</i>	(BES Collab.)
BONVICINI 07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
BUGG 07A	JPG 34 151	D.V. Bugg <i>et al.</i>	
GARCIA-MAR...07	PR D76 074034	R. Garcia-Martin, J.R. Pelaez, F.J. Yndurain	
MORI 07	PR D75 051101R	T. Mori <i>et al.</i>	(BELLE Collab.)
ANISOVICH 06	IJMP A21 3615	V.V. Anisovich	
CAPRINI 06	PRL 96 132001	I. Caprini, G. Colangelo, H. Leutwyler	(BCIP+)
PDG 06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
PENNINGTON 06	PRL 97 011601	M.R. Pennington	
ZHOU 05	JHEP 0502 043	Z.Y. Zhou <i>et al.</i>	
ABLIKIM 04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)
AKHMETSHIN 04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
GALLEGOS 04	PR D69 074033	A. Gallegos <i>et al.</i>	
PELAEZ 04A	MPL A19 2879	J.R. Pelaez	
BUGG 03	PL B572 1	D.V. Bugg	
PISLAK 03	PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)
Also	PR D81 119903E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)
MURAMATSU 02	PRL 89 251802	H. Muramatsu <i>et al.</i>	(CLEO Collab.)
Also	PRL 90 059901 (erratum)	H. Muramatsu <i>et al.</i>	(CLEO Collab.)
AITALA 01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BLACK 01	PR D64 014031	D. Black <i>et al.</i>	
COLANGELO 01	NP B603 125	G. Colangelo, J. Gasser, H. Leutwyler	
ISHIDA 01	PL B518 47	M. Ishida <i>et al.</i>	
KOMADA 01	PL B508 31	T. Komada <i>et al.</i>	

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

$\rho(770)$

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

A REVIEW GOES HERE – Check our WWW List of Reviews

 $\rho(770)$ 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
775.49±0.34 OUR AVERAGE				
775.97±0.46±0.70	900k	¹ AKHMETSHIN 07		$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}$
774.6 ±0.4 ±0.5	800k	^{2,3} ACHASOV 06	SND	$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}$
775.65±0.64±0.50	114k	^{4,5} AKHMETSHIN 04	CMD2	$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}$
775.9 ±0.5 ±0.5	1.98M	⁶ ALOISIO 03	KLOE	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
775.8 ±0.9 ±2.0	500k	⁶ ACHASOV 02	SND	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
775.9 ±1.1		⁷ 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	⁸ ALOISIO 03	KLOE	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
775.9 ±0.6 ±0.5	1.98M	⁹ ALOISIO 03	KLOE	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
775.0 ±0.6 ±1.1	500k	¹⁰ ACHASOV 02	SND	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
775.1 ±0.7 ±5.3		¹¹ BENAYOUN 98	RVUE	$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}, \mu^{+}\mu^{-}$
770.5 ±1.9 ±5.1		¹² GARDNER 98	RVUE	$0.28-0.92 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}$
764.1 ±0.7		¹³ O'CONNELL 97	RVUE	$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}$
757.5 ±1.5		¹⁴ BERNICHA 94	RVUE	$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}$
768 ±1		¹⁵ 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	^{16,17} FUJIKAWA 08	BELL	±	$\tau^{-} \rightarrow \pi^{-}\pi^0\nu_{\tau}$
775.5 ±0.7		^{17,18} SCHAELE 05c	ALEP		$\tau^{-} \rightarrow \pi^{-}\pi^0\nu_{\tau}$
775.5 ±0.5 ±0.4	1.98M	⁶ ALOISIO 03	KLOE		$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
775.1 ±1.1 ±0.5	87k	^{19,20} 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	⁹ ALOISIO 03	KLOE	−	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
776.3 ±0.6 ±0.7	1.98M	⁹ ALOISIO 03	KLOE	+	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
773.9 ±2.0 ^{+0.3} −1.0		²¹ SANZ-CILLERO03	RVUE		$\tau^{-} \rightarrow \pi^{-}\pi^0\nu_{\tau}$
774.5 ±0.7 ±1.5	500k	⁶ ACHASOV 02	SND	±	$1.02 e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^0$
775.1 ±0.5		²² PICH 01	RVUE		$\tau^{-} \rightarrow \pi^{-}\pi^0\nu_{\tau}$

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OCCUR=2

OCCUR=3

OCCUR=2

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
763.0±0.3±1.2					
	600k	²³ ABELE 99E	CBAR	0±	$0.0 \bar{p}p \rightarrow \pi^{+}\pi^{-}\pi^0$

NODE=M009M7
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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	²⁴ CAPRARO 87	SPEC	−	$200 \pi^{-}\pi^0\text{Cu} \rightarrow \pi^{-}\pi^0\text{Cu}$
761 ±5	967	²⁴ 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	²⁵ BYERLY 73	OSPK	−	5 $\pi^{-}p$
766.8±1.5	9650	²⁶ PISUT 68	RVUE	−	1.7–3.2 $\pi^{-}p, t < 10$
767 ±6	900	²⁴ EISNER 67	HBC	−	4.2 $\pi^{-}p, t < 10$

NODE=M009M2
NODE=M009M2

OCCUR=2

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
768.5 ± 1.1 OUR AVERAGE					
770 ± 2 ± 1	79k	27 BREITWEG 98B	ZEUS	0	50–100 γp
767.6 ± 2.7		BARTALUCCI 78	CNTR	0	$\gamma p \rightarrow e^+ e^- p$
775 ± 5		GLADDING 73	CNTR	0	2.9–4.7 γp
767 ± 4	1930	BALLAM 72	HBC	0	2.8 γp
770 ± 4	2430	BALLAM 72	HBC	0	4.7 γp
765 ± 10		ALVENSLEB... 70	CNTR	0	γA , $t < 0.01$
767.7 ± 1.9	140k	BIGGS 70	CNTR	0	$< 4.1 \gamma C \rightarrow \pi^+ \pi^- C$

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OCCUR=2

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

771 ± 2	79k	28 BREITWEG 98B	ZEUS	0	50–100 γp

OCCUR=2

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
769.0 ± 0.9 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.
765 ± 6		BERTIN 97C	OBLX		0.0 $\bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
773 ± 1.6		WEIDENAUER 93	ASTE		$\bar{p} p \rightarrow \pi^+ \pi^- \omega$
762.6 ± 2.6		AGUILAR... 91	EHS		400 $p p$
770 ± 2		29 HEYN 81	RVUE		Pion form factor
768 ± 4		30,31 BOHACIK 80	RVUE	0	
769 ± 3		25 WICKLUND 78	ASPK	0	3,4,6 $\pi^\pm N$
768 ± 1	76000	DEUTSCH... 76	HBC	0	16 $\pi^+ p$
767 ± 4	4100	ENGLER 74	DBC	0	6 $\pi^+ n \rightarrow \pi^+ \pi^- p$
775 ± 4	32000	30 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 $\pi^- p$
769.2 ± 1.5	13300	32 PISUT 68	RVUE	0	1.7–3.2 $\pi^- p$, $t < 10$

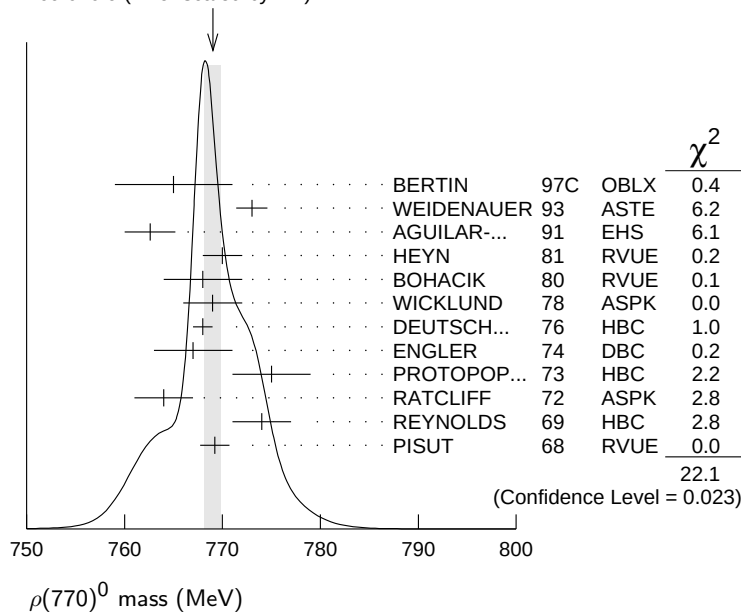
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• • • We do not use the following data for averages, fits, limits, etc. • • •

773.5 ± 2.5		33 COLANGELO 01	RVUE		$\pi\pi \rightarrow \pi\pi$
762.3 ± 0.5 ± 1.2	600k	34 ABELE 99E	CBAR	0	0.0 $\bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
777 ± 2	4943	35 ADAMS 97	E665		470 $\mu p \rightarrow \mu X B$
770 ± 2		36 BOGOLYUB... 97	MIRA		32 $\bar{p} p \rightarrow \pi^+ \pi^- X$
768 ± 8		36 BOGOLYUB... 97	MIRA		32 $p p \rightarrow \pi^+ \pi^- X$
761.1 ± 2.9		DUBNICKA 89	RVUE		π form factor
777.4 ± 2.0		37 CHABAUD 83	ASPK	0	17 $\pi^- p$ polarized
769.5 ± 0.7		30,31 LANG 79	RVUE	0	
770 ± 9		31 ESTABROOKS 74	RVUE	0	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
773.5 ± 1.7	11200	24 JACOBS 72	HBC	0	2.8 $\pi^- p$
775 ± 3	2250	HYAMS 68	OSPK	0	11.2 $\pi^- p$

OCCUR=2

WEIGHTED AVERAGE
 769.0 ± 0.9 (Error scaled by 1.4)



- 1 A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
- 2 Supersedes ACHASOV 05A.
- 3 A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.
- 4 Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.
- 5 Update of AKHMETSHIN 02.
- 6 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- 7 From the GOUNARIS 68 parametrization of the pion form factor.
- 8 Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
- 9 Without limitations on masses and widths.
- 10 Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
- 11 Using the data of BARKOV 85 in the hidden local symmetry model.
- 12 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.
- 13 A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
- 14 Applying the S-matrix formalism to the BARKOV 85 data.
- 15 Includes BARKOV 85 data. Model-dependent width definition.
- 16 $|F_\pi(0)|^2$ fixed to 1.
- 17 From the GOUNARIS 68 parametrization of the pion form factor.
- 18 The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
- 19 $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
- 20 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.
- 21 Using the data of BARATE 97M and the effective chiral Lagrangian.
- 22 From a fit of the model-independent parameterization of the pion form factor to the data of BARATE 97M.
- 23 Assuming the equality of ρ^+ and ρ^- masses and widths.
- 24 Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- 25 Phase shift analysis. Systematic errors added corresponding to spread of different fits.
- 26 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.
- 27 From the parametrization according to SOEDING 66.
- 28 From the parametrization according to ROSS 66.
- 29 HEYN 81 includes all spacelike and timelike F_π values until 1978.
- 30 From pole extrapolation.
- 31 From phase shift analysis of GRAYER 74 data.
- 32 Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDHABER 64, ABOLINS 63.
- 33 Breit-Wigner mass from a phase-shift analysis of HYAMS 73 and PROTOPODESCU 73 data.
- 34 Using relativistic Breit-Wigner and taking into account ρ - ω interference.
- 35 Systematic errors not evaluated.
- 36 Systematic effects not studied.
- 37 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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$m_{\rho(770)^0} - m_{\rho(770)^\pm}$

NODE=M009D

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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		38 SCHAEAL	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
0.4±0.7±0.6	1.98M	39 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3±1.1±2.0	500k	39 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	40 REYNOLDS	69	HBC	-0 $2.26 \pi^- p$
-5 ±5	3600	40 FOSTER	68	HBC	±0 $0.0 \bar{p} p$
2.4±2.1	22950	41 PISUT	68	RVUE	$\pi N \rightarrow \rho N$

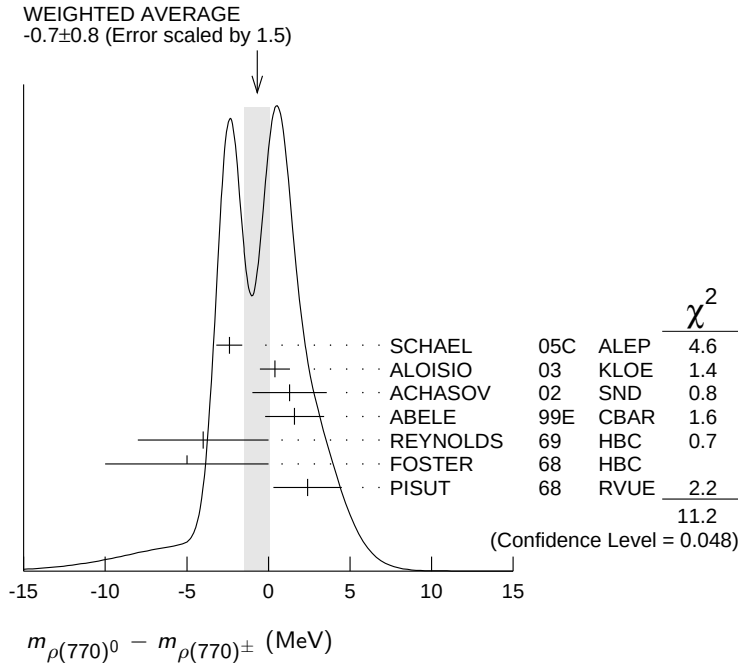
- 38 From the combined fit of the τ^- data from ANDERSON 00A and SCHAE 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.
- 39 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- 40 From quoted masses of charged and neutral modes.
- 41 Includes MALAMUD 69, ARMENISE 68, BATON 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65, CARMONY 64, GOLDHABER 64, ABOLINS 63.

NODE=M009D;LINKAGE=SC

NODE=M009D;LINKAGE=CH

NODE=M009D;LINKAGE=A

NODE=M009D;LINKAGE=R



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

NODE=M009D1

NODE=M009D1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5±0.8±0.7	1.98M	⁴² ALOISIO	03	KLOE 1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
⁴² Without limitations on masses and widths.				

NODE=M009D;LINKAGE=WO

$\rho(770)$ RANGE PARAMETER

NODE=M009R

NODE=M009R

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

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

NODE=M009R

$\rho(770)$ WIDTH

NODE=M009220

NODE=M009220

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

NEUTRAL ONLY, e^+e^-

NODE=M009W0

NODE=M009W0

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
146.2 ±0.7	OUR AVERAGE	Error includes scale factor of 1.1.			
145.98±0.75±0.50	900k	⁴³ AKHMETSHIN	07		$e^+e^- \rightarrow \pi^+\pi^-$
146.1 ±0.8 ±1.5	800k	^{44,45} ACHASOV	06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
143.85±1.33±0.80	114k	^{46,47} AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
147.3 ±1.5 ±0.7	1.98M	⁴⁸ ALOISIO	03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
151.1 ±2.6 ±3.0	500k	⁴⁸ ACHASOV	02	SND	0 1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
150.5 ±3.0		⁴⁹ BARKOV	85	OLYA	0 $e^+e^- \rightarrow \pi^+\pi^-$

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

143.9 ±1.3 ±1.1	1.98M	50	ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=2
147.4 ±1.5 ±0.7	1.98M	51	ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=3
149.8 ±2.2 ±2.0	500k	52	ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=3
147.9 ±1.5 ±7.5		53	BENAYOUN	98	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- , \mu^+ \mu^-$	
153.5 ±1.3 ±4.6		54	GARDNER	98	RVUE	$0.28-0.92 e^+ e^- \rightarrow \pi^+ \pi^-$	
145.0 ±1.7		55	O'CONNELL	97	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$	
142.5 ±3.5		56	BERNICA	94	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$	
138 ±1		57	GESHKEN...	89	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$	

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	58,59	FUJIKAWA	08	BELL	$\pm$	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	
149.0±1.2		59,60	SCHAEAL	05c	ALEP		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	
149.9±2.3±2.0	500k	48	ACHASOV	02	SND	$\pm$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=2
150.4±1.4±1.4	87k	61,62	ANDERSON	00A	CLE2		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	

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

143.7±1.3±1.2	1.98M	48	ALOISIO	03	KLOE	$\pm$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	
142.9±1.3±1.4	1.98M	51	ALOISIO	03	KLOE	$-$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=2
144.7±1.4±1.2	1.98M	51	ALOISIO	03	KLOE	$+$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	OCCUR=3
150.2±2.0 $^{+0.7}_{-1.6}$		63	SANZ-CILLERO	03	RVUE		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	
150.9±2.2±2.0	500k	52	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	64	ABELE	99E	CBAR	0±	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$	

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	65	CAPRARO	87	SPEC	$-$	$200 \pi^- \text{Cu} \rightarrow \pi^- \pi^0 \text{Cu}$	
154 ±20	967	65	CAPRARO	87	SPEC	$-$	$200 \pi^- \text{Pb} \rightarrow \pi^- \pi^0 \text{Pb}$	OCCUR=2
150 ± 5			HUSTON	86	SPEC	$+$	$202 \pi^+ \text{A} \rightarrow \pi^+ \pi^0 \text{A}$	
146 ±12	6500	66	BYERLY	73	OSPK	$-$	$5 \pi^- p$	
148.2± 4.1	9650	67	PISUT	68	RVUE	$-$	$1.7-3.2 \pi^- p, t < 10$	
146 ±13	900		EISNER	67	HBC	$-$	$4.2 \pi^- p, t < 10$	

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

150.7± 2.9 OUR AVERAGE

146 ± 3 ±13	79k	68	BREITWEG	98B	ZEUS	0	$50-100 \gamma p$	
150.9± 3.0			BARTALUCCI	78	CNTR	0	$\gamma p \rightarrow e^+ e^- p$	
138 ± 3	79k	69	BREITWEG	98B	ZEUS	0	$50-100 \gamma p$	OCCUR=2
147 ±11			GLADDING	73	CNTR	0	$2.9-4.7 \gamma p$	
155 ±12	2430		BALLAM	72	HBC	0	$4.7 \gamma p$	
145 ±13	1930		BALLAM	72	HBC	0	$2.8 \gamma p$	OCCUR=2
140 ± 5			ALVENSLEB...	70	CNTR	0	$\gamma A, t < 0.01$	
146.1± 2.9	140k		BIGGS	70	CNTR	0	$<4.1 \gamma C \rightarrow \pi^+ \pi^- C$	
160 ±10			LANZEROTTI	68	CNTR	0	γp	
130 ± 5	4000		ASBURY	67B	CNTR	0	$\gamma + \text{Pb}$	

NODE=M009W5
NODE=M009W5

NODE=M009W7
NODE=M009W7

NODE=M009W2
NODE=M009W2

NODE=M009W0P
NODE=M009W0P

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	70,71	BOHACIK	80	RVUE	0
152 ± 9	66	WICKLUND	78	ASPK	0
154 ± 2	76000	DEUTSCH...	76	HBC	0
157 ± 8	6800	RATCLIFF	72	ASPK	0
143 ± 8	1700	REYNOLDS	69	HBC	0
• • • We do not use the following data for averages, fits, limits, etc. • • •					
147.0± 2.5	600k	72 ABELE	99E	CBAR	0
146 ± 3	4943	73 ADAMS	97	E665	470 $\mu p \rightarrow \mu X B$
160.0 ⁺ _{-4.0}		74 CHABAUD	83	ASPK	0
155 ± 1		75 HEYN	81	RVUE	0
148.0± 1.3	70,71	LANG	79	RVUE	0
146 ± 14	4100	ENGLER	74	DBC	0
143 ± 13		71 ESTABROOKS	74	RVUE	0
160 ± 10	32000	70 PROTOPOP...	73	HBC	0
145 ± 12	2250	65 HYAMS	68	OSPK	0
163 ± 15	13300	76 PISUT	68	RVUE	0
43 A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.					
44 Supersedes ACHASOV 05A.					
45 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.					
46 Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.					
47 From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.					
48 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.					
49 From the GOUNARIS 68 parametrization of the pion form factor.					
50 Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.					
51 Without limitations on masses and widths.					
52 Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0 \pi \pi} = g_{\rho^\pm \pi \pi}$.					
53 Using the data of BARKOV 85 in the hidden local symmetry model.					
54 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.					
55 A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.					
56 Applying the S-matrix formalism to the BARKOV 85 data.					
57 Includes BARKOV 85 data. Model-dependent width definition.					
58 $ F_\pi(0) ^2$ fixed to 1.					
59 From the GOUNARIS 68 parametrization of the pion form factor.					
60 The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.					
61 $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.					
62 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.					
63 Using the data of BARATE 97M and the effective chiral Lagrangian.					
64 Assuming the equality of ρ^+ and ρ^- masses and widths.					
65 Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.					
66 Phase shift analysis. Systematic errors added corresponding to spread of different fits.					
67 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.					
68 From the parametrization according to SOEDING 66.					
69 From the parametrization according to ROSS 66.					
70 From pole extrapolation.					
71 From phase shift analysis of GRAYER 74 data.					
72 Using relativistic Breit-Wigner and taking into account ρ - ω interference.					
73 Systematic errors not evaluated.					
74 From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P -wave intensity. CHABAUD 83 includes data of GRAYER 74.					
75 HEYN 81 includes all spacelike and timelike F_π values until 1978.					
76 Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDHABER 64, ABOLINS 63.					

NODE=M009W0R
 NODE=M009W0R

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

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

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

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

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

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

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

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

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.3±1.3 OUR AVERAGE		Error includes scale factor of 1.4.		
-0.2±1.0		77 SCHAEAL	05C	ALEP $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
3.6±1.8±1.7	1.98M	78 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±2.0±0.5	1.98M	⁷⁹ ALOISIO	03 KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

⁷⁷ 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.

⁷⁸ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

⁷⁹ Without limitations on masses and widths.

NODE=M009W16
NODE=M009W16

NODE=M009W6;LINKAGE=SC

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

$\rho(770)$ DECAY MODES

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

NODE=M009225;NODE=M009

DESIG=1;OUR EVAL;→ NOT CHECKED ←

$\rho(770)^\pm$ decays

$\Gamma_2 \quad \pi^\pm\pi^0$	~ 100	%
$\Gamma_3 \quad \pi^\pm\gamma$	(4.5 ± 0.5)	$\times 10^{-4}$ S=2.2
$\Gamma_4 \quad \pi^\pm\eta$	< 6	$\times 10^{-4}$ CL=84%
$\Gamma_5 \quad \pi^\pm\pi^+\pi^-\pi^0$	< 2.0	$\times 10^{-4}$ CL=84%

NODE=M009;CLUMP=A
DESIG=11;OUR EVAL;
DESIG=3 NOT CHECKED ←
DESIG=5
DESIG=21

$\rho(770)^0$ decays

$\Gamma_6 \quad \pi^+\pi^-$	~ 100	%
$\Gamma_7 \quad \pi^+\pi^-\gamma$	(9.9 ± 1.6)	$\times 10^{-3}$
$\Gamma_8 \quad \pi^0\gamma$	(6.0 ± 0.8)	$\times 10^{-4}$
$\Gamma_9 \quad \eta\gamma$	(3.00±0.20)	$\times 10^{-4}$
$\Gamma_{10} \quad \pi^0\pi^0\gamma$	(4.5 ± 0.8)	$\times 10^{-5}$
$\Gamma_{11} \quad \mu^+\mu^-$	[a] (4.55±0.28)	$\times 10^{-5}$
$\Gamma_{12} \quad e^+e^-$	[a] (4.72±0.05)	$\times 10^{-5}$
$\Gamma_{13} \quad \pi^+\pi^-\pi^0$	(1.01 ^{+0.54} _{-0.36} ± 0.34)	$\times 10^{-4}$
$\Gamma_{14} \quad \pi^+\pi^-\pi^+\pi^-$	(1.8 ± 0.9)	$\times 10^{-5}$
$\Gamma_{15} \quad \pi^+\pi^-\pi^0\pi^0$	(1.6 ± 0.8)	$\times 10^{-5}$
$\Gamma_{16} \quad \pi^0e^+e^-$	< 1.2	$\times 10^{-5}$ CL=90%
$\Gamma_{17} \quad \eta e^+e^-$		

NODE=M009;CLUMP=B
DESIG=12;OUR EVAL;
DESIG=60 → NOT CHECKED ←
DESIG=40
DESIG=8
DESIG=80
DESIG=6
DESIG=4
DESIG=7;OUR EVAL;→ NOT CHECKED ←

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
$\Gamma_2 \quad \pi^\pm\pi^0$	150.2 ± 2.4	
$\Gamma_3 \quad \pi^\pm\gamma$	0.068±0.007	2.3

DESIG=11
DESIG=3

CONSTRAINED FIT INFORMATION

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

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

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

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

$\rho(770)$ PARTIAL WIDTHS

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

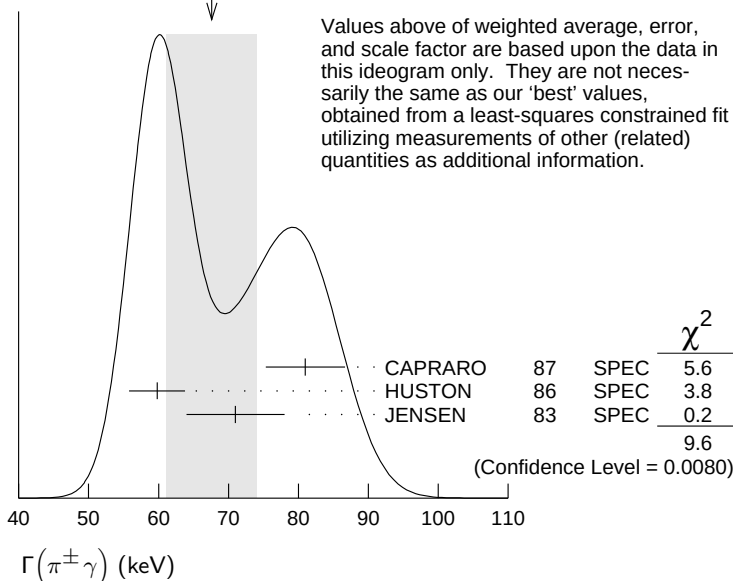
Γ_3

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

NODE=M009230

NODE=M009W3
NODE=M009W3

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



$\Gamma(e^+e^-)$ Γ_{12}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.04 ±0.06 OUR FIT				
7.04 ±0.06 OUR AVERAGE				
7.048±0.057±0.050	900k	⁸⁰ AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
7.06 ±0.11 ±0.05	114k	^{81,82} 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	⁸³ ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
6.3 ±0.1		⁸⁴ 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	⁸⁵ 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	⁸⁶ 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

- ⁸⁰ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
⁸¹ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.
⁸² From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.
⁸³ Supersedes ACHASOV 05A.
⁸⁴ Using the data of BARKOV 85 in the hidden local symmetry model.
⁸⁵ Using $\Gamma_{\text{total}} = 147.9 \pm 1.3$ MeV and $B(\rho \rightarrow \pi^0\gamma)$ from ACHASOV 03.
⁸⁶ 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	^{87,88} ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.72 ±0.02		⁸⁹ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

⁸⁷ Supersedes ACHASOV 05A.
⁸⁸ 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.
⁸⁹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G4
 NODE=M009G4

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

NODE=M009G4;LINKAGE=BE

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

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
1.42±0.10 OUR FIT				
1.45±0.12 OUR AVERAGE				
1.32±0.14±0.08	33k	⁹⁰ ACHASOV 07B	SND	$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
1.50±0.65±0.09	17.4k	⁹¹ AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
1.61±0.20±0.11	23k	^{92,93} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.85±0.49		⁹⁴ DOLINSKY 89	ND	$e^+e^- \rightarrow \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.05±0.02		⁹⁵ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

⁹⁰ 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.
⁹¹ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
⁹² From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
⁹³ 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).
⁹⁴ Recalculated by us from the cross section in the peak.
⁹⁵ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G1
 NODE=M009G1

NODE=M009G1;LINKAGE=AH

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

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

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

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
2.8 ± 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 $\pm 0.53 \pm 0.33$	36500	⁹⁶ ACHASOV 03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
3.61 $\pm 0.74 \pm 0.49$	10625	⁹⁷ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.875 ± 0.026		⁹⁸ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$

⁹⁶ 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 $(-10.2 \pm 7.0)^\circ$.

⁹⁷ Recalculated by us from the cross section in the peak.

⁹⁸ 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		⁹⁹ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$
4.58 $^{+2.46}_{-1.64} \pm 1.56$	1.2M	¹⁰⁰ ACHASOV 03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$

⁹⁹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

¹⁰⁰ Statistical significance is less than 3σ .

NODE=M009G3
NODE=M009G3

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

$\rho(770)$ BRANCHING RATIOS

NODE=M009235

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

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

NODE=M009R4
NODE=M009R4

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

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

NODE=M009R1
NODE=M009R1

 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$
 Γ_{11}/Γ_6

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.60 ± 0.28 OUR FIT			
4.6 $\pm 0.2 \pm 0.2$	ANTIPOV 89	SIGM	$\pi^- \text{Cu} \rightarrow \mu^+\mu^-\pi^- \text{Cu}$

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

8.2 $^{+1.6}_{-3.6}$	¹⁰¹ ROTHWELL 69	CNTR	Photoproduction
5.6 ± 1.5	¹⁰² WEHMANN 69	OSPK	12 $\pi^- \text{C, Fe}$
9.7 $^{+3.1}_{-3.3}$	¹⁰³ HYAMS 67	OSPK	11 $\pi^- \text{Li, H}$

NODE=M009R5
NODE=M009R5

 $\Gamma(e^+e^-)/\Gamma(\pi\pi)$
 Γ_{12}/Γ_1

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.40 ± 0.05	¹⁰⁴ BENAKSAS 72	OSPK	$e^+e^- \rightarrow \pi^+\pi^-$

NODE=M009R3
NODE=M009R3

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3.00 ± 0.21 OUR FIT					
2.90 ± 0.32 OUR AVERAGE					
2.79 $\pm 0.34 \pm 0.03$	33k	¹⁰⁵ ACHASOV 07B	SND		$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
3.6 ± 0.9		¹⁰⁶ ANDREWS 77	CNTR 0		$6.7-10 \gamma \text{Cu}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.21 $\pm 1.39 \pm 0.20$	17.4k	^{107,108} AKHMETSHIN 05	CMD2		$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
3.39 $\pm 0.42 \pm 0.23$	106,109,110	AKHMETSHIN 01B	CMD2		$e^+e^- \rightarrow \eta\gamma$
1.9 $^{+0.6}_{-0.8}$		¹¹¹ BENAYOUN 96	RVUE		$0.54-1.04 e^+e^- \rightarrow \eta\gamma$
4.0 ± 1.1		^{106,108} 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 112	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	113 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
$1.60 \pm 0.74 \pm 0.18$		114 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		115 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		116 VASSERMAN 88	ND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<0.005	90	117 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	118,119 AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
$5.22 \pm 1.17 \pm 0.75$	36500	119,120 ACHASOV 03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
6.8 ± 1.7		121 BENAYOUN 96	RVUE	$0.54-1.04 e^+e^- \rightarrow \pi^0\gamma$
7.9 ± 2.0		119 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} ± 0.6 190 122 AKHMETSHIN 04B CMD2 0.6^{-0.97}_{0.0} $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$ 4.1^{+1.0}_{-0.9} ± 0.3 295 123 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 63 124 ACHASOV 00G SND $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

OCCUR=2

101 Possibly large ρ - ω interference leads us to increase the minus error.102 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=W

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

NODE=M009R5;LINKAGE=H

104 The ρ' contribution is not taken into account.

NODE=M009R;LINKAGE=KS

105 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.

NODE=M009R7;LINKAGE=AO

106 Solution corresponding to constructive ω - ρ interference.

NODE=M009R7;LINKAGE=A

107 Using $B(\rho \rightarrow e^+ e^-) = (4.67 \pm 0.09) \times 10^{-5}$ and $B(\eta \rightarrow \gamma \gamma) = 39.43 \pm 0.26\%$.

NODE=M009R;LINKAGE=AK

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

NODE=M009R7;LINKAGE=AZ

109 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).

NODE=M009R;LINKAGE=BQ

110 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

111 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

112 Statistical significance is less than 3σ .

NODE=M009R;LINKAGE=NS

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

NODE=M009R6;LINKAGE=G

114 Assuming no interference between the ρ and ω contributions.

NODE=M009R8;LINKAGE=AC

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

NODE=M009R12;LINKAGE=J

116 Superseded by DOLINSKY 91.

NODE=M009R12;LINKAGE=I

117 Structure radiation due to quark rearrangement in the decay.

NODE=M009R12;LINKAGE=N

118 Using $B(\rho \rightarrow e^+ e^-) = (4.67 \pm 0.09) \times 10^{-5}$.

NODE=M009R9;LINKAGE=AK

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

NODE=M009R9;LINKAGE=BZ

120 Using $B(\rho \rightarrow e^+ e^-) = (4.54 \pm 0.10) \times 10^{-5}$.

NODE=M009R9;LINKAGE=AS

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

NODE=M009R9;LINKAGE=A

122 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

123 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

124 Superseded by ACHASOV 02F.

NODE=M009R;LINKAGE=GF

$\rho(770)$ REFERENCES

NODE=M009

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.			
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
		Translated from ZETF 134 80.			
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AKHMETSHIN	07	PL B648 28	R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETF 130 437.			
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
		Translated from ZETFP 84 491.			
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
		Translated from ZETF 128 1201.			
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
		Translated from ZETFP 82 841.			
SCHAEEL	05C	PRPL 421 191	S. Schael <i>et al.</i>	(ALEPH Collab.)	REFID=50845
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
SANZ-CILLERO	03	EPJ C27 587	J.J. Sanz-Cillero, A. Pich		REFID=49399
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler		REFID=49180
PICH	01	PR D63 093005	A. Pich, J. Portoles		REFID=48313
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
		Translated from ZETFP 72 411.			
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
		Translated from ZETFP 71 519.			
AKHMETSHIN	00	PL B475 190	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47421
ANDERSON	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47468
ABELE	99E	PL B469 270	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47414
BENAYOUN	98	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
BREITWEG	98B	EPJ C2 247	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=46354
GARDNER	98	PR D57 2716	S. Gardner, H.B. O'Connell		REFID=46366
		Also PR D62 019903 (erratum)	S. Gardner, H.B. O'Connell		REFID=47981
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
ADAMS	97	ZPHY C74 237	M.R. Adams <i>et al.</i>	(E665 Collab.)	REFID=45533
BARATE	97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=45622
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
BOGOLYUB...	97	PAN 60 46	M.Y. Bogolyubsky <i>et al.</i>	(MOSU, SERP)	REFID=45393
		Translated from YAF 60 53.			
O'CONNELL	97	NP A623 559	H.B. O'Connell <i>et al.</i>	(ADLD)	REFID=45860
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
BERNICHIA	94	PR D50 4454	A. Bernichia, G. Lopez Castro, J. Pestieau	(LOUV+)	REFID=44097
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
AGUILAR...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
ANTIPOV	89	ZPHY C42 185	Y.M. Antipov <i>et al.</i>	(SERP, JINR, BGNA+)	REFID=40739
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
DUBNICKA	89	JPG 15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
KURDADZE	88	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
		Translated from ZETFP 47 432.			
VASSERMAN	88	SJNP 47 1035	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41019
		Translated from YAF 47 1635.			
VASSERMAN	88B	SJNP 48 480	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41020
		Translated from YAF 48 753.			
AULCHENKO	87C	IYF 87-90 Preprint	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=41370
CAPRARO	87	NP B288 659	L. Capraro <i>et al.</i>	(CLER, FRAS, MILA+)	REFID=40003
BRAMON	86	PL B173 97	A. Bramon, J. Casulleras	(BARC)	REFID=22102
HUSTON	86	PR D33 3199	J. Huston <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20137
KURDADZE	86	JETPL 43 643	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
		Translated from ZETFP 43 497.			
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
DRUZHININ	84	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
JENSEN	83	PR D27 26	T. Jensen <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20132
HEYN	81	ZPHY C7 169	M.F. Heyn, C.B. Lang	(GRAZ)	REFID=20129
BOHACIK	80	PR D21 1342	J. Bohacik, H. Kuhnelt	(SLOV, WIEN)	REFID=20128
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parareda	(GRAZ)	REFID=20126
BARTALUCCI	78	NC 44A 587	S. Bartalucci <i>et al.</i>	(DESY, FRAS)	REFID=20122
WICKLUND	78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
DEUTSCH...	76	NP B103 426	M. Deutschmann <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20119
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20110
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
BYERLY	73	PR D7 637	W.L. Byerly <i>et al.</i>	(MICH)	REFID=20104
GLADDING	73	PR D8 3721	G.E. Gladding <i>et al.</i>	(HARV)	REFID=20106
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107

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

 $\omega(782)$

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

 $\omega(782)$ MASS

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. ● ● ●				
781.78±0.10		⁶ 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	⁷ COYNE	71 HBC	3.7 $\pi^+ p \rightarrow p \pi^+ \pi^+ \pi^- \pi^0$
784.1 ±1.2	750	ABRAMOVI...	70 HBC	3.9 $\pi^- p$
783.2 ±1.6		⁸ BIGGS	70B CNTR	<4.1 $\gamma C \rightarrow \pi^+ \pi^- C$
782.4 ±0.5	2400	BIZZARRI	69 HBC	0.0 $\bar{p} p$

NODE=M001

NODE=M001M

NODE=M001M

OCCUR=2

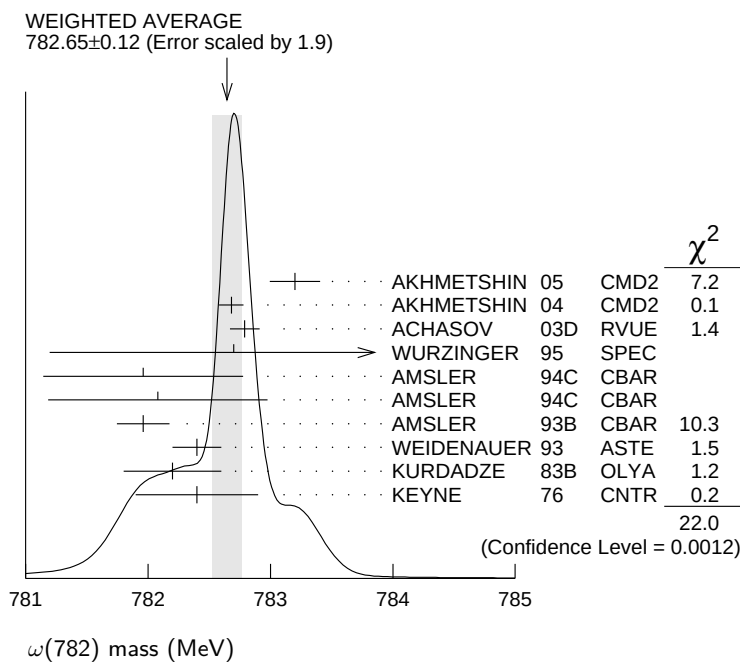
OCCUR=2

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 Systematic uncertainties underestimated.
⁷ From best-resolution sample of COYNE 71.
⁸ 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=KB
 NODE=M001M;LINKAGE=D
 NODE=M001M;LINKAGE=F



$\omega(782)$ WIDTH

NODE=M001W

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
8.49 ± 0.08 OUR AVERAGE				
$8.68 \pm 0.23 \pm 0.10$	11200	⁹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$8.68 \pm 0.04 \pm 0.15$	1.2M	¹⁰ ACHASOV 03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.2 ± 0.3	19500	WURZINGER 95	SPEC	$1.33 p d \rightarrow {}^3\text{He} \omega$
8.4 ± 0.1		¹¹ 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. ● ● ●				
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	¹² 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	$2.18 K^- p$
$7.70 \pm 0.9 \pm 1.15$	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

- ⁹ Update of AKHMETSHIN 00C.
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 Relativistic Breit-Wigner includes radiative corrections.
¹² 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=B

$\omega(782)$ DECAY MODES

NODE=M001215;NODE=M001

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

DESIG=1

DESIG=3

DESIG=2

DESIG=13

DESIG=6

DESIG=14

DESIG=11

DESIG=18

DESIG=7

DESIG=12

DESIG=4

DESIG=15

DESIG=5

DESIG=17

DESIG=8

DESIG=10

Charge conjugation (C) violating modes

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

NODE=M001;CLUMP=A

DESIG=9

DESIG=193

DESIG=16

CONSTRAINED FIT INFORMATION

An overall fit to 15 branching ratios uses 51 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 51.8$ for 42 degrees of freedom.

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

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

 $\omega(782)$ PARTIAL WIDTHS

NODE=M001218

$\Gamma(\pi^0\gamma)$						Γ_2
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$788 \pm 12 \pm 27$	36500	¹³ ACHASOV	03	SND	$0.60\text{--}0.97\ e^+e^- \rightarrow \pi^0\gamma$	
764 ± 51	10625	DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\gamma$	
¹³ Using $\Gamma_\omega = 8.44 \pm 0.09$ MeV and $B(\omega \rightarrow \pi^0\gamma)$ from ACHASOV 03.						

NODE=M001W1

NODE=M001W1

NODE=M001W1;LINKAGE=AD

$\Gamma(\eta\gamma)$				Γ_5
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.1 ± 2.5	¹⁴ DOLINSKY	89	ND	$e^+ e^- \rightarrow \eta\gamma$
¹⁴ Using $\Gamma_\omega = 8.4 \pm 0.1$ MeV and $B(\omega \rightarrow \eta\gamma)$ from DOLINSKY 89.				

NODE=M001W2

NODE=M001W2

NODE=M001W2;LINKAGE=DA

$\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.60 ±0.02 OUR EVALUATION

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

0.591±0.015	11200	^{15,16} AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.653±0.003±0.021	1.2M	¹⁷ ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.600±0.031	10625	DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

¹⁵ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = 0.891 \pm 0.007$ and $\Gamma_{\text{total}} = 8.44 \pm 0.09$ MeV.¹⁶ Update of AKHMETSHIN 00C.¹⁷ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

NODE=M001W7

NODE=M001W7

→ NOT CHECKED ←

NODE=M001W7;LINKAGE=3P

NODE=M001W7;LINKAGE=PT

NODE=M001W;LINKAGE=VF

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

NODE=M001225

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

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

6.49±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	¹⁸ 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	^{19,20} ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.37±0.35		¹⁹ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.45±0.24		¹⁹ BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.79±0.42	1488	¹⁹ KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.89±0.54	433	¹⁹ CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
7.54±0.84	451	¹⁹ BENAJSAS 72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

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

6.20±0.13 ²¹ BENAYOUN 10 RVUE 0.4–1.05 e^+e^- ¹⁸ Update of AKHMETSHIN 00C.¹⁹ Recalculated by us from the cross section in the peak.²⁰ 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.²¹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

NODE=M001G2

NODE=M001G2

NODE=M001G;LINKAGE=PT

NODE=M001G;LINKAGE=LP

NODE=M001G;LINKAGE=VH

NODE=M001G2;LINKAGE=BE

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

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

6.02±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	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
6.50±0.11±0.20	36500	²² ACHASOV 03	SND	0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
6.34±0.21±0.21	10625	²³ 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 ²⁴ BENAYOUN 10 RVUE 0.4–1.05 e^+e^- ²² 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 $(-10.2 \pm 7.0)^\circ$.²³ Recalculated by us from the cross section in the peak.²⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

NODE=M001G4

NODE=M001G4

NODE=M001G;LINKAGE=SH

NODE=M001G4;LINKAGE=LP

NODE=M001G4;LINKAGE=BE

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

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

1.225±0.058±0.041 800k ²⁵ ACHASOV 06 SND $e^+e^- \rightarrow \pi^+\pi^-$

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

1.146±0.057 ²⁶ BENAYOUN 10 RVUE 0.4–1.05 e^+e^- ²⁵ Supersedes ACHASOV 05A.²⁶ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

NODE=M001G5

NODE=M001G5

NODE=M001G5;LINKAGE=AC

NODE=M001G5;LINKAGE=BE

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

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

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	²⁷ ACHASOV	07B SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
3.17 ^{+1.85} _{-1.31} ±0.21	17.4k	²⁸ AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
3.41±0.52±0.21	23k	^{29,30} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.50±0.10		³¹ BENAYOUN 10	RVUE	0.4–1.05 e^+e^-
²⁷ 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.				
²⁸ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.				
²⁹ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.				
³⁰ 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).				
³¹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.				

NODE=M001G3
NODE=M001G3

NODE=M001G3;LINKAGE=AH

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

NODE=M001G3;LINKAGE=BE

$\omega(782)$ BRANCHING RATIOS

NODE=M001220

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

$$\Gamma_1/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.9024±0.0019		³² 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	^{33,34} ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.880 ±0.020 ±0.032	11200	^{34,35} AKHMETSHIN 00C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.8942±0.0062		³⁴ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
³² Not independent of $\Gamma(\pi^0\gamma) / \Gamma(\pi^+\pi^-\pi^0)$ from AMBROSINO 08G.				
³³ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.				
³⁴ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}^2$.				
³⁵ Using $\Gamma(e^+e^-) = 0.60 \pm 0.02$ keV.				

NODE=M001R21
NODE=M001R21

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

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

$$\Gamma_2/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.09±0.14		³⁶ AMBROSINO 08G	KLOE	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
9.06±0.20±0.57	18680	^{37,38} AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
9.34±0.15±0.31	36500	³⁸ ACHASOV 03	SND	0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
8.65±0.16±0.42	1.2M	^{39,40} ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.39±0.24	9975	⁴¹ BENAYOUN 96	RVUE	$e^+e^- \rightarrow \pi^0\gamma$
8.88±0.62	10625	³⁸ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$
³⁶ Not independent of $\Gamma(\pi^0\gamma) / \Gamma(\pi^+\pi^-\pi^0)$ from AMBROSINO 08G.				
³⁷ Using $B(\omega \rightarrow e^+e^-) = (7.14 \pm 0.13) \times 10^{-5}$.				
³⁸ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.				
³⁹ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.				
⁴⁰ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}^2$.				
⁴¹ 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

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

$$\Gamma_2/\Gamma_1$$

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	⁴² 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 π^+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	^{43,44} ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.9 ±0.7	⁴³ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

NODE=M001R3
NODE=M001R3

42 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.

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

44 Using ACHASOV 03. Based on 1.2M events.

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

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	45	AKHMETSHIN 07	$e^+e^- \rightarrow \pi^+\pi^-$
1.30 ^{±0.24} _{±0.05}	11.2k	46	AKHMETSHIN 04	CMD2 $e^+e^- \rightarrow \pi^+\pi^-$
2.38 ^{+1.77} _{-0.90}	±0.18	5.4k	47	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	48	ACHASOV 05A	SND $e^+e^- \rightarrow \pi^+\pi^-$
2.01 ^{±0.29}		49	BENAYOUN 03	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
1.9	±0.3	50	GARDNER 99	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
2.3	±0.4	51	BENAYOUN 98	RVUE $e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$
1.0	±0.11	52	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 γp
0.80	^{+0.28} _{-0.20}	53	BIGGS 70B	CNTR 4.2 $\gamma C \rightarrow \pi^+\pi^- C$

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

46 Update of AKHMETSHIN 02.

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

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

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

50 Using the data of BARKOV 85.

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

52 From a model-dependent analysis assuming complete coherence.

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

NODE=M001R3;LINKAGE=AL

NODE=M001R3;LINKAGE=VL

NODE=M001R3;LINKAGE=VW

NODE=M001R15

NODE=M001R15

NODE=M001R15

NODE=M001R15;LINKAGE=AK

NODE=M001R15;LINKAGE=PT

NODE=M001R;LINKAGE=VE

NODE=M001R;LINKAGE=SN

NODE=M001R;LINKAGE=BY

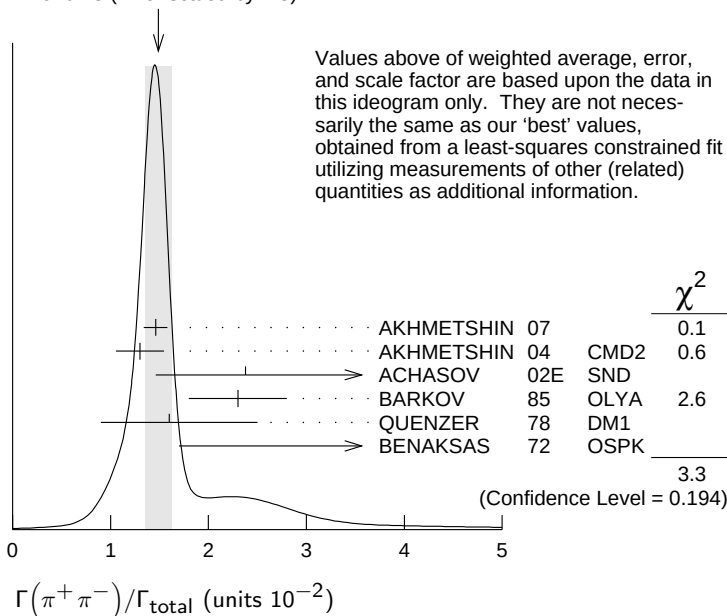
NODE=M001R15;LINKAGE=H4

NODE=M001R15;LINKAGE=Q

NODE=M001R15;LINKAGE=F

NODE=M001R15;LINKAGE=B

WEIGHTED AVERAGE
1.49^{±0.13} (Error scaled by 1.3)



$\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ See also $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$. Γ_3/Γ_1

NODE=M001R2

NODE=M001R2

NODE=M001R2

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 $^{+0.028}_{-0.009}$	54,55 RATCLIFF	72 ASPK	15 $\pi^- p \rightarrow n2\pi$
0.028 ±0.006	54 BEHREND	71 ASPK	Photoproduction
0.022 $^{+0.009}_{-0.01}$	56 ROOS	70 RVUE	

⁵⁴ 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.

⁵⁵ Significant interference effect observed. NB of $\omega \rightarrow 3\pi$ comes from an extrapolation.

⁵⁶ ROOS 70 combines ABRAMOVICH 70 and BIZZARRI 70.

NODE=M001R2;LINKAGE=A

NODE=M001R2;LINKAGE=S

NODE=M001R2;LINKAGE=R

 $\Gamma(\pi^+\pi^-)/\Gamma(\pi^0\gamma)$ Γ_3/Γ_2

NODE=M001R33

NODE=M001R33

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.20±0.04	1.98M	⁵⁷ ALOISIO	03 KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

⁵⁷ Using the data of ALOISIO 02D.

NODE=M001R;LINKAGE=KL

 $\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(\Gamma_2+\Gamma_4)/\Gamma$

NODE=M001R14

NODE=M001R14

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 $\pi^- p$

 $\Gamma(\text{neutrals})/\Gamma(\pi^+\pi^-\pi^0)$ $(\Gamma_2+\Gamma_4)/\Gamma_1$

NODE=M001R1

NODE=M001R1

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 $K^- p$

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

NODE=M001R18

NODE=M001R18

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.78±0.07		⁵⁸ DAKIN	72 OSPK	1.4 $\pi^- p \rightarrow nMM$
>0.81	90	DEINET	69B OSPK	

⁵⁸ Error statistical only. Authors obtain good fit also assuming $\pi^0\gamma$ as the only neutral decay.

NODE=M001R18;LINKAGE=D

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

NODE=M001R9

NODE=M001R9

VALUE	DOCUMENT ID	TECN	COMMENT
0.100±0.008 OUR FIT			
0.124±0.021	FELDMAN	67C OSPK	1.2 $\pi^- p$

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

NODE=M001R19

NODE=M001R19

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	⁵⁹ 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 $^{+2.5}_{-1.8}$	⁶⁰ ANDREWS	77 CNTR	6.7–10 γCu	

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

$4.3 \pm 0.5 \pm 0.1$	33k	⁶¹ ACHASOV	07B	SND	$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
$4.44^{+2.59}_{-1.83} \pm 0.28$	17.4k	^{62,63} AKHMETSHIN	05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
$5.10 \pm 0.72 \pm 0.34$	23k	⁶⁴ AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
0.7 to 5.5		⁶⁵ CASE	00	CBAR	$0.0 p\bar{p} \rightarrow \eta\eta\gamma$
$6.56^{+2.41}_{-2.55}$	3525	^{60,66} BENAYOUN	96	RVUE	$e^+e^- \rightarrow \eta\gamma$
7.3 ± 2.9		^{60,62} DOLINSKY	89	ND	$e^+e^- \rightarrow \eta\gamma$

⁵⁹ No flat $\eta\eta\gamma$ background assumed.

⁶⁰ Solution corresponding to constructive ω - ρ interference.

⁶¹ 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.

⁶² Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.

⁶³ Using $B(\omega \rightarrow e^+e^-) = (7.14 \pm 0.13) \times 10^{-5}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

⁶⁴ 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 $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.

⁶⁵ Depending on the degree of coherence with the flat $\eta\eta\gamma$ background and using $B(\omega \rightarrow \pi^0\gamma) = (8.5 \pm 0.5) \times 10^{-2}$.

⁶⁶ 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	⁶⁷ ALDE	93	GAM2	$38\pi^- p \rightarrow \omega n$
0.0082 ± 0.0033	⁶⁸ DOLINSKY	89	ND	$e^+e^- \rightarrow \eta\gamma$
0.010 ± 0.045	APEL	72B	OSPK	$4-8 \pi^- p \rightarrow n3\gamma$

⁶⁷ Model independent determination.

⁶⁸ 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 $\pm$ 0.6 OUR FIT

7.7 $\pm$ 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 $\pm$ 0.4 OUR FIT Error includes scale factor of 2.1.

1.3 $\pm$ 0.4 OUR AVERAGE Error includes scale factor of 2.1.

$1.72 \pm 0.25 \pm 0.14$	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 $\pm$ 0.014 OUR FIT Error includes scale factor of 1.3.

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

NODE=M001R13

NODE=M001R13

0.700±0.016	11200	^{69,70} AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.752±0.004±0.024	1.2M	^{70,71} ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.714±0.036		⁷⁰ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.72 ±0.03		⁷⁰ BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.64 ±0.04	1488	⁷⁰ KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.675±0.069	433	⁷⁰ CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.83 ±0.10	451	⁷⁰ BENAKSAS 72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.77 ±0.06		⁷² AUGUSTIN 69D	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.65 ±0.13	33	⁷³ ASTVACAT... 68	OSPK	Assume SU(3)+mixing

⁶⁹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = 0.891 \pm 0.007$. Update of AKHMETSHIN 00C.

⁷⁰ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}^2$.

⁷¹ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

⁷² Rescaled by us to correspond to ω width 8.4 MeV. Systematic errors underestimated.

⁷³ Not resolved from ρ decay. Error statistical only.

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

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2	90	ACHASOV 09A	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<200	90	KURDADZE 86	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M001R5
 NODE=M001R5

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

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

NODE=M001R22
 NODE=M001R22

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

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

NODE=M001R4
 NODE=M001R4

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1 × 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				
$6.4^{+2.4}_{-2.0} \pm 0.8$	190	⁷⁴ AKHMETSHIN 04B	CMD2	0.6–0.97 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
$6.6^{+1.4}_{-1.3} \pm 0.6$	295	ACHASOV 02F	SND	0.36–0.97 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

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

$11.8^{+2.1}_{-1.9} \pm 1.4$	190	⁷⁵ AKHMETSHIN 04B	CMD2	0.6–0.97 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
$7.8 \pm 2.7 \pm 2.0$	63	^{74,76} ACHASOV 00G	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$12.7 \pm 2.3 \pm 2.5$	63	^{75,76} ACHASOV 00G	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=2

OCCUR=2

⁷⁴ In the model assuming the $\rho \rightarrow \pi^0\pi^0\gamma$ decay via the $\omega\pi$ and $f_0(500)\gamma$ mechanisms.

⁷⁵ In the model assuming the $\rho \rightarrow \pi^0\pi^0\gamma$ decay via the $\omega\pi$ mechanism only.

⁷⁶ Superseded by ACHASOV 02F.

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

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

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

NODE=M001R10
 NODE=M001R10

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

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

NODE=M001R7
 NODE=M001R7

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.22±0.07		⁷⁷ DAKIN	72 OSPK	$1.4\pi^- p \rightarrow nMM$
<0.19	90	DEINET	69B OSPK	
⁷⁷ See $\Gamma(\pi^0\gamma)/\Gamma(\text{neutrals})$.				

NODE=M001R17
 NODE=M001R17

NODE=M001R17;LINKAGE=D

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

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

NODE=M001R32
 NODE=M001R32

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

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

NODE=M001R30
 NODE=M001R30

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.2	90	WILSON	69 OSPK	$12\pi^- C \rightarrow Fe$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.7	74	FLATTE	66 HBC	$1.2-1.7 K^- p \rightarrow \Lambda\mu^+\mu^-$
<1.2		BARBARO-...	65 HBC	$2.7 K^- p$

NODE=M001R6
 NODE=M001R6

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.2±0.6	30	⁷⁸ DZHELYADIN	79 CNTR	$25-33\pi^- p$
⁷⁸ Superseded by DZHELYADIN 81B result above.				

NODE=M001R20
 NODE=M001R20

NODE=M001R20;LINKAGE=S

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	⁷⁹ ABELE	97E CBAR	$0.0\bar{p}p \rightarrow 5\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2	90	⁷⁹ PROKOSHKIN	95 GAM2	$38\pi^- p \rightarrow 3\gamma n$
⁷⁹ From direct 3γ decay search.				

NODE=M001R27
 NODE=M001R27

NODE=M001R27;LINKAGE=A

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

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

NODE=M001R25
 NODE=M001R25
 NODE=M001R25

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.016	90	⁸⁰ FLATTE	66 HBC	$1.2-1.7 K^- p \rightarrow \Lambda\pi^+\pi^- MM$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.045	95	JACQUET	69B HLBC	$2.05\pi^+ p \rightarrow \pi^+ p\omega$

NODE=M001R8
 NODE=M001R8

⁸⁰ Restated by us using $B(\eta \rightarrow \text{charged modes}) = 29.2\%$.

NODE=M001R8;LINKAGE=A

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	⁸¹ STAROSTIN 09	CRYM	$\gamma p \rightarrow \eta\pi^0 p$
⁸¹ STAROSTIN 09 reports $[\Gamma(\omega(782) \rightarrow \eta\pi^0)/\Gamma(\omega(782) \rightarrow \pi^0\gamma)] \times [B(\eta \rightarrow 2\gamma)]$ < 1.01×10^{-3} which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.				

NODE=M001R35
 NODE=M001R35
 NODE=M001R35

NODE=M001R35;LINKAGE=ST

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

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

NODE=M001R36
 NODE=M001R36
 NODE=M001R36

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

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

NODE=M001R26
 NODE=M001R26
 NODE=M001R26

 $\Gamma(3\pi^0)/\Gamma(\pi^0\gamma)$ Γ_{19}/Γ_2 Violates C conservation.

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

NODE=M001R37
 NODE=M001R37
 NODE=M001R37

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

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

NODE=M001R31
 NODE=M001R31
 NODE=M001R31

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

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

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

where for the parameter Λ vector dominance predicts $\Lambda = M_p \approx 0.770$ 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 ± 0.03		DZHELYADIN 81B	CNTR	$25-33 \pi^- p \rightarrow \omega n$

NODE=M001LAM
 NODE=M001LAM

NODE=M001LAM

 $\omega(782)$ REFERENCES

BENAYOUN 10	EPJ C65 211	M. Benayoun <i>et al.</i>		
ACHASOV 09A	JETP 109 379	M.N. Achasov <i>et al.</i>		(SND Collab.)
	Translated from ZETF 136 442.			
ARNALDI 09	PL B677 260	R. Arnaldi <i>et al.</i>		(NA60 Collab.)
STAROSTIN 09	PR C79 065201	A. Starostin <i>et al.</i>		(Crystal Ball Collab. at MAMI)
ACHASOV 08	JETP 107 61	M.N. Achasov <i>et al.</i>		(SND Collab.)
	Translated from ZETF 134 80.			
AMBROSINO 08G	PL B669 223	F. Ambrosino <i>et al.</i>		(KLOE Collab.)
ACHASOV 07B	PR D76 077101	M.N. Achasov <i>et al.</i>		(SND Collab.)
AKHMETSHIN 07	PL B648 28	R. Akhmetshin <i>et al.</i>		(Novosibirsk CMD-2 Collab.)
ACHASOV 06	JETP 103 380	M.N. Achasov <i>et al.</i>		(Novosibirsk SND Collab.)
	Translated from ZETF 130 437.			
ACHASOV 06A	PR D74 014016	M.N. Achasov <i>et al.</i>		(SND Collab.)
AULCHENKO 06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>		(Novosibirsk CMD-2 Collab.)
	Translated from ZETFP 84 491.			
ACHASOV 05A	JETP 101 1053	M.N. Achasov <i>et al.</i>		(Novosibirsk SND Collab.)
	Translated from ZETF 128 1201.			
AKHMETSHIN 05	PL B605 26	R.R. Akhmetshin <i>et al.</i>		(Novosibirsk CMD-2 Collab.)
AKHMETSHIN 05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>		(Novosibirsk CMD-2 Collab.)
AULCHENKO 05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>		(Novosibirsk CMD-2 Collab.)
	Translated from ZETFP 82 841.			

NODE=M001

REFID=53212
 REFID=53101

REFID=52720
 REFID=53001
 REFID=52258

REFID=52573
 REFID=51942
 REFID=51615
 REFID=51113

REFID=51133
 REFID=51513

REFID=51045

REFID=50330
 REFID=50508
 REFID=51060

AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
BENAYOUN	03	EPJ C29 397	M. Benayoun <i>et al.</i>		REFID=49477
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48815
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
HEISTER	02C	PL B528 19	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48564
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>		REFID=48324
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00G	Translated from ZETFP 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
AKHMETSHIN	00C	Translated from ZETFP 71 519	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47423
AULCHENKO	00A	PL B476 33	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
CASE	00	JETP 90 927	T. Case <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47409
ACHASOV	99E	Translated from ZETF 117 1067	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
GARDNER	99	PR D61 032002	S. Gardner, H.B. O'Connell	(Novosibirsk SND Collab.)	REFID=46919
BENAYOUN	98	PR D59 076002	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
ABELE	97E	EPJ C2 269	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45755
BENAYOUN	96	PL B411 361	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
PROKOSHKIN	95	ZPHY C72 221	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=44616
WURZINGER	95	SPD 40 273	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=45209
ALDE	94B	Translated from DANS 342 610	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	PL B327 425	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43603
AMSLER	93B	PAN 56 1229	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43790
WEIDENAUER	93	ZPHY C61 35	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
ANTONELLI	92	PL B311 362	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
DOLINSKY	91	ZPHY C59 387	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
WEIDENAUER	90	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
DOLINSKY	89	ZPHY C47 353	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41368
BITYUKOV	88B	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
DOLINSKY	88	SJNP 47 800	S.I. Bitukov <i>et al.</i>	(SERP)	REFID=41021
KURDADZE	88	Translated from YAF 47 1258	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
AULCHENKO	87	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
BARKOV	87	Translated from ZETFP 47 432	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=40007
KURDADZE	86	PL B186 432	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=40280
BARKOV	85	JETPL 46 164	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
DRUZHININ	84	Translated from ZETFP 43 497	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
KURDADZE	83B	NP B256 365	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
DZHELYADIN	81B	PL 144B 136	A.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20244
CORDIER	80	JETPL 36 274	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=20242
DZHELYADIN	80	PL 102B 296	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
ROOS	80	NP B172 13	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=10831
BENKHEIRI	79	PL 94B 548	M. Roos, A. Pellinen	(HELS)	REFID=20241
DZHELYADIN	79	LNC 27 321	P. Benkheiri <i>et al.</i>	(EPOL, CERN, CDEF+)	REFID=20238
COOPER	78B	NP B150 268	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=20239
QUENZER	78	PL 84B 143	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
VANAPEL...	78	NP B146 1	A. Quenzer <i>et al.</i>	(ZEEM)	REFID=20123
WICKLUND	78	PL 76B 512	G.W. van Apeldoorn <i>et al.</i>	(ANL)	REFID=20124
ANDREWS	77	NP B133 245	A.B. Wicklund <i>et al.</i>	(ROCH)	REFID=20120
GESSAROLI	77	PR D17 1197	D.E. Andrews <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
KEYNE	76	PRL 38 198	R. Gessaroli <i>et al.</i>	(LOIC, SHMP)	REFID=20226
KALBFLEISCH	75	NP B126 382	J. Keyne <i>et al.</i>	(LOIC, SHMP)	REFID=20216
AGUILAR...	72B	PR D8 2789	D.M. Binnie <i>et al.</i>	(BNL+)	REFID=20223
APEL	72B	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL)	REFID=20205
BASILE	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20206
BENAKSAS	72	PL 41B 234	M. Basile <i>et al.</i>	(CERN)	REFID=20207
BENAKSAS	72B	Phil. Conf. 153	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
BENAKSAS	72C	PL 39B 289	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20209
BORENSTEIN	72	PL 42B 507	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20517
BROWN	72	PL 42B 511	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
DAKIN	72	PR D5 1559	R.M. Brown <i>et al.</i>	(ILL, ILL)	REFID=20211
RATCLIFF	72	PL 42B 117	J.T. Dakin <i>et al.</i>	(PRIN)	REFID=20212
ALVENSLEB...	71C	PL 38B 345	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
BALDIN	71	PRL 27 888	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20193
BEHREND	71	SJNP 13 758	A.B. Baldin <i>et al.</i>	(ITEP)	REFID=20195
BIZZARRI	71	Translated from YAF 13 1318	H.J. Behrend <i>et al.</i>	(ROCH, CORN, FNAL)	REFID=20197
COYNE	71	PRL 27 61	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20198
MOFFEIT	71	NP B27 140	D.G. Coyne <i>et al.</i>	(LRL)	REFID=20201
ABRAMOVICH	70	NP B32 333	K.C. Moffeit <i>et al.</i>	(LRL, UCB, SLAC+)	REFID=20204
BIGGS	70B	NP B29 349	M. Abramovich <i>et al.</i>	(CERN)	REFID=20180
BIZZARRI	70	NP B20 209	P.J. Biggs <i>et al.</i>	(DARE)	REFID=20184
ROOS	70	PRL 24 1201	R. Bizzarri <i>et al.</i>	(ROMA, SYRA)	REFID=20181
Proc. Daresbury Study Weekend No. 1.		PRL 25 1385	M. Roos	(CERN)	REFID=20191
AUGUSTIN	69D	DNPL/R7 173	J.E. Augustin <i>et al.</i>	(ORSAY)	REFID=20169
BIZZARRI	69	PL 28B 513	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20171
DEINET	69B	NP B14 169	W. Deinet <i>et al.</i>	(KARL, CERN)	REFID=20173
JACQUET	69B	PL 30B 426	F. Jacquet <i>et al.</i>	(EPOL, BERG)	REFID=20176
WILSON	69	NC 63A 743	R. Wilson	(HARV)	REFID=20179
ASTVACAT...	68C	Private Comm.	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)	REFID=20084
BOLLINI	68	PR 178 2095	R.G. Astvatsaturov <i>et al.</i>	(JINR, MOSU)	REFID=20055
BARASH	67B	PL 27B 45	D. Bollini <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20164
FELDMAN	67C	NC 56A 531	N. Barash <i>et al.</i>	(COLU)	REFID=20160
DIGIUGNO	66B	PR 156 1399	M. Feldman <i>et al.</i>	(PENN)	REFID=20161
FLATTE	66	PR 159 1219	G. Di Giugno <i>et al.</i>	(NAPL, FRAS, TRST)	REFID=20156
JAMES	65	NC 44A 1272	S.M. Flatte <i>et al.</i>	(LRL)	REFID=20157
BARBARO...	65	PR 145 1050	F.E. James, H.L. Kraybill	(YALE, BNL)	REFID=10770
BARMIN	64	PR 142 896	A. Barbaro-Galtieri, R.D. Tripp	(LRL)	REFID=20152
KRAEMER	64	PRL 14 279	V.V. Barmin <i>et al.</i>	(ITEP)	REFID=20149
BUSCHBECK	63	JETP 18 1289	R.W. Kraemer <i>et al.</i>	(JHU, NWES, WOOD)	REFID=10755
		Translated from ZETF 45 1879	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

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 $1.68\ p d \rightarrow {}^3\text{He}\eta'$
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 $300\ p p \rightarrow p p \eta \pi^+ \pi^-$
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 $1.7\text{--}2.7\ K^- p$

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

OCCUR=2

OCCUR=2

NODE=M002M;LINKAGE=BS

NODE=M002M;LINKAGE=NS

NODE=M002M;LINKAGE=BA

 $\eta'(958)$ WIDTH

NODE=M002W

NODE=M002W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.199±0.009 OUR FIT					
0.230±0.021 OUR AVERAGE					
0.226±0.017±0.014	2300	CZERWINSKI	10	MMS	$p p \rightarrow p p \eta'$
0.40 ±0.22	4800	WURZINGER	96	SPEC	$1.68\ p d \rightarrow {}^3\text{He}\eta'$
0.28 ±0.10	1000	BINNIE	79	MMS	$\pi^- p \rightarrow n\text{MM}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.20 ±0.04		BAI	04J	BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

 $\eta'(958)$ DECAY MODES

NODE=M002215;NODE=M002

Mode	Fraction (Γ_i/Γ)	Confidence level	
$\Gamma_1\ \pi^+\pi^-\eta$	(43.4 ±0.7) %		DESIG=1
$\Gamma_2\ \rho^0\gamma(\text{including non-resonant})$	(29.3 ±0.6) %		DESIG=9
$\Gamma_3\ \pi^+\pi^-\pi^0$	(21.6 ±0.8) %		DESIG=2
$\Gamma_4\ \omega\gamma$	(2.75±0.22) %		DESIG=7
$\Gamma_5\ \gamma\gamma$	(2.18±0.08) %		DESIG=6
$\Gamma_6\ 3\pi^0$	(1.68±0.22) × 10 ⁻³		DESIG=8
$\Gamma_7\ \mu^+\mu^-\gamma$	(1.07±0.26) × 10 ⁻⁴		DESIG=20
$\Gamma_8\ \pi^+\pi^-\mu^+\mu^-$	< 2.2 × 10 ⁻⁴	90%	DESIG=201
$\Gamma_9\ \pi^+\pi^-\pi^0$	(3.6 ^{+1.1} _{-0.9}) × 10 ⁻³		DESIG=121
$\Gamma_{10}\ \pi^0\rho^0$	< 4 %	90%	DESIG=18
$\Gamma_{11}\ 2(\pi^+\pi^-)$	< 2.4 × 10 ⁻⁴	90%	DESIG=131
$\Gamma_{12}\ \pi^+\pi^-2\pi^0$	< 2.6 × 10 ⁻³	90%	DESIG=202
$\Gamma_{13}\ 2(\pi^+\pi^-) \text{ neutrals}$	< 1 %	95%	DESIG=132
$\Gamma_{14}\ 2(\pi^+\pi^-)\pi^0$	< 1.9 × 10 ⁻³	90%	DESIG=141
$\Gamma_{15}\ 2(\pi^+\pi^-)2\pi^0$	< 1 %	95%	DESIG=15
$\Gamma_{16}\ 3(\pi^+\pi^-)$	< 5 × 10 ⁻⁴	90%	DESIG=203
$\Gamma_{17}\ \pi^+\pi^-e^+e^-$	(2.4 ^{+1.3} _{-1.0}) × 10 ⁻³		DESIG=10
$\Gamma_{18}\ \gamma e^+e^-$	< 9 × 10 ⁻⁴	90%	DESIG=28
$\Gamma_{19}\ \pi^0\gamma\gamma$	< 8 × 10 ⁻⁴	90%	DESIG=24
$\Gamma_{20}\ 4\pi^0$	< 5 × 10 ⁻⁴	90%	DESIG=26
$\Gamma_{21}\ e^+e^-$	< 2.1 × 10 ⁻⁷	90%	DESIG=150
$\Gamma_{22}\ \text{invisible}$	< 9 × 10 ⁻⁴	90%	DESIG=200

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

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

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

NODE=M002;CLUMP=B

DESIG=111

DESIG=25

DESIG=16

DESIG=17

DESIG=23

DESIG=22

DESIG=21

DESIG=27

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 13 branching ratios uses 40 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 31.5$ for 32 degrees of freedom.

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

x_2	1							
x_3	-76	-57						
x_4	-20	-24	6					
x_5	-31	-26	35	0				
x_6	-23	-17	28	1	10			
x_9	-1	-5	-7	-3	-4	-2		
x_{17}	-4	-6	-5	-2	-3	-2	-1	
Γ	26	5	-21	4	-72	-6	4	3
	x_1	x_2	x_3	x_4	x_5	x_6	x_9	x_{17}

	Mode	Rate (MeV)	
Γ_1	$\pi^+\pi^-\eta$	0.086 $\pm$ 0.004	DESIG=1
Γ_2	$\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\pi^-\gamma$)	0.0583 $\pm$ 0.0028	DESIG=9
Γ_3	$\pi^0\pi^0\eta$	0.0430 $\pm$ 0.0022	DESIG=2
Γ_4	$\omega\gamma$	0.0055 $\pm$ 0.0005	DESIG=7
Γ_5	$\gamma\gamma$	0.00434 $\pm$ 0.00013	DESIG=6
Γ_6	$3\pi^0$	(3.3 $\pm$ 0.5) $\times 10^{-4}$	DESIG=8
Γ_9	$\pi^+\pi^-\pi^0$	(7.2 $\pm$ 2.2 $\pm$ 1.9) $\times 10^{-4}$	DESIG=121
Γ_{17}	$\pi^+\pi^-\pi^+e^+e^-$	(4.8 $\pm$ 2.6 $\pm$ 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
4.34 $\pm$ 0.14 OUR FIT				
4.28 $\pm$ 0.19 OUR AVERAGE				
4.17 $\pm$ 0.10 $\pm$ 0.27	2000	4 ACCIARRI	98Q L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.53 $\pm$ 0.29 $\pm$ 0.51	266	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
3.61 $\pm$ 0.13 $\pm$ 0.48		5 BEHREND	91 CELL	$e^+e^- \rightarrow e^+e^-\eta'(958)$
4.6 $\pm$ 1.1 $\pm$ 0.6	23	BARU	90 MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.57 $\pm$ 0.25 $\pm$ 0.44		BUTLER	90 MRK2	$e^+e^- \rightarrow e^+e^-\eta'(958)$
5.08 $\pm$ 0.24 $\pm$ 0.71	547	6 ROE	90 ASP	$e^+e^- \rightarrow e^+e^-2\gamma$
3.8 $\pm$ 0.7 $\pm$ 0.6	34	AIHARA	88C TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.9 $\pm$ 0.5 $\pm$ 0.5	136	7 WILLIAMS	88 CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$

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

NODE=M002W4
NODE=M002W4

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

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

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

NODE=M002223

NODE=M002223

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

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

NODE=M002G1
 NODE=M002G1

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

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.94±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 initial assumptions and strong correlations of the parameters we do not average the parameters in the section below.

NODE=M002225

Re(α) decay parameter

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

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

$Im(\alpha)$ 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=M002IA0NODE=M002IA0;LINKAGE=AB
NODE=M002IA0;LINKAGE=AMNODE=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=M002C0NODE=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=M002D0NODE=M002D0;LINKAGE=AB
NODE=M002D0;LINKAGE=AMNODE=M002D0;LINKAGE=AL
NODE=M002D0;LINKAGE=KA **$\eta'(958) \rightarrow \eta \pi \pi$ DECAY PARAMETERS**

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

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

NODE=M002227

NODE=M002227

a decay parameter

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

²⁸ See ABLIKIM 11 for the full correlation matrix.²⁹ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.³⁰ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.NODE=M002DPA
NODE=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=M002DPC

NODE=M002DPC;LINKAGE=AB
NODE=M002DPC;LINKAGE=BL
NODE=M002DPC;LINKAGE=DO

d decay parameter

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

³⁷ See ABLIKIM 11 for the full correlation matrix.

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

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

NODE=M002DPD
NODE=M002DPD

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

NODE=M002DPD;LINKAGE=DO

$$\eta'(958) \beta \text{ PARAMETER}$$

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

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

NODE=M002226

NODE=M002226

 β decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.46 ± 0.22 OUR AVERAGE	Error includes scale factor of 1.4.			
-0.59 ± 0.18	235	BLIK	08 GAMS	$32 \pi^- p \rightarrow \eta' n$
-0.1 ± 0.3		ALDE	87B GAM2	$38 \pi^- p \rightarrow n 3\pi^0$

NODE=M002B0
NODE=M002B0

 $\eta'(958)$ BRANCHING RATIOS

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

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

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

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

NODE=M002230

NODE=M002R47
NODE=M002R47

NODE=M002R47;LINKAGE=PE

$\Gamma(\pi^+ \pi^- \eta(\text{charged decay}))/\Gamma_{\text{total}}$				$0.286 \Gamma_1/\Gamma$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1240 ± 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

$\Gamma(\pi^+ \pi^- \eta(\text{neutral decay}))/\Gamma_{\text{total}}$				$0.714 \Gamma_1/\Gamma$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.310 ± 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

$\Gamma(\pi^0 \gamma(\text{including non-resonant } \pi^+ \pi^- \gamma))/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.293 ± 0.006 OUR FIT				

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

$0.287 \pm 0.007 \pm 0.004$ 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

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.676±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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.947±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	473	DANBURG	73 HBC	$2.2 K^- p \rightarrow \Lambda X^0$
1.11 ±0.18	192	JACOBS	73 HBC	$2.9 K^- p \rightarrow \Lambda X^0$

NODE=M002R27
NODE=M002R27

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.216±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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0694±0.0026 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.11 ±0.06	4	BENSINGER	70 DBC	$2.2 \pi^+ d$

NODE=M002R26
NODE=M002R26

$$\Gamma(\pi^0 \pi^0 \eta) / \Gamma(\pi^+ \pi^- \eta) \quad \Gamma_3/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.498±0.025 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
0.451±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±0.0022 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
0.063±0.005 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
0.127±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
0.433±0.012 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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0863 ± 0.0032 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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

NODE=M002R2
NODE=M002R2

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

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

2.18 ± 0.08 OUR FIT

2.00 ± 0.15 OUR AVERAGE

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
NODE=M002R19

NODE=M002R19;LINKAGE=WI

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

$$\frac{\Gamma(\gamma\gamma)}{\Gamma(\pi^+ \pi^- \eta)} \quad \Gamma_5/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.0503 ± 0.0022 OUR FIT

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

NODE=M002R46
NODE=M002R46

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.0744 ± 0.0033 OUR FIT

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

NODE=M002R42
NODE=M002R42

$$\frac{\Gamma(\gamma\gamma)}{\Gamma(\pi^0 \pi^0 \eta)} \quad \Gamma_5/\Gamma_3$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.101 ± 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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.141 ± 0.006 OUR FIT

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

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

NODE=M002R28
NODE=M002R28

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.179 ± 0.006 OUR FIT

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

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

NODE=M002R5
NODE=M002R5

$\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_6/Γ_3 VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

78±10 OUR FIT**78±10 OUR AVERAGE**

86±19	235	BLIK	08	GAMS	32 $\pi^- p \rightarrow \eta' n$
74±15		ALDE	87B	GAM2	38 $\pi^- p \rightarrow n6\gamma$
75±18		BINON	84	GAM2	30-40 $\pi^- p \rightarrow n6\gamma$

NODE=M002R32
NODE=M002R32 $\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_7/Γ_5 VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

4.9±1.2

33

VIKTOROV 80 CNTR 25,33 $\pi^- p \rightarrow 2\mu\gamma$ NODE=M002R29
NODE=M002R29 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_8/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

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

<2.4 90 ⁴⁸ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁴⁸ Not independent of measured value of Γ_8/Γ_1 from NAIK 09.

NODE=M002R50;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_8/Γ_1 VALUE (units 10^{-3}) CL%

DOCUMENT ID

TECN

COMMENT

<0.5

90

⁴⁹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁴⁹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.3 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.NODE=M002R03
NODE=M002R03

NODE=M002R03;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ VALUE (units 10^{-2}) CL%

DOCUMENT ID

TECN

COMMENT

0.36^{+0.11}_{-0.09} OUR FIT

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

0.37^{+0.11}_{-0.09} ± 0.04 ⁵⁰ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ <9 95 DANBURG 73 HBC 2.2 $K^- p \rightarrow \Lambda X^0$ <5 90 RITTENBERG 69 HBC 1.7-2.7 $K^- p$ ⁵⁰ 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

8.3 ^{+2.5}_{-2.1} OUR FIT**8.26^{+2.49}_{-2.12} ± 0.04** 20 ⁵¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁵¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (21^{+6}_{-5} \pm 2) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$. 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 ⁵² NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ <100 90 RITTENBERG 69 HBC 1.7-2.7 $K^- p$ ⁵² Not independent of measured value of Γ_{11}/Γ_1 from NAIK 09.NODE=M002R24
NODE=M002R24

NODE=M002R24;LINKAGE=NA

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

DOCUMENT ID

TECN

COMMENT

<0.6

90

⁵³ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁵³ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.NODE=M002R04
NODE=M002R04

NODE=M002R04;LINKAGE=NA

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

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

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

<27	90	54 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

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

NODE=M002R51
 NODE=M002R51

NODE=M002R51;LINKAGE=NA

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{12}/Γ_1

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

<6	90	55 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

55 NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 15 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

NODE=M002R05
 NODE=M002R05

NODE=M002R05;LINKAGE=NA

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

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

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

NODE=M002R22
 NODE=M002R22

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.002	90	56 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

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

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

NODE=M002R23
 NODE=M002R23

NODE=M002R23;LINKAGE=NA

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

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

<4	90	57 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

57 NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 11 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

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

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

<0.01	90	LONDON	66	HBC Compilation

NODE=M002R16
 NODE=M002R16

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

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

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

<0.53	90	58 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

<5	95	KALBFLEISCH 64B	HBC	$K^- p \rightarrow \Lambda 2(\pi^+\pi^-)$

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

NODE=M002R07
 NODE=M002R07

NODE=M002R07;LINKAGE=NA

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

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

<1.2	90	59 NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

59 NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 3(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 3.0 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

NODE=M002R08
 NODE=M002R08

NODE=M002R08;LINKAGE=NA

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

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

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

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

2.5 ^{+1.2} _{-0.9} ± 0.5	60	NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

<6	90	RITTENBERG	65	HBC $2.7 K^- p$

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

NODE=M002R12
 NODE=M002R12

NODE=M002R12;LINKAGE=NA

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

VALUE (units 10^{-3})	EVT5	DOCUMENT ID	TECN	COMMENT

NODE=M002R02
NODE=M002R02

5.6 $\frac{+3.0}{-2.2}$ OUR FIT5.50 $\frac{+2.99}{-2.29} \pm 0.03$ 8 ⁶¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁶¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R02;LINKAGE=NA

 $\Gamma(\gamma e^+e^-)/\Gamma_{\text{total}}$ Γ_{18}/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_{19}/Γ_3

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

NODE=M002R35
NODE=M002R35

 $\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{20}/Γ_3

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<23	90	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n8\gamma$

NODE=M002R37
NODE=M002R37

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

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

NODE=M002R39
NODE=M002R39

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{22}/Γ

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

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

<9.5 90 ⁶² NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$ ⁶² Not independent of measured value of Γ_{22}/Γ_1 from NAIK 09.

NODE=M002R52;LINKAGE=NA

 $\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{22}/Γ_5

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

• • • 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_{22}/Γ_1

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

<2.1 90 ⁶³ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

⁶³ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 5.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.31 \times 10^{-2}$.

NODE=M002R09
NODE=M002R09

NODE=M002R09;LINKAGE=NA

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

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

< 0.6 (CL = 90%) [$<29 \times 10^{-4}$ (CL = 90%) OUR 2011 BEST LIMIT]< 0.6 90 ⁶⁴ ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-$

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

< 29 90 ⁶⁵ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+\pi^-$ < 3.3 90 ⁶⁶ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+\pi^-$ <800 95 DANBURG 73 HBC $2.2 K^- p \rightarrow \Lambda X^0$ <200 90 RITTENBERG 69 HBC $1.7\text{--}2.7 K^- p$

OCCUR=2

⁶⁴ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.16 \times 10^{-3}$.

NODE=M002R20;LINKAGE=AL

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

NODE=M002R20;LINKAGE=MO

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

NODE=M002R20;LINKAGE=MR

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

⁶⁷ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.16 \times 10^{-3}$.

NODE=M002R53
NODE=M002R53

NODE=M002R53;LINKAGE=AL

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{24}/Γ_3

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<45	90	ALDE	87B	GAM2 $38\pi^-p \rightarrow n4\gamma$

NODE=M002R36
 NODE=M002R36

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{25}/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_{26}/Γ

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

NODE=M002R9
 NODE=M002R9

 $\Gamma(3\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{27}/Γ_3

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.6	90	ALDE	87B	GAM2 $38\pi^-p \rightarrow n3\gamma$

NODE=M002R34
 NODE=M002R34

 $\Gamma(\mu^+ \mu^- \pi^0)/\Gamma_{\text{total}}$ Γ_{28}/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_{29}/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_{30}/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	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
DZHELADIN	81	PL 105B 239	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=10836
STANTON	80	PL B92 353	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)	REFID=40294
VIKTOROV	80	SJNP 32 520	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=20298
		Translated from YAF 32 1005.			
APEL	79	PL 83B 131	W.D. Apel, K.H. Augenstein, E. Bertolucci	(KARLK+)	REFID=20295
BINNIE	79	PL 83B 141	D.M. Binnie <i>et al.</i>	(LOIC)	REFID=20296
ZANFINO	77	PRL 38 930	C. Zangino <i>et al.</i>	(CARL, MCGI, OHIO+)	REFID=20293
GRIGORIAN	75	NP B91 232	A. Grigorian <i>et al.</i>	(+)	REFID=20287
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
DUANE	74	PRL 32 425	A. Duane <i>et al.</i>	(LOIC, SHMP)	REFID=20284
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch	(BNL)	REFID=20286
DANBURG	73	PR D8 3744	J.S. Danburg <i>et al.</i>	(BNL, MICH) JP	REFID=20280
JACOBS	73	PR D8 18	S.M. Jacobs <i>et al.</i>	(BRAN, UMD, SYRA+) 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

$f_0(980)$

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

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

NODE=M003

NODE=M003

NODE=M003M1

NODE=M003M1

NEW;→ NOT CHECKED ←

 $f_0(980)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
990 ±20 OUR ESTIMATE				
[980 ± 10 MeV OUR 2011 ESTIMATE]				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1003 $^{+5}_{-27}$		1,2 GARCIA-MAR..11	RVUE	Compilation
996 ± 7		2,3 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 $^{+11}_{-9}$ ± 1	44	7 ECKLUND 09	CLEO	4.17 $e^+e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
982.2 ± 1.0 $^{+8.1}_{-8.0}$		8 UEHARA 08A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
976.8 ± 0.3 $^{+10.1}_{-0.6}$	64k	9 AMBROSINO 07	KLOE	1.02 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
984.7 ± 0.4 $^{+2.4}_{-3.7}$	64k	10 AMBROSINO 07	KLOE	1.02 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
973 ± 3	262 ± 30	11 AUBERT 07AkBABR		10.6 $e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
970 ± 7	54 ± 9	11 AUBERT 07AkBABR		10.6 $e^+e^- \rightarrow \phi\pi^0\pi^0\gamma$
953 ±20	2.6k	12 BONVICINI 07	CLEO	$D^+ \rightarrow \pi^-\pi^+\pi^+$
985.6 $^{+1.2}_{-1.5}$ $^{+1.1}_{-1.6}$		13 MORI 07	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
983.0 ± 0.6 $^{+4.0}_{-3.0}$		14 AMBROSINO 06B	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\gamma$
977.3 ± 0.9 $^{+3.7}_{-4.3}$		15 AMBROSINO 06B	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\gamma$
950 ± 9	4286	16 GARMASH 06	BELL	$B^+ \rightarrow K^+\pi^+\pi^-$
965 ±10		17 ABLIKIM 05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-, \phi K^+ K^-$
1031 ± 8		18 ANISOVICH 03	RVUE	
1037 ±31		TIKHOMIROV 03	SPEC	40.0 $\pi^-\pi^0 \rightarrow K_S^0 K_S^0 K_S^0 X$
973 ± 1	2438	19 ALOISIO 02D	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
977 ± 3 ± 2	848	20 AITALA 01A	E791	$D^+ \rightarrow \pi^-\pi^+\pi^+$
969.8 ± 4.5	419	21 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
985 $^{+16}_{-12}$	419	22,23 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
976 ± 5 ± 6		24 AKHMETSHIN 99B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
977 ± 3 ± 6	268	24 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
975 ± 4 ± 6		25 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
975 ± 4 ± 6		26 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma, \pi^0\pi^0\gamma$
985 ±10		BARBERIS 99	OMEG	450 $pp \rightarrow p_S p_f K^+ K^-$
982 ± 3		BARBERIS 99B	OMEG	450 $pp \rightarrow p_S p_f \pi^+\pi^-$
982 ± 3		BARBERIS 99C	OMEG	450 $pp \rightarrow p_S p_f \pi^0\pi^0$
987 ± 6 ± 6		27 BARBERIS 99D	OMEG	450 $pp \rightarrow K^+ K^-, \pi^+\pi^-$
989 ±15		BELLAZZINI 99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$
991 ± 3		28 KAMINSKI 99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
~ 980		28 OLLER 99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 993.5		99B 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

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

1008		30 LOCHER	98 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
955 ± 10		29 ALDE	97 GAM2	450 $pp \rightarrow pp\pi^0\pi^0$
994 ± 9		31 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
993.2 $\pm 6.5 \pm 6.9$		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 $\bar{p}p \rightarrow 3\pi^0$
~ 996		35 AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0,$ $\pi^0\eta\eta, \pi^0\pi^0\eta$
987 ± 6		36 ANISOVICH	95 RVUE	
1015		JANSSEN	95 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
983		37 BUGG	94 RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$
973 ± 2		38 KAMINSKI	94 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
988		39 ZOU	94B RVUE	
988 ± 10		40 MORGAN	93 RVUE	$\pi\pi(K\bar{K}) \rightarrow \pi\pi(K\bar{K}),$ $J/\psi \rightarrow \phi\pi\pi(K\bar{K}),$ $D_s \rightarrow \pi(\pi\pi)$
971.1 ± 4.0		29 AGUILAR-...	91 EHS	400 pp
979 ± 4		41 ARMSTRONG	91 OMEG	300 $pp \rightarrow pp\pi\pi,$ $ppK\bar{K}$
956 ± 12		BREAKSTONE	90 SFM	$pp \rightarrow pp\pi^+\pi^-$
959.4 ± 6.5		29 AUGUSTIN	89 DM2	$J/\psi \rightarrow \omega\pi^+\pi^-$
978 ± 9		29 ABACHI	86B HRS	$e^+e^- \rightarrow \pi^+\pi^-\chi$
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 $\bar{p}p \rightarrow K_S^0 K_S^0$
969 ± 5		41 LEEPER	77 ASPK	2-2.4 $\pi^-p \rightarrow$ $\pi^+\pi^-n, K^+K^-n$
987 ± 7		41 BINNIE	73 CNTR	$\pi^-p \rightarrow nMM$
1012 ± 6		43 GRAYER	73 ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$
1007 ± 20		43 HYAMS	73 ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$
997 ± 6		43 PROTOPOP...	73 HBC	7 $\pi^+p \rightarrow \pi^+p\pi^+\pi^-$

OCCUR=2

¹ Quoted number refers to real part of pole position.

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

³ Quoted number refers to twice imaginary part of pole position.

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 $g_{f_0}^2 K K / g_{f_0}^2 \pi\pi = 0$.

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 $g_{f_0}^2 K K / g_{f_0}^2 \pi\pi = 4.21 \pm 0.25 \pm 0.21$ 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, $g_{f_0}^2 K \bar{K} / g_{f_0}^2 \pi\pi = 4.21 \pm 0.25 \pm 0.21$.

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

¹⁹ From the negative interference with the $f_0(500)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(500)$, and ACHASOV 01F for the $\rho\pi$ contribution.

²⁰ Coupled-channel Breit-Wigner, couplings $g_\pi = 0.09 \pm 0.01 \pm 0.01$, $g_K = 0.02 \pm 0.04 \pm 0.03$.

²¹ Supersedes ACHASOV 98i. Using the model of ACHASOV 89.

²² Supersedes ACHASOV 98i.

²³ In the "narrow resonance" approximation.

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- 24 Assuming $\Gamma(f_0) = 40$ MeV.
- 25 From a narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
- 26 From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
- 27 Supersedes BARBERIS 99 and BARBERIS 99B
- 28 T-matrix pole.
- 29 From invariant mass fit.
- 30 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(1039-93i)$ MeV.
- 31 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(963-29i)$ MeV.
- 32 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 33 At high $|t|$.
- 34 At low $|t|$.
- 35 On sheet II in a 4-pole solution, the other poles are found on sheet III at $(953-55i)$ MeV and on sheet IV at $(938-35i)$ MeV.
- 36 Combined fit of ALDE 95B, ANISOVICH 94, AMSLER 94D.
- 37 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(996-103i)$ MeV.
- 38 From sheet II pole position.
- 39 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(797-185i)$ MeV and can be interpreted as a shadow pole.
- 40 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(978-28i)$ MeV.
- 41 From coupled channel analysis.
- 42 Coupled channel analysis with finite width corrections.
- 43 Included in AGUILAR-BENITEZ 78 fit.

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 $f_0(980)$ WIDTH

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

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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. • • •				
42 ± 20 - 16		44,45 GARCIA-MAR..11	RVUE	Compilation
50 ± 20 - 12		45,46 GARCIA-MAR..11	RVUE	Compilation
48 ± 22 - 6		47 MOUSSALLAM11	RVUE	Compilation
36 ± 22		48 MENNESSIER 10	RVUE	Compilation
70 ± 20 - 32		49 ANISOVICH 09	RVUE	0.0 $\bar{p}p$, πN
91 ± 30 - 22 ± 3	44	50 ECKLUND 09	CLEO	4.17 $e^+e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
66.9 ± 2.2 ± 17.6 - 12.5		51 UEHARA 08A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
65 ± 13	262 ± 30	52 AUBERT 07AK	BABR	10.6 $e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
81 ± 21	54 ± 9	52 AUBERT 07AK	BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\pi^0\gamma$
51.3 ± 20.8 ± 13.2 - 17.7 - 3.8		53 MORI 07	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
61 ± 9 ± 14 - 8	2584	54 GARMASH 05	BELL	$B^+ \rightarrow K^+\pi^+\pi^-$
64 ± 16		55 ANISOVICH 03	RVUE	
121 ± 23		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
~ 70		56 BRAMON 02	RVUE	1.02 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
44 ± 2 ± 2	848	57 AITALA 01A	E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$
201 ± 28	419	58 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
122 ± 13	419	59,60 ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
56 ± 20		61 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
65 ± 20		BARBERIS 99	OMEG	450 $pp \rightarrow p_S p_F K^+ K^-$
80 ± 10		BARBERIS 99B	OMEG	450 $pp \rightarrow p_S p_F \pi^+ \pi^-$
80 ± 10		BARBERIS 99C	OMEG	450 $pp \rightarrow p_S p_F \pi^0 \pi^0$
48 ± 12 ± 8		62 BARBERIS 99D	OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$

NODE=M003W1

→ NOT CHECKED ←

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OCCUR=2

OCCUR=2

65 ± 25		BELLAZZINI	99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$	
71 ± 14		63 KAMINSKI	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
~ 28		63 OLLER	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 25		OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 14		63 OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$	
70 ± 20		ALDE	98	GAM4		
86 ± 16		63 ANISOVICH	98B	RVUE	Compilation	
54		64 LOCHER	98	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
69 ± 15		65 ALDE	97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$	
38 ± 20		66 BERTIN	97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$	
~ 100		67 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	68 ALDE	95B	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$	
95 ± 20	10k	69 ALDE	95B	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$	
26 ± 10		AMSLER	95B	CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$	
~ 112		70 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		71 ANISOVICH	95	RVUE		
30		JANSSEN	95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
74		72 BUGG	94	RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$	
29 ± 2		73 KAMINSKI	94	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
46		74 ZOU	94B	RVUE		
48 ± 12		75 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		65 AGUILAR...	91	EHS	400 pp	
72 ± 8		76 ARMSTRONG	91	OMEG	300 $pp \rightarrow pp\pi\pi,$ $ppK\bar{K}$	
110 ± 30		BREAKSTONE	90	SFM	$pp \rightarrow pp\pi^+\pi^-$	
29 ± 13		65 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		76 GIDAL	81	MRK2	$J/\psi \rightarrow \pi^+\pi^-X$	
to 300		77 ACHASOV	80	RVUE		
100 ± 80		78 AGUILAR...	78	HBC	0.7 $\bar{p}p \rightarrow K_S^0 K_S^0$	
30 ± 8		76 LEEPER	77	ASPK	2-2.4 $\pi^-p \rightarrow$ $\pi^+\pi^-n, K^+K^-n$	
48 ± 14		76 BINNIE	73	CNTR	$\pi^-p \rightarrow nMM$	
32 ± 10		79 GRAYER	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$	
30 ± 10		79 HYAMS	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$	
54 ± 16		79 PROTOPOP...	73	HBC	7 $\pi^+p \rightarrow$ $\pi^+\pi^+\pi^-$	

OCCUR=2

44 Quoted number refers to real part of pole position.

45 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 PROTOPOESCU 73.

46 Quoted number refers to twice imaginary part of pole position.

47 Pole position. Used Roy equations.

48 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.

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

50 Using a relativistic Breit-Wigner function and taking into account the finite D_s mass.51 Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^2 K K / g_{f_0}^2 \pi\pi = 0$.

52 Systematic errors not estimated.

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

54 Breit-Wigner, solution 1, PWA ambiguous.

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

56 Using the data of AKHMETSHIN 99C, ACHASOV 00H, and ALOISIO 02D.

57 Breit-Wigner width.

58 Supersedes ACHASOV 98I. Using the model of ACHASOV 89.

59 Supersedes ACHASOV 98I.

60 In the "narrow resonance" approximation.

61 From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.NODE=M003W1;LINKAGE=GC
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- 62 Supersedes BARBERIS 99 and BARBERIS 99B
 63 T-matrix pole.
 64 On sheet II in a 2 pole solution. The other pole is found on sheet III at (1039–93*i*) MeV.
 65 From invariant mass fit.
 66 On sheet II in a 2 pole solution. The other pole is found on sheet III at (963–29*i*) MeV.
 67 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
 68 At high $|t|$.
 69 At low $|t|$.
 70 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.
 71 Combined fit of ALDE 95B, ANISOVICH 94,
 72 On sheet II in a 2 pole solution. The other pole is found on sheet III at (996–103*i*) MeV.
 73 From sheet II pole position.
 74 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.
 75 On sheet II in a 2 pole solution. The other pole is found on sheet III at (978–28*i*) MeV.
 76 From coupled channel analysis.
 77 Coupled channel analysis with finite width corrections.
 78 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.
 79 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 ± 0.017 $^{+0.211}_{-0.070}$	80 UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$		
0.205 $^{+0.095}_{-0.083}$ $^{+0.147}_{-0.117}$	81 MORI	07 BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$		
0.28 $^{+0.09}_{-0.13}$	82 BOGLIONE	99 RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$		
0.42 ± 0.06 ± 0.18	83 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	84 MENNESSIER	11 RVUE			
0.29 ± 0.21 $^{+0.02}_{-0.07}$	85 MOUSSALLAM	11 RVUE	Compilation		
0.42	86,87 PENNINGTON	08 RVUE	Compilation		
0.10	87,88 PENNINGTON	08 RVUE	Compilation		
0.29 ± 0.07 ± 0.12	89,90 BOYER	90 MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$		
0.31 ± 0.14 ± 0.09	89,90 MARSISKE	90 CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$		
0.63 ± 0.14	91 MORGAN	90 RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$		
80 Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^2 K K / g_{f_0}^2 \pi \pi = 0$.					
81 Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^2 K K / g_{f_0}^2 \pi \pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.					
82 Supersedes MORGAN 90.					
83 OEST 90 quote systematic errors $^{+0.08}_{-0.18}$. We use ± 0.18 . Observed 60 events.					
84 Uses an analytic K-matrix model. Compilation.					
85 Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.					
86 Solution A (preferred solution based on χ^2 -analysis).					
87 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.					
88 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).					
89 From analysis allowing arbitrary background unconstrained by unitarity.					
90 Data included in MORGAN 90, BOGLIONE 99 analyses.					
91 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	$e^+e^- \rightarrow \pi^0\pi^0$

NODE=M003W3
 NODE=M003W3

 $f_0(980)$ BRANCHING RATIOS

NODE=M003225

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M003R1
 NODE=M003R1

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

0.52 ± 0.12	9.9k	⁹² AUBERT	06O BABR	$B^\pm \rightarrow K^\pm \pi^\pm \pi^\mp$
$0.75^{+0.11}_{-0.13}$		⁹³ ABLIKIM	05Q BES2	$\chi_{c0} \rightarrow 2\pi^+ 2\pi^-$, $\pi^+ \pi^- K^+ K^-$
0.84 ± 0.02		⁹⁴ ANISOVICH	02D SPEC	Combined fit
~ 0.68		OLLER	99B RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
0.67 ± 0.09		⁹⁵ LOVERRE	80 HBC	$4\pi^- p \rightarrow n 2K_S^0$
$0.81^{+0.09}_{-0.04}$		⁹⁵ CASON	78 STRC	$7\pi^- p \rightarrow n 2K_S^0$
0.78 ± 0.03		⁹⁵ WETZEL	76 OSPK	$8.9\pi^- p \rightarrow n 2K_S^0$

⁹² Recalculated by us using $\Gamma(K^+K^-)/\Gamma(\pi^+\pi^-) = 0.69 \pm 0.32$ from AUBERT 06O and isospin relations.

⁹³ Using data from ABLIKIM 04G.

⁹⁴ 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.

⁹⁵ Measure $\pi\pi$ elasticity assuming two resonances coupled to the $\pi\pi$ and $K\bar{K}$ channels only.

NODE=M003R1;LINKAGE=AU

NODE=M003R1;LINKAGE=AB
 NODE=M003R;LINKAGE=CH

NODE=M003R1;LINKAGE=B

 $f_0(980)$ REFERENCES

NODE=M003

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 051101R	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 00H	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.		
ANISOVICH 98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
	Translated from UFN 168 481.		

REFID=16761
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 REFID=46924
 REFID=47386
 REFID=46600
 REFID=46145
 REFID=46605
 REFID=46914

REFID=46331

LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
ISHIDA	96	PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
MORGAN	93	PR D48 1185	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=43614
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ACHASOV	80	SJNP 32 566	N.N. Achasov, S.A. Devyanin, G.N. Shestakov	(NOVM)	REFID=20458
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+) IJP	REFID=20382
AGUILAR-...	78	NP B140 73	M. Aguilar-Benitez <i>et al.</i>	(MADR, BOMB+)	REFID=20368
CASON	78	PRL 41 271	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20370
LEEPER	77	PR D16 2054	R.J. Leeper <i>et al.</i>	(ISU)	REFID=20365
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)	REFID=20446
WETZEL	76	NP B115 208	W. Wetzel <i>et al.</i>	(ETH, CERN, LOIC)	REFID=20362
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
BINNIE	73	PRL 31 1534	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20343
GRAYER	73	Tallahassee	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20347
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108

$a_0(980)$

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

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

NODE=M036

NODE=M036

 $a_0(980)$ MASS

VALUE (MeV)

DOCUMENT ID

980±20 OUR ESTIMATE Mass determination very model dependent

NODE=M036205

NODE=M036MX

→ NOT CHECKED ←

 $\eta\pi$ FINAL STATE ONLY

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

CHG

COMMENT

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

982.5 ± 1.6 ± 1.1	16.9k	¹ AMBROSINO	09F	KLOE	1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$
986 ± 4		ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$
982.3 + 0.6 + 3.1 - 0.7 - 4.7		² UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
987.4 ± 1.0 ± 3.0		^{3,4} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
989.1 ± 1.0 ± 3.0		^{4,5} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
985 ± 4 ± 6	318	ACHARD	02B	L3	183-209 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
995 + 52 - 10	36	⁶ ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
994 + 33 - 8	36	⁷ ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
975 ± 7		BARBERIS	00H		450 $pp \rightarrow p_f\eta\pi^0p_s$
988 ± 8		BARBERIS	00H		450 $pp \rightarrow \Delta_f^{++}\eta\pi^-p_s$
~ 1055		⁸ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 1009.2		⁸ OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
993.1 ± 2.1		⁹ TEIGE	99	B852	18.3 $\pi^-p \rightarrow \eta\pi^+\pi^-n$
988 ± 6		⁸ ANISOVICH	98B	RVUE	Compilation
987		TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
991		JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$
984.45 ± 1.23 ± 0.34		AMSLER	94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$
982 ± 2		¹⁰ AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
984 ± 4	1040	¹⁰ ARMSTRONG	91B	OMEG ±	300 $pp \rightarrow pp\eta\pi^+\pi^-$
976 ± 6		ATKINSON	84E	OMEG ±	25-55 $\gamma p \rightarrow \eta\pi n$
986 ± 3	500	¹¹ EVANGELIS...	81	OMEG ±	12 $\pi^-p \rightarrow \eta\pi^+\pi^-\pi^-p$
990 ± 7	145	¹¹ GURTU	79	HBC ±	4.2 $K^-p \rightarrow \Lambda\eta 2\pi$
980 ± 11	47	CONFORTO	78	OSPK -	4.5 $\pi^-p \rightarrow pX^-$
978 ± 16	50	CORDEN	78	OMEG ±	12-15 $\pi^-p \rightarrow n\eta 2\pi$
977 ± 7		GRASSLER	77	HBC -	16 $\pi^\mp p \rightarrow p\eta 3\pi$
989 ± 4	70	WELLS	75	HBC -	3.1-6 $K^-p \rightarrow \Lambda\eta 2\pi$
972 ± 10	150	DEFOIX	72	HBC ±	0.7 $\bar{p}p \rightarrow 7\pi$
970 ± 15	20	BARNES	69C	HBC -	4-5 $K^-p \rightarrow \Lambda\eta 2\pi$
980 ± 10		CAMPBELL	69	DBC ±	2.7 π^+d
980 ± 10	15	MILLER	69B	HBC -	4.5 $K^-N \rightarrow \eta\pi\Lambda$
980 ± 10	30	AMMAR	68	HBC ±	5.5 $K^-p \rightarrow \Lambda\eta 2\pi$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ Using the model of ACHASOV 89 and ACHASOV 03B.² From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.³ Parameterizes couplings to $\bar{K}K$, $\pi\eta$, and $\pi\eta'$.⁴ Using AMSLER 94D and ABELE 98.⁵ From the T-matrix pole on sheet II.⁶ Using the model of ACHASOV 89. Supersedes ACHASOV 98B.⁷ Using the model of JAFFE 77. Supersedes ACHASOV 98B.⁸ T-matrix pole.⁹ Breit-Wigner fit, average between $a_0^\pm$ and a_0^0 . The fit favors a slightly heavier $a_0^\pm$.¹⁰ From a single Breit-Wigner fit.¹¹ From $f_1(1285)$ decay.

NODE=M036M1;LINKAGE=AM

NODE=M036M1;LINKAGE=UE

NODE=M036M1;LINKAGE=BP

NODE=M036M1;LINKAGE=BU

NODE=M036M1;LINKAGE=BT

NODE=M036M1;LINKAGE=V1

NODE=M036M1;LINKAGE=M2

NODE=M036M1;LINKAGE=AN

NODE=M036M1;LINKAGE=BF

NODE=M036M1;LINKAGE=A

NODE=M036M1;LINKAGE=R

$K\bar{K}$ ONLY

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

¹² T-matrix pole.¹³ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.¹⁴ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.¹⁵ Plus systematic errors.NODE=M036M2
NODE=M036M2NODE=M036M2;LINKAGE=AN
NODE=M036M2;LINKAGE=Q
NODE=M036M2;LINKAGE=A
NODE=M036M2;LINKAGE=S **$a_0(980)$ WIDTH**

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

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

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

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

NODE=M036210

NODE=M036W1

→ NOT CHECKED ←

OCCUR=2

NODE=M036W1;LINKAGE=UE

NODE=M036W1;LINKAGE=BU

NODE=M036W1;LINKAGE=AN

NODE=M036W1;LINKAGE=BE

NODE=M036W1;LINKAGE=A

NODE=M036W1;LINKAGE=R

NODE=M036W1;LINKAGE=F

$K\bar{K}$ ONLY

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

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

24 T-matrix pole.

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

26 Plus systematic errors.

NODE=M036W2
NODE=M036W2

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

 $a_0(980)$ DECAY MODES

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

NODE=M036215;NODE=M036

DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=2
DESIG=5;OUR EST;→ NOT CHECKED ←
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

NODE=M036

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

REFID=53105

REFID=52719

REFID=53002

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REFID=49217

REFID=48574

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REFID=20399

$\phi(1020)$

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

NODE=M004

 $\phi(1020)$ MASS

NODE=M004M

NODE=M004M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1019.455±0.020 OUR AVERAGE		Error includes scale factor of 1.1.		
1019.30 ±0.02 ±0.10	105k	AKHMETSHIN 06	CMD2	$0.98-1.06 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.52 ±0.05 ±0.05	17.4k	AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
1019.483±0.011±0.025	272k	¹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
1019.42 ±0.05	1900k	² ACHASOV 01E	SND	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$
1019.40 ±0.04 ±0.05	23k	AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1019.36 ±0.12		³ ACHASOV 00B	SND	$e^+e^- \rightarrow \eta\gamma$
1019.38 ±0.07 ±0.08	2200	⁴ AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.51 ±0.07 ±0.10	11169	AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.5 ±0.4		BARBERIS 98	OMEG	$450 pp \rightarrow pp2K^+2K^-$
1019.42 ±0.06	55600	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow \text{hadrons}$
1019.7 ±0.3	2012	DAVENPORT 86	MPSF	$400 pA \rightarrow 4KX$
1019.7 ±0.1 ±0.1	5079	ALBRECHT 85D	ARG	$10 e^+e^- \rightarrow K^+K^-X$
1019.3 ±0.1	1500	ARENTON 82	AEMS	$11.8 \text{ polar. } pp \rightarrow KK$
1019.67 ±0.17	25080	⁵ PELLINEN 82	RVUE	
1019.52 ±0.13	3681	BUKIN 78C	OLYA	$e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1019.441±0.008±0.080	542k	⁶ AKHMETSHIN 08	CMD2	$1.02 e^+e^- \rightarrow K^+K^-$
1019.63 ±0.07	12540	⁷ AUBERT,B 05J	BABR	$D^0 \rightarrow \bar{K}^0 K^+ K^-$
1019.8 ±0.7		ARMSTRONG 86	OMEG	$85 \pi^+ / pp \rightarrow \pi^+ / p4Kp$
1020.1 ±0.11	5526	⁷ ATKINSON 86	OMEG	$20-70 \gamma p$
1019.7 ±1.0		BEBEK 86	CLEO	$e^+e^- \rightarrow \mathcal{T}(4S)$
1019.411±0.008	642k	⁸ DIJKSTRA 86	SPEC	$100-200 \pi^\pm, \bar{p}, p, K^\pm, \text{ on Be}$
1020.9 ±0.2		⁷ FRAME 86	OMEG	$13 K^+ p \rightarrow \phi K^+ p$
1021.0 ±0.2		⁷ ARMSTRONG 83B	OMEG	$18.5 K^- p \rightarrow K^- K^+ \Lambda$
1020.0 ±0.5		⁷ ARMSTRONG 83B	OMEG	$18.5 K^- p \rightarrow K^- K^+ \Lambda$
1019.7 ±0.3		⁷ BARATE 83	GOLI	$190 \pi^- \text{ Be} \rightarrow 2\mu X$
1019.8 ±0.2 ±0.5	766	IVANOV 81	OLYA	$1-1.4 e^+e^- \rightarrow K^+K^-$
1019.4 ±0.5	337	COOPER 78B	HBC	$0.7-0.8 \bar{p}p \rightarrow K_S^0 K_L^0 \pi^+ \pi^-$
1020 ±1	383	⁷ BALDI 77	CNTR	$10 \pi^- p \rightarrow \pi^- \phi p$
1018.9 ±0.6	800	COHEN 77	ASPK	$6 \pi^\pm N \rightarrow K^+ K^- N$
1019.7 ±0.5	454	KALBFLEISCH 76	HBC	$2.18 K^- p \rightarrow \Lambda K \bar{K}$
1019.4 ±0.8	984	BESCH 74	CNTR	$2 \gamma p \rightarrow p K^+ K^-$
1020.3 ±0.4	100	BALLAM 73	HBC	$2.8-9.3 \gamma p$
1019.4 ±0.7		BINNIE 73B	CNTR	$\pi^- p \rightarrow \phi n$
1019.6 ±0.5	120	⁹ AGUILAR-... 72B	HBC	$3.9, 4.6 K^- p \rightarrow \Lambda K^+ K^-$
1019.9 ±0.5	100	⁹ AGUILAR-... 72B	HBC	$3.9, 4.6 K^- p \rightarrow K^- p K^+ K^-$
1020.4 ±0.5	131	COLLEY 72	HBC	$10 K^+ p \rightarrow K^+ p \phi$
1019.9 ±0.3	410	STOTTLE... 71	HBC	$2.9 K^- p \rightarrow \Sigma / \Lambda K \bar{K}$

OCCUR=2

OCCUR=2

OCCUR=2

¹ Update of AKHMETSHIN 99D² From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.³ Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.⁴ Using a total width of 4.43 ± 0.05 MeV.

NODE=M004M;LINKAGE=GS

NODE=M004M;LINKAGE=AE

NODE=M004M;LINKAGE=G2

NODE=M004M;LINKAGE=F2

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

⁶Strongly correlated with AKHMETSHIN 04.

⁷Systematic errors not evaluated.

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

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

NODE=M004M;LINKAGE=R

NODE=M004M;LINKAGE=AH

NODE=M004M;LINKAGE=A

NODE=M004M;LINKAGE=B

NODE=M004M;LINKAGE=D

$\phi(1020)$ WIDTH

NODE=M004W

NODE=M004W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.26 ±0.04 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
4.30 ±0.06 ±0.17	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.280 ±0.033 ±0.025	272k	¹⁰ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
4.21 ±0.04	1900k	¹¹ ACHASOV 01E	SND	$e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$
4.44 ±0.09	55600	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow$ hadrons
4.5 ±0.7	1500	ARENTON 82	AEMS	11.8 polar. $pp \rightarrow KK$
4.2 ±0.6	766	¹² IVANOV 81	OLYA	1–1.4 $e^+e^- \rightarrow K^+K^-$
4.3 ±0.6		¹² CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.36 ±0.29	3681	¹² BUKIN 78C	OLYA	$e^+e^- \rightarrow$ hadrons
4.4 ±0.6	984	¹² BESCH 74	CNTR	$2\gamma p \rightarrow pK^+K^-$
4.67 ±0.72	681	¹² 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	¹³ AKHMETSHIN 08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
4.28 ±0.13	12540	¹⁴ 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	¹² COOPER 78B	HBC	0.7–0.8 $\bar{p}p \rightarrow K_S^0 K_L^0 \pi^+\pi^-$
4.5 ±0.50	1300	^{12,14} AKERLOF 77	SPEC	400 $pA \rightarrow K^+K^-X$
4.5 ±0.8	500	^{12,14} 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	¹² BORENSTEIN 72	HBC	2.18 $K^-p \rightarrow K\bar{K}n$

¹⁰Update of AKHMETSHIN 99D

¹¹From 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.

¹²Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹³Strongly correlated with AKHMETSHIN 04.

¹⁴Systematic errors not evaluated.

NODE=M004W;LINKAGE=GS

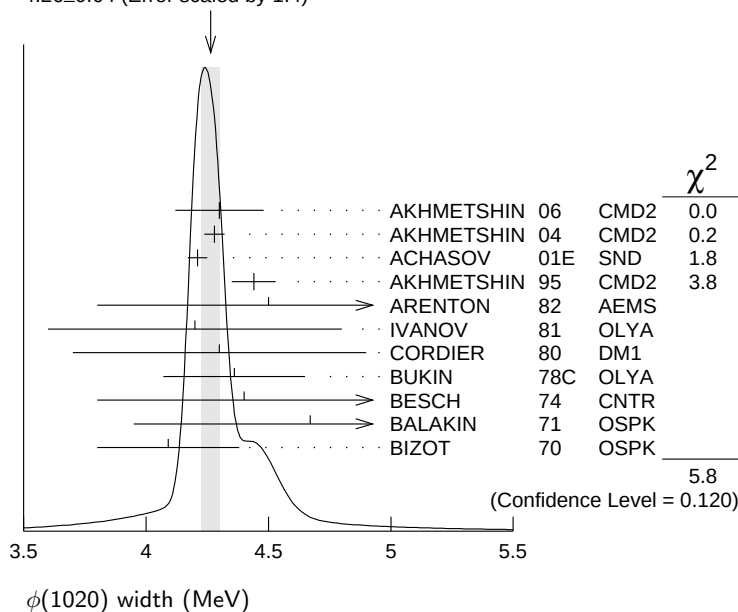
NODE=M004W;LINKAGE=AE

NODE=M004W;LINKAGE=D

NODE=M004W;LINKAGE=AH

NODE=M004W;LINKAGE=A

WEIGHTED AVERAGE
4.26±0.04 (Error scaled by 1.4)



$\phi(1020)$ DECAY MODES

NODE=M004215;NODE=M004

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
$\Gamma_1 \quad K^+ K^-$	(48.9 $\pm$ 0.5) %	S=1.1	DESIG=1
$\Gamma_2 \quad K_L^0 K_S^0$	(34.2 $\pm$ 0.4) %	S=1.1	DESIG=2
$\Gamma_3 \quad \rho\pi^+ \pi^+ \pi^- \pi^0$	(15.32 $\pm$ 0.32) %	S=1.1	DESIG=24
$\Gamma_4 \quad \rho\pi$			DESIG=16
$\Gamma_5 \quad \pi^+ \pi^- \pi^0$			DESIG=3
$\Gamma_6 \quad \eta\gamma$	(1.309 $\pm$ 0.024) %	S=1.2	DESIG=4
$\Gamma_7 \quad \pi^0\gamma$	(1.27 $\pm$ 0.06) $\times 10^{-3}$		DESIG=7
$\Gamma_8 \quad \ell^+ \ell^-$	—		DESIG=256;OUR EVAL; NOT CHECKED ←
$\Gamma_9 \quad e^+ e^-$	(2.954 $\pm$ 0.030) $\times 10^{-4}$	S=1.1	DESIG=5
$\Gamma_{10} \quad \mu^+ \mu^-$	(2.87 $\pm$ 0.19) $\times 10^{-4}$		DESIG=6
$\Gamma_{11} \quad \eta e^+ e^-$	(1.15 $\pm$ 0.10) $\times 10^{-4}$		DESIG=17
$\Gamma_{12} \quad \pi^+ \pi^-$	(7.4 $\pm$ 1.3) $\times 10^{-5}$		DESIG=8
$\Gamma_{13} \quad \omega\pi^0$	(4.7 $\pm$ 0.5) $\times 10^{-5}$		DESIG=25
$\Gamma_{14} \quad \omega\gamma$	< 5 %	CL=84%	DESIG=10
$\Gamma_{15} \quad \rho\gamma$	< 1.2 $\times 10^{-5}$	CL=90%	DESIG=12
$\Gamma_{16} \quad \pi^+ \pi^- \gamma$	(4.1 $\pm$ 1.3) $\times 10^{-5}$		DESIG=9
$\Gamma_{17} \quad f_0(980)\gamma$	(3.22 $\pm$ 0.19) $\times 10^{-4}$	S=1.1	DESIG=20
$\Gamma_{18} \quad \pi^0 \pi^0 \gamma$	(1.13 $\pm$ 0.06) $\times 10^{-4}$		DESIG=19
$\Gamma_{19} \quad \pi^+ \pi^- \pi^+ \pi^-$	(4.0 $^{+2.8}_{-2.2}$) $\times 10^{-6}$		DESIG=15
$\Gamma_{20} \quad \pi^+ \pi^+ \pi^- \pi^- \pi^0$	< 4.6 $\times 10^{-6}$	CL=90%	DESIG=14
$\Gamma_{21} \quad \pi^0 e^+ e^-$	(1.12 $\pm$ 0.28) $\times 10^{-5}$		DESIG=21
$\Gamma_{22} \quad \pi^0 \eta\gamma$	(7.27 $\pm$ 0.30) $\times 10^{-5}$	S=1.5	DESIG=22
$\Gamma_{23} \quad a_0(980)\gamma$	(7.6 $\pm$ 0.6) $\times 10^{-5}$		DESIG=23
$\Gamma_{24} \quad K^0 \bar{K}^0 \gamma$	< 1.9 $\times 10^{-8}$	CL=90%	DESIG=257
$\Gamma_{25} \quad \eta'(958)\gamma$	(6.25 $\pm$ 0.21) $\times 10^{-5}$		DESIG=194
$\Gamma_{26} \quad \eta\pi^0 \pi^0 \gamma$	< 2 $\times 10^{-5}$	CL=90%	DESIG=195
$\Gamma_{27} \quad \mu^+ \mu^- \gamma$	(1.4 $\pm$ 0.5) $\times 10^{-5}$		DESIG=196
$\Gamma_{28} \quad \rho\gamma\gamma$	< 1.2 $\times 10^{-4}$	CL=90%	DESIG=250
$\Gamma_{29} \quad \eta\pi^+ \pi^-$	< 1.8 $\times 10^{-5}$	CL=90%	DESIG=255
$\Gamma_{30} \quad \eta\mu^+ \mu^-$	< 9.4 $\times 10^{-6}$	CL=90%	DESIG=26
Lepton Family number (LF) violating modes			
$\Gamma_{31} \quad e^\pm \mu^\mp$	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. • • •			
$58.9 \pm 0.5 \pm 2.4$	ACHASOV	00	SND $e^+e^- \rightarrow \eta\gamma$

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

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$5.40 \pm 0.16^{+0.43}_{-0.40}$	ACHASOV	00	SND $e^+e^- \rightarrow \pi^0\gamma$

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

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.320 \pm 0.017 \pm 0.015$	¹⁵ AMBROSINO	05	KLOE $1.02 e^+e^- \rightarrow \mu^+\mu^-$

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

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.27 ± 0.04 OUR EVALUATION			
1.251 ± 0.021 OUR AVERAGE Error includes scale factor of 1.1.			
$1.235 \pm 0.006 \pm 0.022$	¹⁶ AKHMETSHIN	11	CMD2 $1.02 e^+e^- \rightarrow \phi$
$1.32 \pm 0.05 \pm 0.03$	¹⁷ 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
→ NOT CHECKED ← **$(\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-))^{\frac{1}{2}}$** **$(\Gamma_9\Gamma_{10})^{\frac{1}{2}}$**

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

NODE=M004W9
NODE=M004W9

¹⁵ Weighted average of Γ_{ee} and $\sqrt{\Gamma_{ee}\Gamma_{\mu\mu}}$ from AMBROSINO 05 assuming lepton universality.

NODE=M004W5;LINKAGE=AM

¹⁶ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

NODE=M004W8;LINKAGE=AK

¹⁷ From forward-backward asymmetry and using $\Gamma_{\text{total}} = 4.26 \pm 0.05$ MeV from the 2004 edition of this Review.

NODE=M004W8;LINKAGE=AM

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

NODE=M004224

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
14.46 ± 0.23 OUR FIT Error includes scale factor of 1.1.				
14.24 ± 0.30 OUR AVERAGE				
$14.27 \pm 0.05 \pm 0.31$	542k	AKHMETSHIN	08	CMD2 $1.02 e^+e^- \rightarrow K^+K^-$
$13.93 \pm 0.14 \pm 0.99$	1000k	¹⁸ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
10.10 ± 0.13 OUR FIT				
10.06 ± 0.16 OUR AVERAGE				
$10.01 \pm 0.04 \pm 0.17$	272k	¹⁹ AKHMETSHIN	04	CMD2 $e^+e^- \rightarrow K_L^0 K_S^0$
$10.27 \pm 0.07 \pm 0.34$	500k	¹⁸ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$

NODE=M004G6
NODE=M004G6

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

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

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

4.46 ±0.12 OUR AVERAGE

4.51 ±0.16 ±0.11	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

4.30 ±0.08 ±0.21		AUBERT,B	04N	BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

4.665 ±0.042 ±0.261	400k	18 ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$

4.35 ±0.27 ±0.08	11169	20 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^-

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

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

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

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

4.050 ±0.067 ±0.118	33k	21 ACHASOV	07B	SND 0.6–1.38 $e^+e^- \rightarrow \eta\gamma$

4.093 ^{+0.040} _{-0.043} ±0.247	17.4k	22 AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$

3.850 ±0.041 ±0.159	23k	23,24 AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

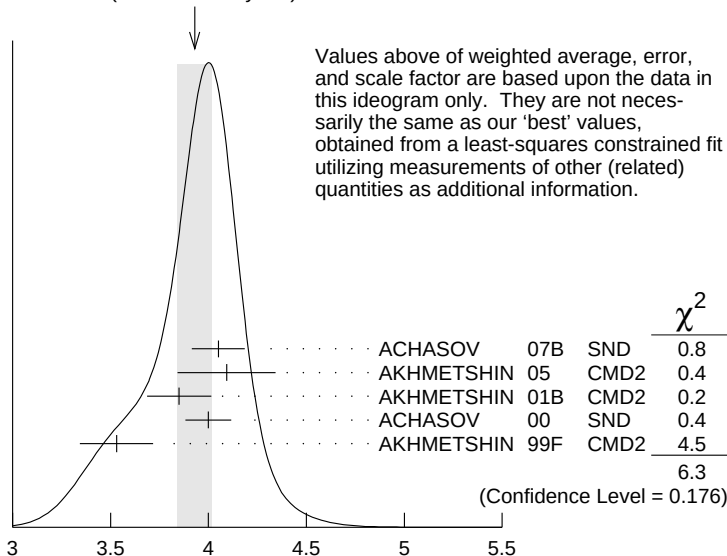
4.00 ±0.04 ±0.11		25 ACHASOV	00	SND $e^+e^- \rightarrow \eta\gamma$

3.53 ±0.08 ±0.17	2200	26,27 AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \eta\gamma$

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

4.19 ±0.06		28 BENAYOUN	10	RVUE 0.4–1.05 e^+e^-

WEIGHTED AVERAGE
3.93±0.09 (Error scaled by 1.3)



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

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

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

3.74 ±0.18 OUR FIT

3.71 ±0.21 OUR AVERAGE

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

3.67 ±0.10 ^{+0.27} _{-0.25}		29 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		28 BENAYOUN	10	RVUE 0.4–1.05 e^+e^-

NODE=M004G7
NODE=M004G7

NODE=M004G2
NODE=M004G2

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})

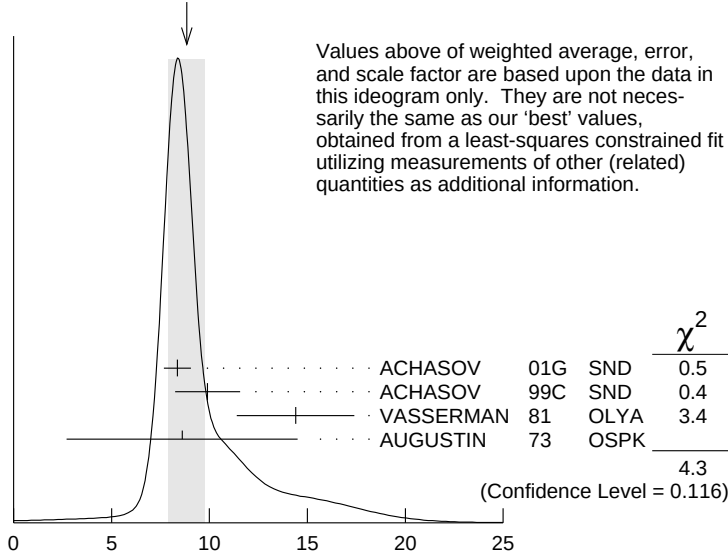
DOCUMENT ID

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 $\pm 1.4 \pm 0.9$	26 ACHASOV	99C	SND	$e^+e^- \rightarrow \mu^+\mu^-$
14.4 ± 3.0	20 VASSERMAN	81	OLYA	$e^+e^- \rightarrow \mu^+\mu^-$
8.6 ± 5.9	20 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 $\pm 0.3 \pm 0.3$	26 ACHASOV	00C	SND	$e^+e^- \rightarrow \pi^+\pi^-$
1.95 ± 1.15 -0.87	20 GOLUBEV	86	ND	$e^+e^- \rightarrow \pi^+\pi^-$
6.01 ± 3.19 -2.51	20 VASSERMAN	81	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$

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

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

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

NODE=M004G11
NODE=M004G11**1.40 ± 0.15 OUR FIT****1.37 $\pm 0.17 \pm 0.01$** 30,31 AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$

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

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

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

NODE=M004G9
NODE=M004G9**3.34 ± 0.17 OUR FIT****3.33 $\pm 0.04 \pm 0.19$
-0.09 -0.20** 32 AMBROSINO 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 26 AKHMETSHIN 00E CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

¹⁸ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

¹⁹ Update of AKHMETSHIN 99D

²⁰ Recalculated by us from the cross section in the peak.

NODE=M004G;LINKAGE=AE

NODE=M004G;LINKAGE=GS

NODE=M004G;LINKAGE=B

- 21 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.
- 22 From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
- 23 From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
- 24 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).
- 25 From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.
- 26 Recalculated by the authors from the cross section in the peak.
- 27 From the $\eta \rightarrow \pi^+\pi^-\pi^0$ decay and using $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.
- 28 A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.
- 29 From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\pi^0 \rightarrow 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.
- 30 Recalculated by the authors from the cross section at the peak.
- 31 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.
- 32 Calculated by the authors from the cross section at the peak.

NODE=M004G2;LINKAGE=AH

NODE=M004G2;LINKAGE=AK

NODE=M004G;LINKAGE=AK

NODE=M004G;LINKAGE=BQ

NODE=M004G2;LINKAGE=A

NODE=M004G;LINKAGE=A

NODE=M004G2;LINKAGE=C

NODE=M004G7;LINKAGE=BE

NODE=M004G3;LINKAGE=A

NODE=M004G11;LINKAGE=AB

NODE=M004G11;LINKAGE=AM

NODE=M004G9;LINKAGE=AM

NODE=M004220

NODE=M004R1

NODE=M004R1

NODE=M004R2

NODE=M004R2

NODE=M004R19

NODE=M004R19

 $\phi(1020)$ BRANCHING RATIOS **$\Gamma(K^+K^-)/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

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	$2.1\text{--}2.7 K^-p \rightarrow \Lambda K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.493±0.003±0.007		33 AKHMETSHIN 11	CMD2	$1.02 e^+e^- \rightarrow K^+K^-$
0.476±0.017	1000k	34 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		33 AKHMETSHIN 11	CMD2	$1.02 e^+e^- \rightarrow K_S^0 K_L^0$
0.351±0.013	500k	34 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	$2.1\text{--}2.7 K^-p \rightarrow \Lambda K_L^0 K_S^0$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.698±0.014 OUR FIT	Error includes scale factor of 1.1.			
0.740±0.031 OUR AVERAGE				
0.70 ±0.06	2732	BUKIN 78C	OLYA	$e^+e^- \rightarrow K_L^0 K_S^0$
0.82 ±0.08		LOSTY 78	HBC	$4.2 K^-p \rightarrow \phi \text{ hyperon}$
0.71 ±0.05		LAVEN 77	HBC	$10 K^-p \rightarrow K^+K^-\Lambda$
0.71 ±0.08		LYONS 77	HBC	$3\text{--}4 K^-p \rightarrow \Lambda\phi$
0.89 ±0.10	144	AGUILAR-...	72B	$3.9, 4.6 K^-p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.68 ±0.03		35 AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0, K^+K^-$

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

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

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

NODE=M004R5
NODE=M004R5

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

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1532±0.0032 OUR FIT	Error includes scale factor of 1.1.			
0.151 ±0.009 OUR AVERAGE	Error includes scale factor of 1.7.			
0.161 ±0.008	11761	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.143 ±0.007		DOLINSKY 91	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.155 ±0.002 ±0.005	33	AKHMETSHIN 11	CMD2	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.159 ±0.008	400k	34 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	36 AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.139 ±0.007		37 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	38,39 ALOISIO	03 KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.0006	90		40 ACHASOV	02 SND	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.23	90		40 CORDIER	80 DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
<0.20	90		40 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	41 ACHASOV	98F SND	$e^+e^- \rightarrow 7\gamma$
1.18 ±0.11	279	42 AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 3\gamma$
1.30 ±0.06		43 DRUZHININ 84	ND	$e^+e^- \rightarrow 3\gamma$
1.4 ±0.2		44 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	43 COSME	76 OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.38 ±0.02 ±0.02		33 AKHMETSHIN 11	CMD2	1.02 $e^+e^- \rightarrow \eta\gamma$
1.37 ±0.05 ±0.01	33k	45 ACHASOV	07B SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
1.373±0.014±0.085	17.4k	46,47 AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
1.287±0.013±0.063		48,49 AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.338±0.012±0.052		50 ACHASOV	00 SND	$e^+e^- \rightarrow \eta\gamma$
1.18 ±0.03 ±0.06	2200	51 AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.21 ±0.07		52 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 ^{53,54} AKHMETSHIN 05 CMD2 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$ 1.226 $\pm$ 0.036 $^{+0.096}_{-0.089}$ ⁵⁵ ACHASOV 00 SND $e^+e^- \rightarrow \pi^0\gamma$ 1.26 $\pm$ 0.17 ⁵² 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 ⁵⁶ ACHASOV 01E SND $e^+e^- \rightarrow K^+K^-, K_S^0K_L^0, \pi^+\pi^-\pi^0$ 2.88 $\pm$ 0.09 55600 AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow \text{hadrons}$ 3.00 $\pm$ 0.21 3681 BUKIN 78C OLYA $e^+e^- \rightarrow \text{hadrons}$ 3.10 $\pm$ 0.14 ⁵⁷ PARROUR 76 OSPK e^+e^- 3.3 $\pm$ 0.3 COSME 74 OSPK $e^+e^- \rightarrow \text{hadrons}$ 2.81 $\pm$ 0.25 681 BALAKIN 71 OSPK $e^+e^- \rightarrow \text{hadrons}$ 3.50 $\pm$ 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 ⁵⁸ HAYES 71 CNTR 8.3,9.8 $\gamma C \rightarrow \mu^+\mu^- X$ 2.17 $\pm$ 0.60 ⁵⁸ 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 ⁵⁹ ACHASOV 01G SND $e^+e^- \rightarrow \mu^+\mu^-$ 3.30 $\pm$ 0.45 $\pm$ 0.32 ³⁶ ACHASOV 99C SND $e^+e^- \rightarrow \mu^+\mu^-$ 4.83 $\pm$ 1.02 ⁶⁰ VASSERMAN 81 OLYA $e^+e^- \rightarrow \mu^+\mu^-$ 2.87 $\pm$ 1.98 ⁶⁰ 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 ⁶¹ ACHASOV 01B SND $e^+e^- \rightarrow \gamma\gamma e^+e^-$ 1.14 $\pm$ 0.10 $\pm$ 0.06 355 ⁶² 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 ⁶³ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ 1.21 $\pm$ 0.14 $\pm$ 0.09 130 ⁶⁴ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$ 1.04 $\pm$ 0.20 $\pm$ 0.08 42 ⁶⁵ 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 ³⁶ ACHASOV 00C SND $e^+e^- \rightarrow \pi^+\pi^-$ 0.65 $^{+0.38}_{-0.29}$ ³⁶ GOLUBEV 86 ND $e^+e^- \rightarrow \pi^+\pi^-$ 2.01 $^{+1.07}_{-0.84}$ ³⁶ 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}**66,67 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

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

~ 5.4

69 ACHASOV 00E SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 5.5^{+1.6}_{-1.4}±0.367,70 AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$ 4.8^{+1.9}_{-1.7}±0.869 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

71 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

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

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

< 0.3

90

73 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

74

AMBROSINO

07

KLOE

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

2.90±0.21±1.54

75

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

76

ALOISIO

02D

KLOE

 $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 3.5 ±0.3 ^{+1.3}_{-0.5}

419

77,78

ACHASOV

00H

SND

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

1.93±0.46±0.50

27188

79

AKHMETSHIN

99B

CMD2

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

3.05±0.25±0.72

268

80

AKHMETSHIN

99C

CMD2

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

1.5 ±0.5

268

81

AKHMETSHIN

99C

CMD2

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

OCCUR=2

3.42±0.30±0.36

164

77

ACHASOV

98I

SND

 $e^+e^- \rightarrow 5\gamma$

< 1

90

82

AKHMETSHIN

97C

CMD2

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

< 7

90

83

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

77

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 $+0.01$ $+0.06$
 -0.03 -0.06 84 AMBROSINO 07 KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 1.08 ± 0.17 ± 0.09

268

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

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

1.09 ± 0.03 ± 0.05

2438

ALOISIO 02D KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 1.158 ± 0.093 ± 0.052

419

78,85 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

85

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

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

0.90 ± 0.08 ± 0.07

164

ACHASOV

98I

SND

 $e^+e^- \rightarrow 5\gamma$ NODE=M004R39
NODE=M004R39 $\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{19}/Γ VALUE (units 10^{-6}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

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

3.93 ± 1.74 ± 2.14

3285

AKHMETSHIN 00E

CMD2

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

< 870

90

CORDIER

79

WIRE

 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$ NODE=M004R22
NODE=M004R22 $\Gamma(\pi^+\pi^+\pi^-\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ VALUE (units 10^{-6}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

< 4.6

90

AKHMETSHIN 00E

CMD2

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

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

<150

95

BARKOV

88

CMD

 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\pi^0$ NODE=M004R27
NODE=M004R27 $\Gamma(\pi^0e^+e^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ VALUE (units 10^{-5}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

1.12 $\pm$ 0.28 OUR AVERAGE1.01 ± 0.28 ± 0.29

52

86

ACHASOV 02D SND $e^+e^- \rightarrow \pi^0e^+e^-$ 1.22 ± 0.34 ± 0.21

46

87

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 ± 0.22

16.9k

88

AMBROSINO

09F

KLOE

1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$ 8.51 ± 0.51 ± 0.57

607

89

ALOISIO

02C

KLOE

 $e^+e^- \rightarrow \eta\pi^0\gamma$ 7.96 ± 0.60 ± 0.40

197

90

ALOISIO

02C

KLOE

 $e^+e^- \rightarrow \eta\pi^0\gamma$ 8.8 ± 1.4 ± 0.9

36

91

ACHASOV

00F

SND

 $e^+e^- \rightarrow \eta\pi^0\gamma$ 9.0 ± 2.4 ± 1.0

80

AKHMETSHIN

99C

CMD2

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

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

7.01 ± 0.10 ± 0.20

13.3k

89,92

AMBROSINO

09F

KLOE

1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$ 7.12 ± 0.13 ± 0.22

3.6k

90,93

AMBROSINO

09F

KLOE

1.02 $e^+e^- \rightarrow \eta\pi^0\gamma$ 8.3 ± 2.3 ± 1.2

20

ACHASOV

98B

SND

 $e^+e^- \rightarrow 5\gamma$

<250

90

DOLINSKY

91

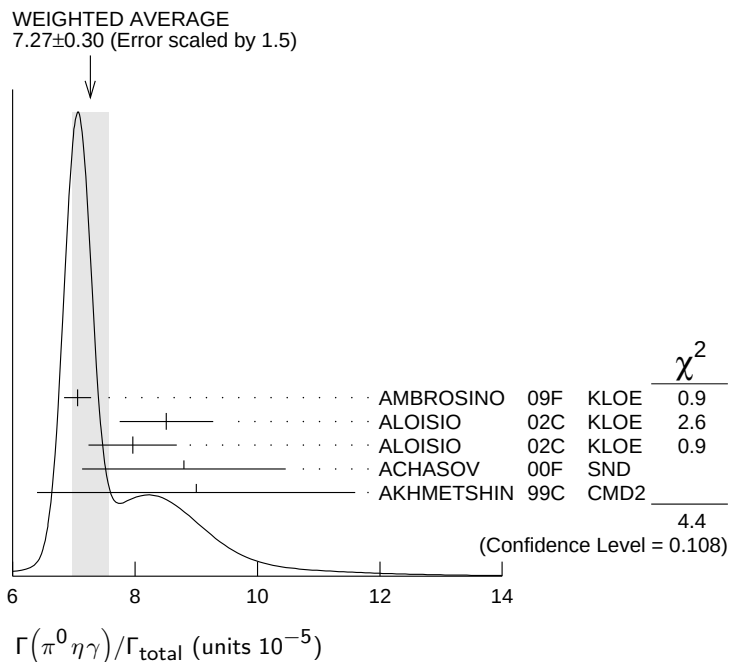
ND

 $e^+e^- \rightarrow \pi^0\eta\gamma$ NODE=M004R32
NODE=M004R32

OCCUR=2

OCCUR=2

OCCUR=3



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

Γ_{23}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.6±0.6 OUR FIT					
7.6±0.6 OUR AVERAGE					
7.4±0.7			94 ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8±1.7	36		95 ACHASOV	00F SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
11 ±2			96 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	97 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		98 AMBROSINO	07A KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\gamma$
6.7 ^{+2.8} _{-2.4} ±0.8	12		99 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		100 ALOISIO	02E KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\gamma$
8.2 ^{+2.1} _{-1.9} ±1.1	21		101 AKHMETSHIN	00B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
4.9 ^{+2.2} _{-1.8} ±0.6	9		102 AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ±1.6	30		103 AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \eta'(958)\gamma$
6.7 ^{+3.4} _{-2.9} ±1.0	5		104 AULCHENKO	99 SND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<11	90		AULCHENKO	98 SND	$e^+e^- \rightarrow 7\gamma$
12 ⁺⁷ ₋₅ ±2	6		101 AKHMETSHIN	97B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<41	90		DRUZHININ	87 ND	$e^+e^- \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M004R25
NODE=M004R25

OCCUR=2

OCCUR=2

$\Gamma(\eta'(958)\gamma)/\Gamma(K_L^0 K_S^0)$ 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

105

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

106

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

107

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

79

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

108

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

³³ 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 .

³⁴ Using $B(\phi \rightarrow e^+e^-) = (2.93 \pm 0.14) \times 10^{-4}$.

³⁵ Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiative corrections, as well as isospin breaking, predicts 0.62. FLOREZ-BAEZ 08 predicts 0.63 considering also structure-dependent radiative corrections. FIS-CHBACH 02 calculates additional corrections caused by the close threshold and predicts 0.68. See also BENAYOUN 01 and DUBYSKIY 07.

³⁶ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

³⁷ 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.

³⁸ From a fit without limitations on charged and neutral ρ masses and widths.

³⁹ Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

⁴⁰ Neglecting the interference between the $\rho\pi$ and $\pi^+\pi^-\pi^0$.

⁴¹ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.

⁴² From $\pi^+\pi^-\pi^0$ decay mode of η .

⁴³ From 2γ decay mode of η .

⁴⁴ From $3\pi^0$ decay mode of η .

⁴⁵ ACHASOV 07B reports $[\Gamma(\phi(1020) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow e^+e^-)] = (4.050 \pm 0.067 \pm 0.118) \times 10^{-6}$ which we divide by our best value $B(\phi(1020) \rightarrow e^+e^-)$

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NODE=M004R;LINKAGE=8D

NODE=M004R3;LINKAGE=E

NODE=M004R;LINKAGE=L1

NODE=M004R;LINKAGE=L2

NODE=M004R;LINKAGE=46

NODE=M004R11;LINKAGE=AC

NODE=M004R11;LINKAGE=Z3

NODE=M004R11;LINKAGE=A

NODE=M004R11;LINKAGE=C

NODE=M004R11;LINKAGE=AO

- $= (2.954 \pm 0.030) \times 10^{-4}$. 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.
- 46 Using $B(\phi \rightarrow e^+ e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
 47 Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
 48 Using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
 49 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).
 50 From the $\eta \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 51 From $\pi^+ \pi^- \pi^0$ decay mode of η and using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 52 Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.
 53 Using $B(\phi \rightarrow e^+ e^-) = (2.98 \pm 0.04) \times 10^{-4}$.
 54 Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\pi^0 \gamma)/\Gamma_{\text{total}}^2$.
 55 From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 56 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.
 57 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.
 58 Neglecting interference between resonance and continuum.
 59 Using $B(\phi \rightarrow e^+ e^-) = (2.91 \pm 0.07) \times 10^{-4}$.
 60 Recalculated by us using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
 61 Using $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.32)\%$, $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06)\%$, and $B(\phi \rightarrow e^+ e^-) = (3.00 \pm 0.06) \times 10^{-4}$.
 62 The average of the branching ratios separately obtained from the $\eta \rightarrow \gamma\gamma$, $3\pi^0$, $\pi^+ \pi^- \pi^0$ decays.
 63 From $\eta \rightarrow \gamma\gamma$ decays and using $B(\eta \rightarrow \gamma\gamma) = (39.33 \pm 0.25) \times 10^{-2}$, $B(\eta \rightarrow \pi^+ \pi^- \gamma) = (4.75 \pm 11) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
 64 From $\eta \rightarrow 3\pi^0$ decays and using $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$, $B(\eta \rightarrow \pi^+ \pi^- \gamma) = (4.75 \pm 0.11) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
 65 From $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays and using $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\pi^0 \rightarrow e^+ e^- \gamma) = (1.198 \pm 0.032) \times 10^{-2}$, $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = (23.0 \pm 0.4) \times 10^{-2}$, $B(\phi \rightarrow \pi^+ \pi^- \pi^0) = (15.5 \pm 0.6) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.
 66 Using the 1996 and 1998 data.
 67 $(2.3 \pm 0.3)\%$ correction for other decay modes of the $\omega(782)$ applied.
 68 Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+ e^-) / \Gamma^2(\text{total})$.
 69 Using the 1996 data.
 70 Using the 1998 data.
 71 Supersedes AKHMETSHIN 97C.
 72 For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.
 73 For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible.
 74 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.
 75 From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
 76 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.
 77 Assuming that the $\pi^0 \pi^0 \gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay $B(\phi \rightarrow K\bar{K}\gamma)$ and using $B(f_0 \rightarrow \pi^+ \pi^-) = 2B(f_0 \rightarrow \pi^0 \pi^0)$.
 78 Using the value $B(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.
 79 For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
 80 Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
 81 A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
 82 For destructive interference with the Bremsstrahlung process
 83 For constructive interference with the Bremsstrahlung process
 84 Supersedes ALOISIO 02D.
 85 Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.
 86 Using various branching ratios from the 2000 Edition of this Review (PDG 00).
 87 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 $B(\eta \rightarrow \pi^+ \pi^- \gamma) = (4.75 \pm 0.11) \times 10^{-2}$.
 88 Combined results of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decay modes measurements.
 89 From the decay mode $\eta \rightarrow \gamma\gamma$.
 90 From the decay mode $\eta \rightarrow \pi^+ \pi^- \pi^0$.
 91 Supersedes ACHASOV 98B.
- NODE=M004R11;LINKAGE=AH
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 NODE=M004R32;LINKAGE=AM
 NODE=M004R;LINKAGE=C1
 NODE=M004R;LINKAGE=C2
 NODE=M004R32;LINKAGE=AF

- 92 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.31 \pm 0.20)\%$.
- 93 Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (22.73 \pm 0.28)\%$.
- 94 Using $M_{a_0(980)} = 984.8$ MeV and assuming $a_0(980)\gamma$ dominance.
- 95 Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.
- 96 Using data of ACHASOV 00F.
- 97 Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.
- 98 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.
- 99 Averaging AULCHENKO 03B with AULCHENKO 99.
- 100 Using $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033)\%$.
- 101 Using the value $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.
- 102 Using $B(\phi \rightarrow K_L^0 K_S^0) = (33.8 \pm 0.6)\%$.
- 103 Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.
- 104 Using the value $B(\eta' \rightarrow \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.
- 105 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.
- 106 From the decay mode $\eta' \rightarrow \eta\pi^+\pi^-$, $\eta \rightarrow \gamma\gamma$.
- 107 Superseded by AKHMETSHIN 00B.
- 108 For $E_\gamma > 20$ MeV.

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NODE=M004R33;LINKAGE=AF

NODE=M004R;LINKAGE=GK

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NODE=M004R25;LINKAGE=BK

NODE=M004R;LINKAGE=E2

NODE=M004R25;LINKAGE=Q

NODE=M004R;LINKAGE=T2

NODE=M004R;LINKAGE=T3

NODE=M004R25;LINKAGE=AU

NODE=M004R;LINKAGE=T1

NODE=M004R;LINKAGE=E1

NODE=M004R;LINKAGE=KS

NODE=M004R35;LINKAGE=A

NODE=M00422A

NODE=M004R29

NODE=M004R29

Lepton Family number (LF) violating modes					
$\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$					Γ_{31}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<2 \times 10^{-6}$	90	ACHASOV	10A	SND	$e^+e^- \rightarrow e^\pm\mu^\mp$

$\pi^+\pi^-\pi^0 / \rho\pi$ AMPLITUDE RATIO a_1 IN DECAY OF $\phi \rightarrow \pi^+\pi^-\pi^0$

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	109	AKHMETSHIN 06	CMD2	$1.017-1.021 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$9.0 \pm 1.1 \pm 0.6$	1.98M	110,111	ALOISIO	03	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-6 < a_1 < 6$	500k	111	ACHASOV	02	SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$-16 < a_1 < 11$	90	9.8k	109,112	AKHMETSHIN 98	CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$

109 Dalitz plot analysis taking into account interference between the contact and $\rho\pi$ amplitudes.

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

111 Recalculated by us to match the notations of AKHMETSHIN 98.

112 Assuming zero phase for the contact term.

NODE=M004D1

NODE=M004D1

NODE=M004D1;LINKAGE=AK

NODE=M004D;LINKAGE=L1

NODE=M004D;LINKAGE=L3

NODE=M004D1;LINKAGE=KL

$\phi(1020)$ REFERENCES

AKHMETSHIN 11	PL B695 412	R. Akhmetshin <i>et al.</i>	(CMD2 Collab.)
ACHASOV 10A	PR D81 057102	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BENAYOUN 10	EPJ C65 211	M. Benayoun <i>et al.</i>	
AMBROSINO 09C	PL B679 10	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AMBROSINO 09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AKHMETSHIN 08	PL B669 217	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)
AMBROSINO 08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AULCHENKO 08	JETPL 88 85	V. Aulchenko <i>et al.</i>	(CMD-2 Collab.)
Translated from ZETFP 88 93.			
FLOREZ-BAEZ 08	PR D78 077301	F.V. Florez-Baez, G. Lopez Castro	
ACHASOV 07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)
AMBROSINO 07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AMBROSINO 07A	PL B648 267	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
DUBYSKIY 07	PR D75 113001	S. Dubynskiy <i>et al.</i>	
ACHASOV 06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)
AKHMETSHIN 06	PL B642 203	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)
AKHMETSHIN 05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMBROSINO 05	PL B608 199	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AUBERT,B 05J	PR D72 052008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AKHMETSHIN 04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AUBERT,B 04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ALOISIO 03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)
AULCHENKO 03B	JETP 97 24	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETF 124 28.			

NODE=M004

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REFID=50330

REFID=50453

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REFID=49404

REFID=49613

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	JPG 28 2783	A. Gokalp <i>et al.</i>		REFID=49167
ACHASOV	01B	PL B504 275	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48111
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
ACHASOV	01G	PRL 86 1698	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48315
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
AKHMETSHIN	01	PL B501 191	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48110
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
AKHMETSHIN	01C	PL B503 237	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48323
BENAYOUN	01	EPJ C22 503	M. Benayoun, H.B. O'Connell		REFID=48570
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00B	JETP 90 17	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47425
		Translated from ZETF 117 22.			
ACHASOV	00C	PL B474 188	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47431
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
		Translated from ZETFP 72 411.			
ACHASOV	00E	NP B569 158	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47927
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	00B	PL B473 337	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47422
AKHMETSHIN	00E	PL B491 81	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47936
AKHMETSHIN	00F	PL B494 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47937
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
		Translated from ZETF 117 1067.			
BRAMON	00	PL B486 406	A. Bramon <i>et al.</i>		REFID=47969
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>		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>	(Novosibirsk CMD-2 Collab.)	REFID=47397
	Also	PL B508 217 (erratum)	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48328
AKHMETSHIN	99F	PL B460 242	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47473
AULCHENKO	99	JETPL 69 97	V.M. Aulchenko <i>et al.</i>		REFID=46920
		Translated from ZETFP 69 87.			
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
ACHASOV	98F	JETPL 68 573	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46321
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
AKHMETSHIN	98	PL B434 426	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=46325
AULCHENKO	98	PL B436 199	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46336
BARBERIS	98	PL B432 436	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46344
AKHMETSHIN	97B	PL B415 445	R.R. Akhmetshin <i>et al.</i>	(NOVO, BOST, PITT+)	REFID=45801
AKHMETSHIN	97C	PL B415 452	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=45802
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=44617
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
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+)
LOSTY	78	NP B133 38	M.J. Losty <i>et al.</i>	(CERN, AMST, NIJM+)
AKERLOF	77	PRL 39 861	C.W. Akerlof <i>et al.</i>	(FNAL, MICH, PURD)
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)
BALDI	77	PL 68B 381	R. Baldi <i>et al.</i>	(GEVA)
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+)
COHEN	77	PRL 38 269	D. Cohen <i>et al.</i>	(ANL)
LAVEN	77	NP B127 43	H. Laven <i>et al.</i>	(AACH3, BERL, CERN, LOIC+)
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)
COSME	76	PL 63B 352	G. Cosme <i>et al.</i>	(ORSAY)
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
PARROUR	76	PL 63B 357	G. Parrou <i>et al.</i>	(ORSAY)
PARROUR	76B	PL 63B 362	G. Parrou <i>et al.</i>	(ORSAY)
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)
AYRES	74	PRL 32 1463	D.S. Ayres <i>et al.</i>	(ANL)
BESCH	74	NP B70 257	H.J. Besch <i>et al.</i>	(BONN)
COSME	74	PL 48B 155	G. Cosme <i>et al.</i>	(ORSAY)
COSME	74B	PL 48B 159	G. Cosme <i>et al.</i>	(ORSAY)
DEGROOT	74	NP B74 77	A.J. de Groot <i>et al.</i>	(AMST, NIJM)
AUGUSTIN	73	PRL 30 462	J.E. Augustin <i>et al.</i>	(ORSAY)
BALLAM	73	PR D7 3150	J. Ballam <i>et al.</i>	(SLAC, LBL)
BINNIE	73B	PR D8 2789	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)
ALVENSLEB...	72	PRL 28 66	H. Alvensleben <i>et al.</i>	(MIT, DESY)
BORENSTEIN	72	PR D5 1559	S.R. Borenstein <i>et al.</i>	(BNL, MICH)
COLLEY	72	NP B50 1	D.C. Colley <i>et al.</i>	(BIRM, GLAS)
BALAKIN	71	PL 34B 328	V.E. Balakin <i>et al.</i>	(NOVO)
CHATELUS	71	Thesis LAL 1247	Y. Chatelus	(STRB)
Also		PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)
HAYES	71	PR D4 899	S. Hayes <i>et al.</i>	(CORN)
STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemeyer	(UMD)
BIZOT	70	PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)
Also		Liverpool Sym. 69	J.P. Perez-y-Jorba	
EARLES	70	PRL 25 1312	D.R. Earles <i>et al.</i>	(NEAS)
LINDSEY	66	PR 147 913	J.S. Lindsey, G. Smith	(LRL)
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IGJPC
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)
LINDSEY	65	PRL 15 221	J.S. Lindsey, G.A. Smith	(LRL)
LINDSEY	65	data included in LINDSEY 66.		
SCHLEIN	63	PRL 10 368	P.E. Schlein <i>et al.</i>	(UCLA) IGJP

REFID=20235
 REFID=20547
 REFID=20534
 REFID=20120
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 REFID=20253
 REFID=20478

REFID=20474

NODE=M030

$h_1(1170)$

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

$h_1(1170)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1170±20 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1168± 4	ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1166± 5±3	¹ ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1190±60	² DANKOWY...	81	SPEC 0	$8 \pi p \rightarrow 3 \pi n$
¹ Average and spread of values using 2 variants of the model of BOWLER 75.				
² Uses the model of BOWLER 75.				

NODE=M030M

NODE=M030M

→ NOT CHECKED ←

OCCUR=2

NODE=M030M;LINKAGE=B
 NODE=M030M;LINKAGE=C

$h_1(1170)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
360±40 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
345± 6	ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
375± 6±34	³ ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
320±50	⁴ DANKOWY...	81	SPEC 0	$8 \pi p \rightarrow 3 \pi n$
³ Average and spread of values using 2 variants of the model of BOWLER 75.				
⁴ Uses the model of BOWLER 75.				

NODE=M030W

NODE=M030W

→ NOT CHECKED ←

OCCUR=2

NODE=M030W;LINKAGE=B
 NODE=M030W;LINKAGE=C

$h_1(1170)$ DECAY MODES

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

NODE=M030215;NODE=M030

DESIG=1;OUR EST;→ NOT CHECKED ←

$h_1(1170)$ BRANCHING RATIOS

NODE=M030220

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	ANDO	92	SPEC $8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
seen	ATKINSON	84	OMEG $20-70 \gamma p \rightarrow \pi^+ \pi^- \pi^0 p$
seen	DANKOWY...	81	SPEC $8 \pi p \rightarrow 3 \pi n$

NODE=M030R1
NODE=M030R1 **$h_1(1170)$ REFERENCES**

ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
ATKINSON	84	NP B231 15	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
DANKOWY...	81	PRL 46 580	J.A. Dankowycz <i>et al.</i>	(TNT0, BNL, CARL+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M030

REFID=43171
REFID=20574
REFID=20572
REFID=20571 **$b_1(1235)$**

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

NODE=M011

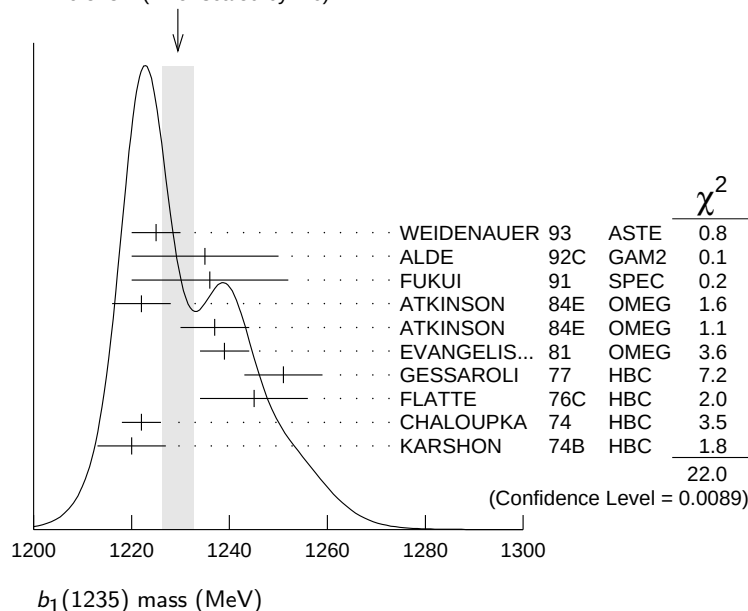
 $b_1(1235)$ MASS

NODE=M011M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1229.5 ± 3.2 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.			
1225 ± 5		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow 2\pi^+ 2\pi^- \pi^0$
1235 ± 15		ALDE	92C	GAM2	$38,100 \pi^- p \rightarrow \omega \pi^0 n$
1236 ± 16		FUKUI	91	SPEC	$8.95 \pi^- p \rightarrow \omega \pi^0 n$
1222 ± 6		ATKINSON	84E	OMEG ±	$25-55 \gamma p \rightarrow \omega \pi X$
1237 ± 7		ATKINSON	84E	OMEG 0	$25-55 \gamma p \rightarrow \omega \pi X$
1239 ± 5		EVANGELIS...	81	OMEG -	$12 \pi^- p \rightarrow \omega \pi p$
1251 ± 8	450	GESSAROLI	77	HBC -	$11 \pi^- p \rightarrow \pi^- \omega p$
1245 ± 11	890	FLATTE	76C	HBC -	$4.2 K^- p \rightarrow \pi^- \omega \Sigma^+$
1222 ± 4	1400	CHALOUPKA	74	HBC -	$3.9 \pi^- p$
1220 ± 7	600	KARSHON	74B	HBC +	$4.9 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1190 ± 10		AUGUSTIN	89	DM2 ±	$e^+ e^- \rightarrow 5\pi$
1213 ± 5		ATKINSON	84C	OMEG 0	$20-70 \gamma p$
1271 ± 11		COLLICK	84	SPEC +	$200 \pi^+ Z \rightarrow Z \pi \omega$

NODE=M011M

OCCUR=2

WEIGHTED AVERAGE
1229.5±3.2 (Error scaled by 1.6) **$b_1(1235)$ WIDTH**

NODE=M011W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
142 ± 9 OUR AVERAGE		Error includes scale factor of 1.2.			
113 ± 12		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow 2\pi^+ 2\pi^- \pi^0$
160 ± 30		ALDE 92C	GAM2		$38,100 \pi^- p \rightarrow \omega \pi^0 n$
151 ± 31		FUKUI 91	SPEC		$8.95 \pi^- p \rightarrow \omega \pi^0 n$
170 ± 15		EVANGELIS...	81 OMEG	—	$12 \pi^- p \rightarrow \omega \pi p$
170 ± 50	225	BALTAY 78B	HBC	+	$15 \pi^+ p \rightarrow p 4\pi$
155 ± 32	450	GESSAROLI 77	HBC	—	$11 \pi^- p \rightarrow \pi^- \omega p$
182 ± 45	890	FLATTE 76C	HBC	—	$4.2 K^- p \rightarrow \pi^- \omega \Sigma^+$
135 ± 20	1400	CHALOUPKA 74	HBC	—	$3.9 \pi^- p$
156 ± 22	600	KARSHON 74B	HBC	+	$4.9 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
210 ± 19		AUGUSTIN 89	DM2	±	$e^+ e^- \rightarrow 5\pi$
231 ± 14		ATKINSON 84C	OMEG	0	$20-70 \gamma p$
232 ± 29		COLLICK 84	SPEC	+	$200 \pi^+ Z \rightarrow Z \pi \omega$

NODE=M011W

 $b_1(1235)$ DECAY MODES

NODE=M011215;NODE=M011

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\omega \pi$ [D/S amplitude ratio = 0.277 ± 0.027]	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 $(KK)^\pm \pi^0$	< 8 %	90%
Γ_7 $K_S^0 K_L^0 \pi^\pm$	< 6 %	90%
Γ_8 $K_S^0 K_S^0 \pi^\pm$	< 2 %	90%
Γ_9 $\phi \pi$	< 1.5 %	84%

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=9

DESIG=8;OUR EST;→ NOT CHECKED ←

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=74

DESIG=71;OUR EST;→ NOT CHECKED ←

DESIG=73;OUR EST;→ NOT CHECKED ←

DESIG=72;OUR EST;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

 $b_1(1235)$ PARTIAL WIDTHS

NODE=M011220

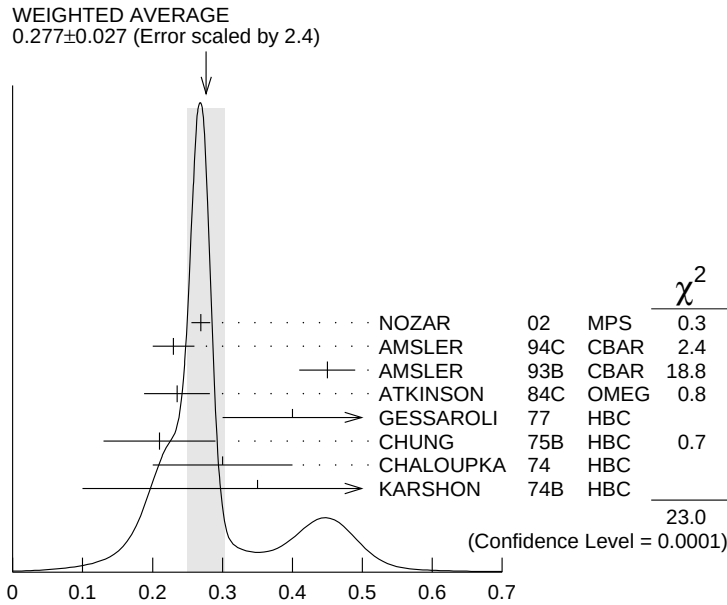
$\Gamma(\pi^\pm \gamma)$	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2
VALUE (keV)					
230 ± 60	COLLICK	84	SPEC	+	$200 \pi^+ Z \rightarrow Z \pi \omega$

NODE=M011W3
NODE=M011W3 **$b_1(1235)$ D-wave/S-wave AMPLITUDE RATIO
IN DECAY OF $b_1(1235) \rightarrow \omega \pi$**

NODE=M011DS

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.277 ± 0.027 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.			
0.269 ± 0.009 ± 0.010		NOZAR 02	MPS	—	$18 \pi^- p \rightarrow \omega \pi^- p$
0.23 ± 0.03		AMSLER 94C	CBAR		$0.0 \bar{p} p \rightarrow \omega \eta \pi^0$
0.45 ± 0.04		AMSLER 93B	CBAR		$0.0 \bar{p} p \rightarrow \omega \pi^0 \pi^0$
0.235 ± 0.047		ATKINSON 84C	OMEG		$20-70 \gamma p$
0.4 $^{+0.1}_{-0.1}$		GESSAROLI 77	HBC	—	$11 \pi^- p \rightarrow \pi^- \omega p$
0.21 ± 0.08		CHUNG 75B	HBC	+	$7.1 \pi^+ p$
0.3 ± 0.1		CHALOUPKA 74	HBC	—	$3.9-7.5 \pi^- p$
0.35 ± 0.25	600	KARSHON 74B	HBC	+	$4.9 \pi^+ p$

NODE=M011DS



$b_1(1235)$ D-wave/S-wave amplitude ratio in decay of $b_1(1235) \rightarrow \omega \pi$

$b_1(1235)$ D-wave/S-wave AMPLITUDE PHASE DIFFERENCE IN DECAY OF $b_1(1235) \rightarrow \omega \pi$

NODE=M011PH

VALUE (°)	DOCUMENT ID	TECN	CHG	COMMENT
10.5±2.4±3.9	NOZAR	02	MPS	— 18 $\pi^- p \rightarrow \omega \pi^- p$

NODE=M011PH

$b_1(1235)$ BRANCHING RATIOS

NODE=M011230

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

Γ_3/Γ_1

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

NODE=M011R9
NODE=M011R9

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

Γ_4/Γ_1

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

NODE=M011R1
NODE=M011R1

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

Γ_5/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	¹ ABLIKIM	10E	BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M011R10
NODE=M011R10

¹ From a fit including ten additional resonances and energy-independent Breit-Wigner width.

NODE=M011R10;LINKAGE=AB

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

Γ_6/Γ_1

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

NODE=M011R6
NODE=M011R6

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

Γ_7/Γ_1

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

NODE=M011R8
NODE=M011R8

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

Γ_8/Γ_1

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

NODE=M011R7
NODE=M011R7

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

Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.004	95	VIKTOROV	96	SPEC	0 32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$

NODE=M011R4
NODE=M011R4

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

<0.04	95	BIZZARRI	69	HBC	± 0.0 $\bar{p} p$
<0.015		DAHL	67	HBC	1.6–4.2 $\pi^- p$

$b_1(1235)$ REFERENCES

ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)
NOZAR	02	PL B541 35	M. Nozar <i>et al.</i>	
VIKTOROV	96	PAN 59 1184	V.A. Viktorov <i>et al.</i>	(SERP)
		Translated from YAF 59 1239.		
AMSLER	94C	PL B327 425	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	93B	PL B311 362	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)
ATKINSON	84C	NP B243 1	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+) JP
ATKINSON	84D	NP B242 269	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
COLLICK	84	PRL 53 2374	B. Collick <i>et al.</i>	(MINN, ROCH, FNAL)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+) JP
FLATTE	76C	PL 64B 225	S.M. Flatte <i>et al.</i>	(CERN, AMST, NIJ+) JP
CHUNG	75B	PR D11 2426	S.U. Chung <i>et al.</i>	(BNL, LBL, UCSC) JP
CHALOUPKA	74	PL 51B 407	V. Chaloupka <i>et al.</i>	(CERN) JP
KARSHON	74B	PR D10 3608	U. Karshon <i>et al.</i>	(REHO) JP
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)
BALTAY	67	PRL 18 93	C. Baltay <i>et al.</i>	(COLU)
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL)
ABOLINS	63	PRL 11 381	M.A. Abolins <i>et al.</i>	(UCSD)

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 $a_1(1260)$

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

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

NODE=M010

NODE=M010

 $a_1(1260)$ MASS

NODE=M010M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1230±40 OUR ESTIMATE				
1255± 6⁺⁷₋₁₇	420k	ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1243±12±20		¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$
1230-1270	6360	² LINK	07A FOCUS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1203± 3		³ GOMEZ-DUM..	04 RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
1330±24	90k	SALVINI	04 OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
1331±10± 3	37k	⁴ ASNER	00 CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
1255± 7± 6	5904	⁵ ABREU	98G DLPH	$e^+ e^-$
1207± 5± 8	5904	⁶ ABREU	98G DLPH	$e^+ e^-$
1196± 4± 5	5904	^{7,8} ABREU	98G DLPH	$e^+ e^-$
1240±10		BARBERIS	98B	450 $p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
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 $p p \rightarrow p p \pi^+ \pi^- \pi^0$
1220±15		¹⁴ ISGUR	89 RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260±25		¹⁵ BOWLER	88 RVUE	
1166±18±11		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1164±41±23		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
1250±40		¹⁴ TORNQVIST	87 RVUE	
1046±11		ALBRECHT	86B ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1056±20±15		RUCKSTUHL	86 DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1194±14±10		SCHMIDKE	86 MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1255±23		BELLINI	85 SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1240±80		¹⁶ DANKOWY...	81 SPEC	8.45 $\pi^- p \rightarrow n 3\pi$
1280±30		¹⁶ DAUM	81B CNTR	63,94 $\pi^- p \rightarrow p 3\pi$
1041±13		¹⁷ GAVILLET	77 HBC	4.2 $K^- p \rightarrow \Sigma 3\pi$

NODE=M010M

→ NOT CHECKED ←

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

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

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$a_1(1260)$ WIDTH

NODE=M010W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
250 to 600 OUR ESTIMATE				
367$\pm$ 9$^{+28}_{-25}$	420k	ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
410 $\pm$ 31 $\pm$ 30		¹⁸ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$
520–680	6360	¹⁹ LINK	07A FOCUS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
480 $\pm$ 20		²⁰ GOMEZ-DUM..04	RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
580 $\pm$ 41	90k	SALVINI	04 OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
460 $\pm$ 85	205	²¹ DRUTSKOY	02 BELL	$B \rightarrow D^{(*)} K^- K^{*0}$
814 $\pm$ 36 $\pm$ 13	37k	²² ASNER	00 CLE2	10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
450 $\pm$ 50	22k	²³ AKHMETSHIN 99E	CMD2	1.05–1.38 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
570 $\pm$ 10		²⁴ BONDAR	99 RVUE	$e^+ e^- \rightarrow 4\pi, \tau \rightarrow 3\pi \nu_\tau$
587 $\pm$ 27 $\pm$ 21	5904	²⁵ ABREU	98G DLPH	$e^+ e^-$
478 $\pm$ 3 $\pm$ 15	5904	²⁶ ABREU	98G DLPH	$e^+ e^-$
425 $\pm$ 14 $\pm$ 8	5904	^{27,28} ABREU	98G DLPH	$e^+ e^-$
400 $\pm$ 35		BARBERIS	98B	$450 p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
621 $\pm$ 32 $\pm$ 58		^{25,29} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
457 $\pm$ 15 $\pm$ 17		^{26,29} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
446 $\pm$ 21 $^{+140}_{-0}$		²⁶ ALBRECHT	93C ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
239 $\pm$ 11		ANDO	92 SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
266 $\pm$ 13 $\pm$ 4		³⁰ ANDO	92 SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
465 $^{+228}_{-143}$		³¹ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
298 $^{+40}_{-34}$		³² IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
488 $\pm$ 32		³³ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
430 $\pm$ 50		ARMSTRONG	90 OMEG	$300.0 p p \rightarrow p p \pi^+ \pi^- \pi^0$
420 $\pm$ 40		³⁴ ISGUR	89 RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
396 $\pm$ 43		³⁵ BOWLER	88 RVUE	
405 $\pm$ 75 $\pm$ 25		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
419 $\pm$ 108 $\pm$ 57		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
521 $\pm$ 27		ALBRECHT	86B ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
476 $^{+132}_{-120}$ $\pm$ 54		RUCKSTUHL	86 DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
462 $\pm$ 56 $\pm$ 30		SCHMIDKE	86 MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
292 $\pm$ 40		BELLINI	85 SPEC	$40 \pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
380 $\pm$ 100		³⁶ DANKOWY...	81 SPEC	$8.45 \pi^- p \rightarrow n 3\pi$
300 $\pm$ 50		³⁶ DAUM	81B CNTR	$63,94 \pi^- p \rightarrow p 3\pi$
230 $\pm$ 50		³⁷ GAVILLET	77 HBC	$4.2 K^- p \rightarrow \Sigma 3\pi$

NODE=M010W
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OCCUR=2
 OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

- 18 The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.
 19 Using the Breit-Wigner parameterization; strong correlation between mass and width.
 20 Using the data of BARATE 98R.
 21 From a fit of the $K^- K^{*0}$ distribution assuming $m_{a_1} = 1230$ MeV and purely resonant production of the $K^- K^{*0}$ system.
 22 From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.
 23 Using the $a_1(1260)$ mass of 1230 MeV.
 24 From AKHMETSHIN 99E and ASNER 00 data using the $a_1(1260)$ mass of 1230 MeV.
 25 Uses the model of KUHN 90.
 26 Uses the model of ISGUR 89.
 27 Includes the effect of a possible a'_1 state.
 28 Uses the model of FEINDT 90.
 29 Supersedes AKERS 95P.
 30 Average and spread of values using 2 variants of the model of BOWLER 75.
 31 Reanalysis of RUCKSTUHL 86.
 32 Reanalysis of SCHMIDKE 86.
 33 Reanalysis of ALBRECHT 86B.
 34 From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.
 35 From a combined reanalysis of ALBRECHT 86B and DAUM 81B.
 36 Uses the model of BOWLER 75.
 37 Produced in K^- backward scattering.

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$a_1(1260)$ DECAY MODES

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

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 DESIG=8;OUR EST;→ NOT CHECKED ←
 DESIG=9;OUR EST;→ NOT CHECKED ←
 DESIG=10;OUR EST;→ NOT CHECKED ←
 DESIG=16;OUR EST;→ NOT CHECKED ←
 DESIG=11;OUR EST;→ NOT CHECKED ←
 DESIG=12;OUR EST;→ NOT CHECKED ←
 DESIG=13;OUR EST;→ NOT CHECKED ←
 DESIG=14;OUR EST;→ NOT CHECKED ←
 DESIG=4;OUR EST;→ NOT CHECKED ←

$a_1(1260)$ PARTIAL WIDTHS

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

NODE=M010220

NODE=M010W4
 NODE=M010W4

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

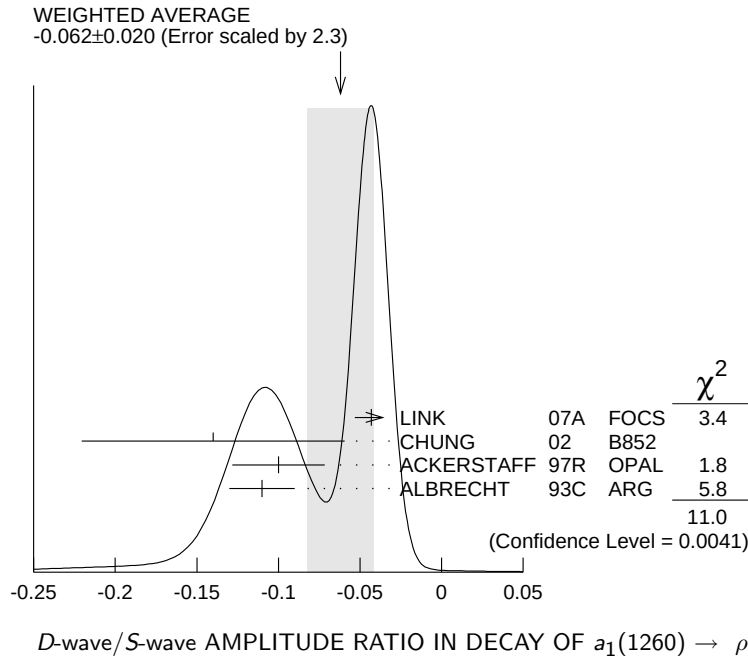
VALUE	DOCUMENT ID	TECN	COMMENT
-0.062 ± 0.020 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.		
$-0.043 \pm 0.009 \pm 0.005$	LINK	07A	FOCS $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
$-0.14 \pm 0.04 \pm 0.07$	³⁸ CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$-0.10 \pm 0.02 \pm 0.02$	^{39,40} ACKERSTAFF	97R	OPAL $E_{\text{cm}}^{\text{ee}} = 88-94, \tau \rightarrow 3\pi\nu$
-0.11 ± 0.02	³⁹ ALBRECHT	93C	ARG $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$

- ³⁸ Deck-type background not subtracted.
³⁹ Uses the model of ISGUR 89.
⁴⁰ Supersedes AKERS 95P.

NODE=M010DS

NODE=M010DS

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



$a_1(1260)$ BRANCHING RATIOS

NODE=M010225

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

 Γ_3/Γ

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

NODE=M010R5
NODE=M010R5

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

 Γ_4/Γ

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

NODE=M010R6
NODE=M010R6

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

 Γ_5/Γ

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

NODE=M010R7
NODE=M010R7

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

 Γ_6/Γ

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

NODE=M010R8
NODE=M010R8

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

 Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen		CHUNG	02 B852	$18.3 \pi^- p \rightarrow \pi^+\pi^-\pi^-p$
$18.76 \pm 4.29 \pm 1.48$	37k	^{41,43} ASNER	00 CLE2	10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

NODE=M010R9
NODE=M010R9

$\Gamma(f_0(980)\pi)/\Gamma_{\text{total}}$

 Γ_8/Γ

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

NODE=M010R10
NODE=M010R10

$\Gamma(f_0(1370)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$7.40 \pm 2.71 \pm 1.26$	37k	^{41,44} ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R11
 NODE=M010R11

 $\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.19 \pm 0.49 \pm 0.17$	37k	^{41,45} ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R12
 NODE=M010R12

 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.2 ± 0.5	2255	⁴⁶ COAN	04 CLEO	$\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$
8 to 15	205	⁴⁷ DRUTSKOY	02 BELL	$B \rightarrow D(^*) K^- K^{*0}$
$3.3 \pm 0.5 \pm 0.1$	37k	⁴⁸ ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
2.6 ± 0.3		⁴⁹ BARATE	99R ALEP	$\tau \rightarrow K\bar{K} \pi \nu_\tau$

NODE=M010R13
 NODE=M010R13

 $\Gamma(\sigma\pi)/\Gamma((\rho\pi)_{S\text{-wave}})$ Γ_7/Γ_3

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.06 ± 0.05	90k	SALVINI	04 OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
~ 0.3	28k	AKHMETSHIN	99E CMD2	$1.05\text{--}1.38 e^+ e^- \rightarrow \pi^+ \pi^- \pi^+ \pi^-$
0.003 ± 0.003		⁵⁰ LONGACRE	82 RVUE	

NODE=M010R4
 NODE=M010R4

 $\Gamma(\pi^0 \pi^0 \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.008	90	⁵¹ BARBERIS	01 450 $pp \rightarrow p_f 3\pi^0 p_s$
⁴¹ From a fit to the Dalitz plot. ⁴² Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively. ⁴³ Assuming for σ mass and width of 860 and 880 MeV respectively. ⁴⁴ Assuming for $f_0(1370)$ mass and width of 1186 and 350 MeV respectively. ⁴⁵ Assuming for $f_2(1270)$ mass and width of 1275 and 185 MeV respectively. ⁴⁶ Using structure functions from KUHN 92 and DECKER 93A and $B(\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau) = (0.155 \pm 0.006 \pm 0.009)\%$ from BRIERE 03. ⁴⁷ From a comparison to ALAM 94 assuming purely resonant production of the $K^- K^{*0}$ system. ⁴⁸ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold. ⁴⁹ Assuming $a_1(1260)$ dominance and taking $B(\tau \rightarrow a_1(1260) \nu_\tau)$ from BUSKULIC 96. ⁵⁰ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from GAVIL-LET 77, DAUM 80, and DANKOWYCH 81. ⁵¹ Inconsistent with observations of $\sigma\pi$, $f_0(1370)\pi$, and $f_2(1270)\pi$ decay modes.			

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 $a_1(1260)$ REFERENCES

NODE=M010

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
LINK	07A	PR D75 052003	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
GOMEZ-DUM...	04	PR D69 073002	D. Gomez Dumm, A. Pich, J. Portoles	
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
BRIERE	03	PRL 90 181802	R. A. Briere <i>et al.</i>	(CLEO Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
DRUTSKOY	02	PL B542 171	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN	99E	PL B466 392	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
BARATE	99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)
BONDAR	99	PL B466 403	A.E. Bondar <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABREU	98G	PL B426 411	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BARATE	98R	EPJ C4 409	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACKERSTAFF	97R	ZPHY C75 593	K. Akerstaff <i>et al.</i>	(OPAL Collab.)
BUSKULIC	96	ZPHY C70 579	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
AKERS	95P	ZPHY C67 45	R. Akers <i>et al.</i>	(OPAL Collab.)
ALAM	94	PR D50 43	M.S. Alam <i>et al.</i>	(CLEO Collab.)

REFID=53356
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 REFID=46345
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ALBRECHT	93C	ZPHY C58 61	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DECKER	93A	ZPHY C58 445	R. Decker <i>et al.</i>	
ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
KUHN	92	ZPHY C56 661	J.H. Kuhn, E. Mirkes	
IVANOV	91	ZPHY C49 563	Y.P. Ivanov, A.A. Osipov, M.K. Volkov	(JINR)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
FEINDT	90	ZPHY C48 681	M. Feindt	(HAMB)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ISGUR	89	PR D39 1357	N. Isgur, C. Morningstar, C. Reader	(TNTO)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BAND	87	PL B198 297	H.R. Band <i>et al.</i>	(MAC Collab.)
TORNQVIST	87	ZPHY C36 695	N.A. Tornqvist	(HELS)
ALBRECHT	86B	ZPHY C33 7	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
RUCKSTUHL	86	PRL 56 2132	W. Ruckstuhl <i>et al.</i>	(DELCO Collab.)
SCHMIDKE	86	PRL 57 527	W.B. Schmidke <i>et al.</i>	(Mark II Collab.)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
		Translated from YAF 41 1223.		
ZIELINSKI	84C	PRL 52 1195	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
LONGACRE	82	PR D26 82	R.S. Longacre	(BNL)
DANKOWY...	81	PRL 46 580	J.A. Dankowycz <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM	80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
GAVILLET	77	PL 69B 119	P. Gavillet <i>et al.</i>	(AMST, CERN, NIJ+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

REFID=43310
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NODE=M005

$f_2(1270)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

$f_2(1270)$ MASS

NODE=M005M

NODE=M005M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1275.1 ± 1.2 OUR AVERAGE		Error includes scale factor of 1.1.		
1262 $^{+1}_{-2}$ ±8		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1275 ±15		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
1283 ± 5		ALDE	98 GAM4	$100\pi^-p \rightarrow \pi^0\pi^0n$
1278 ± 5		¹ BERTIN	97C OBLX	$0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1272 ± 8	200k	PROKOSHKIN	94 GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$
1269.7 ± 5.2	5730	AUGUSTIN	89 DM2	$e^+e^- \rightarrow 5\pi$
1283 ± 8	400	² ALDE	87 GAM4	$100\pi^-p \rightarrow 4\pi^0n$
1274 ± 5		² AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		³ LONGACRE	86 MPS	$22\pi^-p \rightarrow n2K_S^0$
1276 ± 7		COURAU	84 DLCO	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
1273.3 ± 2.3		⁴ CHABAUD	83 ASPK	$17\pi^-p$ polarized
1280 ± 4		⁵ CASON	82 STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL	81 MRK2	J/ψ decay
1282 ± 5		⁶ CORDEN	79 OMEG	$12-15\pi^-p \rightarrow n2\pi$
1269 ± 4	10k	APEL	75 NICE	$40\pi^-p \rightarrow n2\pi^0$
1272 ± 4	4600	ENGLER	74 DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$
1277 ± 4	5300	FLATTE	71 HBC	$7.0\pi^+p$
1273 ± 8		² STUNTEBECK	70 HBC	$8\pi^-p, 5.4\pi^+d$
1265 ± 8		BOESEBECK	68 HBC	$8\pi^+p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1270 ± 8		⁷ ANISOVICH	09 RVUE	$0.0\bar{p}p, \pi N$
1277 ± 6	870	⁸ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1251 ±10		TIKHOMIROV	03 SPEC	$40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
1260 ±10		⁹ ALDE	97 GAM2	$450pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		⁹ GRYGOREV	96 SPEC	$40\pi^-N \rightarrow K_S^0 K_S^0 X$
1262 ±11		AGUILAR...	91 EHS	$400pp$
1275 ±10		AKER	91 CBAR	$0.0\bar{p}p \rightarrow 3\pi^0$
1220 ±10		BREAKSTONE	90 SFM	$pp \rightarrow pp\pi^+\pi^-$
1288 ±12		ABACHI	86B HRS	$e^+e^- \rightarrow \pi^+\pi^-X$
1284 ±30	3k	BINON	83 GAM2	$38\pi^-p \rightarrow n2\eta$
1280 ±20	3k	APEL	82 CNTR	$25\pi^-p \rightarrow n2\pi^0$
1284 ±10	16000	DEUTSCH...	76 HBC	$16\pi^+p$
1258 ±10	600	TAKAHASHI	72 HBC	$8\pi^-p \rightarrow n2\pi$
1275 ±13		ARMENISE	70 HBC	$9\pi^+n \rightarrow p\pi^+\pi^-$
1261 ± 5	1960	² ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
1270 ±10	360	² ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^0MM$
1268 ± 6		¹⁰ JOHNSON	68 HBC	$3.7-4.2\pi^-p$

OCCUR=2

OCCUR=2

- ¹ T-matrix pole.
² Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
³ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
⁴ From an energy-independent partial-wave analysis.
⁵ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
⁶ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
⁷ 4-poles, 5-channel K matrix fit.
⁸ From analysis of L3 data at 91 and 183–209 GeV.
⁹ Systematic uncertainties not estimated.
¹⁰ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

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$f_2(1270)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

185.1^{+2.9}_{-2.4} OUR FIT Error includes scale factor of 1.5.

184.2^{+4.0}_{-2.4} OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

175	± 6 -4	± 10	ABLIKIM	06V	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
190	± 20		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
171	± 10		ALDE	98	GAM4	$100\pi^-p \rightarrow \pi^0\pi^0n$
204	± 20		¹¹ BERTIN	97C	OBLX	$0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
192	± 5	200k	PROKOSHKIN	94	GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$
180	± 24		AGUILAR-...	91	EHS	$400pp$
169	± 9	5730	¹² AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$
150	± 30	400	¹² ALDE	87	GAM4	$100\pi^-p \rightarrow 4\pi^0n$
186	± 9 -2		¹³ LONGACRE	86	MPS	$22\pi^-p \rightarrow n2K_S^0$
179.2 ^{+6.9} _{-6.6}			¹⁴ CHABAUD	83	ASPK	$17\pi^-p$ polarized
160	± 11		DENNEY	83	LASS	$10\pi^+N$
196	± 10	3k	APEL	82	CNTR	$25\pi^-p \rightarrow n2\pi^0$
152	± 9		¹⁵ CASON	82	STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
186	± 27	11600	GIDAL	81	MRK2	J/ψ decay
216	± 13		¹⁶ CORDEN	79	OMEG	$12-15\pi^-p \rightarrow n2\pi$
190	± 10	10k	APEL	75	NICE	$40\pi^-p \rightarrow n2\pi^0$
192	± 16	4600	ENGLER	74	DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$
183	± 15	5300	FLATTE	71	HBC	$7\pi^+p \rightarrow \Delta^{++}f_2$
196	± 30		¹² STUNTEBECK	70	HBC	$8\pi^-p, 5.4\pi^+d$
216	± 20	1960	¹² ARMENISE	68	DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
128	± 27		¹² BOESEBECK	68	HBC	$8\pi^+p$
176	± 21		^{12,17} JOHNSON	68	HBC	$3.7-4.2\pi^-p$

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

194	± 36		¹⁸ ANISOVICH	09	RVUE	$0.0\bar{p}p, \pi N$
195	± 15	870	¹⁹ SCHEGELSKY	06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121	± 26		TIKHOMIROV	03	SPEC	$40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
187	± 20		²⁰ ALDE	97	GAM2	$450pp \rightarrow pp\pi^0\pi^0$
184	± 10		²⁰ GRYGOREV	96	SPEC	$40\pi^-N \rightarrow K_S^0 K_S^0 X$
200	± 10		AKER	91	CBAR	$0.0\bar{p}p \rightarrow 3\pi^0$
240	± 40	3k	BINON	83	GAM2	$38\pi^-p \rightarrow n2\eta$
187	± 30	650	¹² ANTIPOV	77	CIBS	$25\pi^-p \rightarrow p3\pi$
225	± 38	16000	DEUTSCH...	76	HBC	$16\pi^+p$
166	± 28	600	¹² TAKAHASHI	72	HBC	$8\pi^-p \rightarrow n2\pi$
173	± 53		¹² ARMENISE	70	HBC	$9\pi^+n \rightarrow p\pi^+\pi^-$

- ¹¹ T-matrix pole.
¹² Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
¹³ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
¹⁴ From an energy-independent partial-wave analysis.
¹⁵ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
¹⁶ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
¹⁷ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.
¹⁸ 4-poles, 5-channel K matrix fit.
¹⁹ From analysis of L3 data at 91 and 183–209 GeV.
²⁰ Systematic uncertainties not estimated.

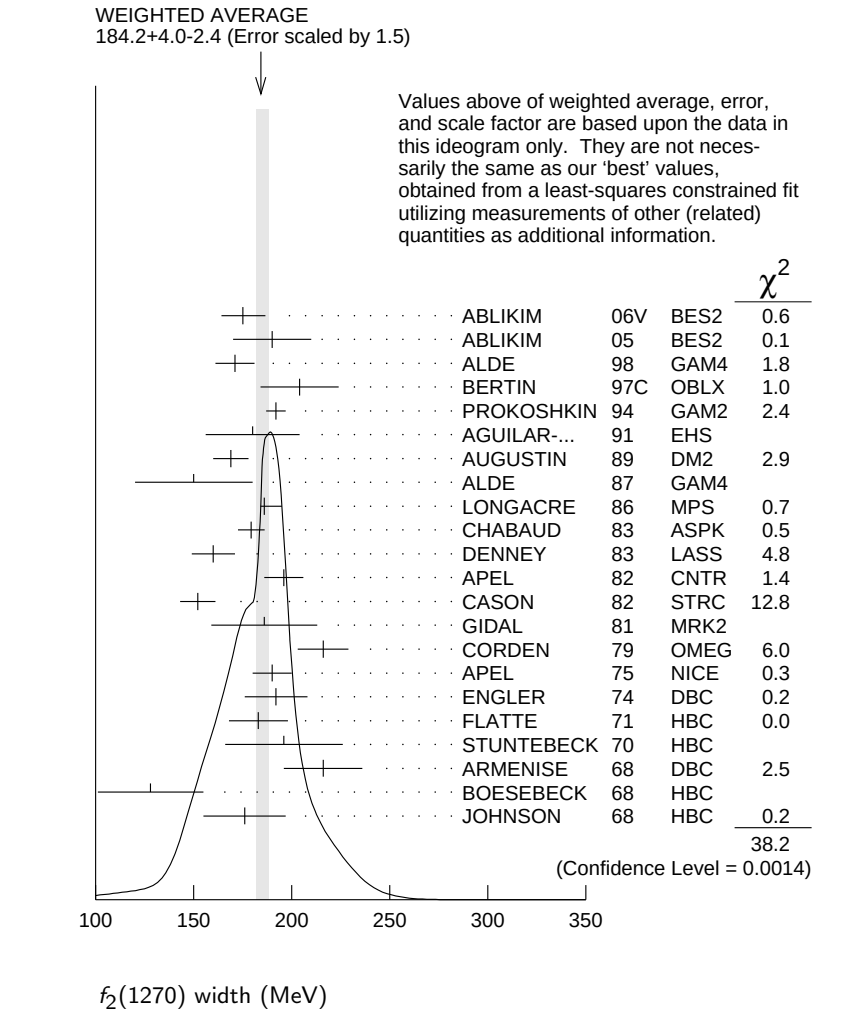
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$f_2(1270)$ DECAY MODES

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

DESIG=1

DESIG=3

DESIG=4

DESIG=2

DESIG=7

DESIG=9

DESIG=8

NODE=M005220

$\Gamma(\pi\pi)$	VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_1

NODE=M005W1
NODE=M005W1

156.9 $^{+4.0}_{-1.2}$ OUR FIT

157.0 $^{+6.0}_{-1.0}$ ²¹ LONGACRE 86 MPS $22\pi^-p \rightarrow n2K_S^0$

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

152 ± 8 870 ²² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(K\bar{K})$	VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_3

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 $22\pi^-p \rightarrow n2K_S^0$

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

7.5 ± 2.0 870 ²² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\eta\eta)$	VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_5

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 $22\pi^-p \rightarrow n2K_S^0$

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

1.8 ± 0.4 870 ²² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\gamma\gamma)$	VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_7

NODE=M005W8
NODE=M005W8

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).

$\Gamma(\gamma\gamma)$	VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_7
3.03± 0.35 OUR FIT					Error includes scale factor of 1.9.	
3.14± 0.20			^{23,24} PENNINGTON 08	RVUE	Compilation	

NODE=M005W8

OCCUR=2

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

3.82 ± 0.30	24,25	PENNINGTON 08	RVUE	Compilation
2.55 ± 0.15	870	22 SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2.84 ± 0.35		BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
$2.93 \pm 0.23 \pm 0.32$	26	YABUKI 95	VNS	
$2.58 \pm 0.13^{+0.36}_{-0.27}$	27	BEHREND 92	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.10 \pm 0.35 \pm 0.35$	28	BLINOV 92	MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.27 \pm 0.47 \pm 0.11$		ADACHI 90D	TOPZ	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.15 \pm 0.04 \pm 0.39$		BOYER 90	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.19 \pm 0.16^{+0.29}_{-0.28}$		MARSISKE 90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2.35 ± 0.65	29	MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
$3.19 \pm 0.09^{+0.22}_{-0.38}$	2177	OEST 90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
$3.2 \pm 0.1 \pm 0.4$	30	AIHARA 86B	TPC	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.5 \pm 0.1 \pm 0.5$		BEHREND 84B	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.85 \pm 0.25 \pm 0.5$	31	BERGER 84	PLUT	$e^+ e^- \rightarrow e^+ e^- 2\pi$
$2.70 \pm 0.05 \pm 0.20$		COURAU 84	DLCO	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.52 \pm 0.13 \pm 0.38$	32	SMITH 84C	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$2.7 \pm 0.2 \pm 0.6$		EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
$2.9^{+0.6}_{-0.4} \pm 0.6$	33	EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
$3.2 \pm 0.2 \pm 0.6$		BRANDELIK 81B	TASS	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$3.6 \pm 0.3 \pm 0.5$		ROUSSARIE 81	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.3 ± 0.8	34	BERGER 80B	PLUT	$e^+ e^-$

OCCUR=3

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

Γ_{10}

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

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

<1.7	90	VOROBIEV	88	ND $e^+ e^- \rightarrow \pi^0 \pi^0$
21		From a partial-wave analysis of data using a K-matrix formalism with 5 poles.		
22		From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.		
23		Solution A (preferred solution based on χ^2 -analysis).		
24		Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.		
25		Solution B (worse than solution A; still acceptable when systematic uncertainties are included).		
26		With a narrow scalar state around 1220 MeV.		
27		Using a unitarized model with a 300 - 500 keV wide scalar at 1100 MeV.		
28		Using the unitarized model of LYTH 85.		
29		Error includes spread of different solutions. Data of MARK2 and CRYSTAL BALL used in the analysis. Authors report strong correlations with $\gamma\gamma$ width of $f_0(1370)$: $\Gamma(f_2) + 1/4 \Gamma(f_0) = 3.6 \pm 0.3$ KeV.		
30		Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes 2.66 ± 0.21 in the calculation of LANDRO 86.		
31		Using the MENNESSIER 83 model.		
32		Superseded by BOYER 90.		
33		If helicity = 2 assumption is not made.		
34		Using mass, width and $B(f_2(1270) \rightarrow 2\pi)$ from PDG 78.		

NODE=M005W9
NODE=M005W9

NODE=M005PW;LINKAGE=L
NODE=M005W1;LINKAGE=SC
NODE=M005W8;LINKAGE=P1
NODE=M005W8;LINKAGE=P3

NODE=M005W8;LINKAGE=P2

NODE=M005W8;LINKAGE=YA
NODE=M005W;LINKAGE=B
NODE=M005W;LINKAGE=A
NODE=M005PW;LINKAGE=C

NODE=M005PW;LINKAGE=B

NODE=M005PW;LINKAGE=X
NODE=M005PW;LINKAGE=V
NODE=M005PW;LINKAGE=H
NODE=M005PW;LINKAGE=A

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

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

$\Gamma_3 \Gamma_7 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.139 ± 0.019 OUR FIT	Error includes scale factor of 1.9.		

0.091 ± 0.007 ± 0.027 35 ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

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

0.104 ± 0.007 ± 0.072 36 ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

35 Using an incoherent background.

36 Using a coherent background.

OCCUR=2

NODE=M005G1;LINKAGE=A
NODE=M005G1;LINKAGE=K

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

$\Gamma_5 \Gamma_7 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
11.5^{+1.8+4.5}_{-2.0-3.7}	37	UEHARA 10A	BELL $10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$

37 Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_0(\Upsilon)$.

NODE=M005G02
NODE=M005G02

NODE=M005G02;LINKAGE=UE

Helicity-0/Helicity-2 RATIO IN $\gamma\gamma \rightarrow f_2(1270) \rightarrow \pi\pi$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$3.7 \pm 0.3^{+15.9}_{-2.9}$	UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
13	38,39 PENNINGTON 08	RVUE	Compilation
26	39,40 PENNINGTON 08	RVUE	Compilation
38 Solution A (preferred solution based on χ^2 -analysis).			
39 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.			
40 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).			

NODE=M005HR0
NODE=M005HR0

OCCUR=2
OCCUR=3

NODE=M005HR0;LINKAGE=P1
NODE=M005HR0;LINKAGE=P3

NODE=M005HR0;LINKAGE=P2

 $f_2(1270)$ BRANCHING RATIOS

NODE=M005225

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
$0.848^{+0.024}_{-0.012}$ OUR FIT	Error includes scale factor of 1.2.					
0.837 ± 0.020 OUR AVERAGE						
0.849 ± 0.025			CHABAUD	83 ASPK	$17 \pi^- p$ polarized	
0.85 ± 0.05	250		BEAUPRE	71 HBC	$8 \pi^+ p \rightarrow \Delta^{++} f_2$	
0.8 ± 0.04	600		OH	70 HBC	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$	

NODE=M005R10
NODE=M005R10

$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
Should be twice $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ if decay is $\rho\rho$. (See ASCOLI 68D.)						
$0.084^{+0.018}_{-0.033}$ OUR FIT	Error includes scale factor of 1.3.					
0.15 ± 0.06	600		EISENBERG	74 HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.07			EMMS	75D DBC	$4 \pi^+ n \rightarrow p f_2$	

NODE=M005R2
NODE=M005R2
NODE=M005R2

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_1
We average only experiments which either take into account $f_2(1270)$ - $a_2(1320)$ interference explicitly or demonstrate that $a_2(1320)$ production is negligible.						
$0.054^{+0.005}_{-0.006}$ OUR FIT	Error includes scale factor of 2.8.					
$0.041^{+0.004}_{-0.005}$ OUR AVERAGE						
0.045 ± 0.01			41 BARGIOTTI	03 OBLX	$\bar{p}p$	
$0.037^{+0.008}_{-0.021}$			ETKIN	82B MPS	$23 \pi^- p \rightarrow n 2K_S^0$	
0.045 ± 0.009			CHABAUD	81 ASPK	$17 \pi^- p$ polarized	
0.039 ± 0.008			LOVERRE	80 HBC	$4 \pi^- p \rightarrow K \bar{K} N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.052 ± 0.025			ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$	
0.036 ± 0.005			42 COSTA...	80 OMEG	$1-2.2 \pi^- p \rightarrow K^+ K^- n$	
0.030 ± 0.005			43 MARTIN	79 RVUE		
0.027 ± 0.009			44 POLYCHRO...	79 STRC	$7 \pi^- p \rightarrow n 2K_S^0$	
0.025 ± 0.015			EMMS	75D DBC	$4 \pi^+ n \rightarrow p f_2$	
0.031 ± 0.012	20		ADERHOLZ	69 HBC	$8 \pi^+ p \rightarrow K^+ K^- \pi^+ p$	

NODE=M005R3
NODE=M005R3
NODE=M005R3

$\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_1
0.033 ± 0.005 OUR FIT	Error includes scale factor of 1.2.					
0.033 ± 0.004 OUR AVERAGE	Error includes scale factor of 1.1.					
0.024 ± 0.006	160		EMMS	75D DBC	$4 \pi^+ n \rightarrow p f_2$	
0.051 ± 0.025	70		EISENBERG	74 HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$	
$0.043^{+0.007}_{-0.011}$	285		LOUIE	74 HBC	$3.9 \pi^- p \rightarrow n f_2$	
0.037 ± 0.007	154		ANDERSON	73 DBC	$6 \pi^+ n \rightarrow p f_2$	
0.047 ± 0.013			OH	70 HBC	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$	

NODE=M005R1
NODE=M005R1

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

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

4.0±0.8 OUR FIT Error includes scale factor of 2.1.**2.9±0.5 OUR AVERAGE**

2.7±0.7	BINON	05	GAMS 33 $\pi^- p \rightarrow \eta\eta n$
2.8±0.7	ALDE	86D	GAM4 100 $\pi^- p \rightarrow 2\eta n$
5.2±1.7	BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

NODE=M005R7
 NODE=M005R7

 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.003±0.001 BARBERIS 00E 450 $p p \rightarrow p_f \eta \eta p_S$

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

<0.05	95	EDWARDS	82F	CBAL $e^+ e^- \rightarrow e^+ e^- 2\eta$
<0.016	95	EMMS	75D	DBC 4 $\pi^+ n \rightarrow p f_2$
<0.09	95	EISENBERG	74	HBC 4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$

NODE=M005R6
 NODE=M005R6

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0030±0.0010 OUR FIT**0.003 ±0.001** 400 ± 50 ALDE 87 GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

NODE=M005R11
 NODE=M005R11

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

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

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

1.57±0.01^{+1.39}_{-0.14} UEHARA 08A BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$

NODE=M005R13
 NODE=M005R13

 $\Gamma(\eta\pi\pi)/\Gamma(\pi\pi)$ Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.010 95 EMMS 75D DBC 4 $\pi^+ n \rightarrow p f_2$

NODE=M005R5
 NODE=M005R5

 $\Gamma(K^0 K^- \pi^+ + \text{c.c.})/\Gamma(\pi\pi)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.004 95 EMMS 75D DBC 4 $\pi^+ n \rightarrow p f_2$

NODE=M005R4
 NODE=M005R4

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

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

<6 90 ACHASOV 00K SND $e^+ e^- \rightarrow \pi^0 \pi^0$ ⁴¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.⁴² Re-evaluated by CHABAUD 83.⁴³ Includes PAWLICKI 77 data.⁴⁴ Takes into account the $f_2(1270)$ - $f_2'(1525)$ interference.

NODE=M005R12
 NODE=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.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>	
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
MORI	07	PR D75 051101R	T. Mori <i>et al.</i>	(BELLE Collab.)
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
		Translated from YAF 66 860.		
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington	
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446.		
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
GRYGOREV	96	PAN 59 2105	V.K. Grigoriev, O.N. Baloshin, B.P. Barkov	(ITEP)
		Translated from YAF 59 2187.		
YABUKI	95	JPSJ 64 435	F. Yabuki <i>et al.</i>	(VENUS Collab.)
PROKOSHKIN	94	SPD 39 420	Y.D. Prokoshkin, A.A. Kondashov	(SERP)
		Translated from DANS 336 613.		

REFID=53641
 REFID=52719
 REFID=52166
 REFID=52303
 REFID=52309
 REFID=51652
 REFID=51507
 REFID=51185
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 REFID=47961
 REFID=46931
 REFID=46605
 REFID=46914

REFID=45392
 REFID=45701
 REFID=45566

REFID=46384
 REFID=44094

BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
BLINOV	92	ZPHY C53 33	A.E. Blinov <i>et al.</i>	(NOVO)	REFID=41858
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)	REFID=41587
ADACHI	90D	PL B234 185	I. Adachi <i>et al.</i>	(TOPAZ Collab.)	REFID=41345
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
Translated from YAF 48 436.					
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)	REFID=20767
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
LYTH	85	JPG 11 459	D.H. Lyth		REFID=42169
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20757
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20760
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)	REFID=20758
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)	REFID=20759
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
Translated from YAF 38 934.					
CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)	REFID=20393
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20745
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)	REFID=20741
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20742
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)	REFID=20388
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20736
COSTA...	80	NP B175 402	G. Costa 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

NODE=M008

 $f_1(1285)$

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

 $f_1(1285)$ MASS

NODE=M008M

NODE=M008M

NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1282.1 ± 0.6 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below. [1281.8 ± 0.6 MeV OUR 2011 AVERAGE Scale factor = 1.6]				
1285.1 ± 1.0 ⁺ _{-0.3}		¹ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
1281 ± 2 ± 1		AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
1276.1 ± 8.1 ± 8.0	203	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
1274 ± 6	237	ABDALLAH	03H DLPH	$91.2 e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1280 ± 4		ACCIARRI	01G L3	
1288 ± 4 ± 5	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1284 ± 6	1400	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta\pi^0\pi^0 n$
1281 ± 1		BARBERIS	97B OMEG	$450 pp \rightarrow pp2(\pi^+\pi^-)$
1281 ± 1		BARBERIS	97C OMEG	$450 pp \rightarrow ppK_S^0 K^\pm \pi^\mp$
1280 ± 2		² 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	$300 pp \rightarrow K\bar{K}pp$
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	³ BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
1280 ± 1	504	BITYUKOV	88 SPEC	$32.5 \pi^- p \rightarrow K^+ K^- \pi^0 n$
1280 ± 4		ANDO	86 SPEC	$8 \pi^- p \rightarrow \eta\pi^+\pi^- n$
1277 ± 2	420	REEVES	86 SPEC	$6.6 p\bar{p} \rightarrow K K \pi X$
1285 ± 2		CHUNG	85 SPEC	$8 \pi^- p \rightarrow N K \bar{K} \pi$
1279 ± 2	604	ARMSTRONG	84 OMEG	$85 \pi^+ p \rightarrow K \bar{K} \pi \pi p, pp \rightarrow K \bar{K} \pi pp$
1286 ± 1		CHAUVAT	84 SPEC	ISR 31.5 pp
1278 ± 4		EVANGELIS...	81 OMEG	$12 \pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
1283 ± 3	103	DIONISI	80 HBC	$4 \pi^- p \rightarrow K \bar{K} \pi n$
1282 ± 2	320	NACASCH	78 HBC	$0.7, 0.76 p\bar{p} \rightarrow K \bar{K} 3\pi$
1279 ± 5	210	GRASSLER	77 HBC	$16 \pi^\mp p$
1286 ± 3	180	DUBOC	72 HBC	$1.2 p\bar{p} \rightarrow 2K 4\pi$
1283 ± 5		DAHL	67 HBC	$1.6-4.2 \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1281.9 ± 0.5		⁴ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
1282.8 ± 0.6		⁴ 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		⁵ 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	⁶ STANTON	79 CNTR	$8.5 \pi^- p \rightarrow n2\gamma 2\pi$
1271 ± 10	34	CORDEN	78 OMEG	$12-15 \pi^- p \rightarrow K^+ K^- \pi n$

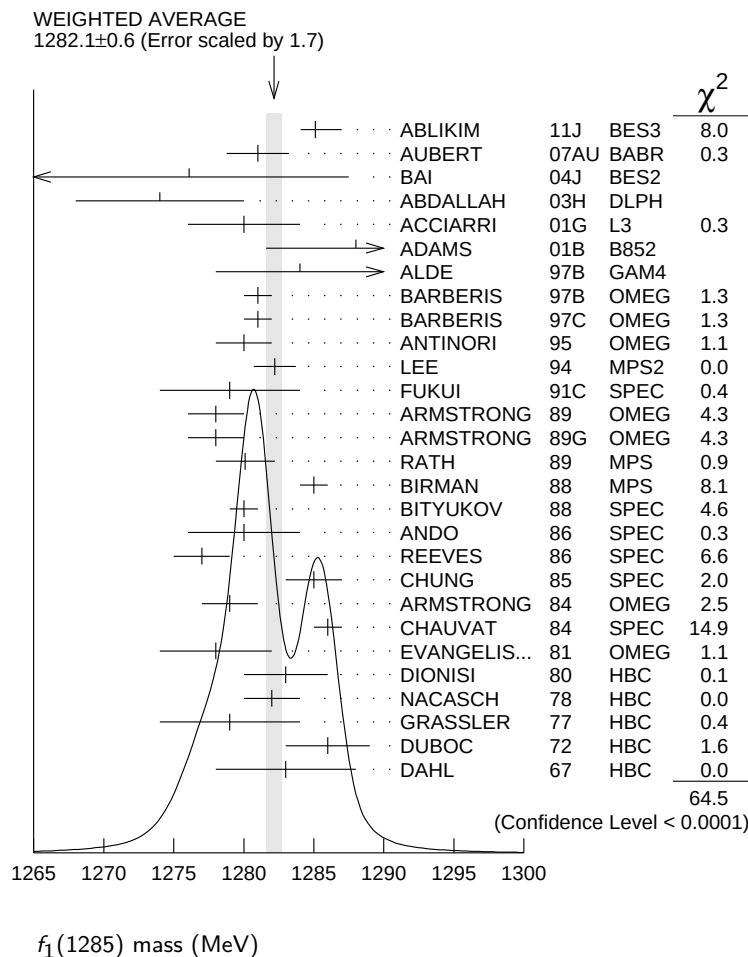
OCCUR=2

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	⁷ 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 The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.
² Supersedes ABATZIS 94, ARMSTRONG 89E.
³ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.
⁴ No systematic error given.
⁵ From a unitarized quark-model calculation.
⁶ From phase shift analysis of $\eta \pi^+ \pi^-$ system.
⁷ Seen in the missing mass spectrum.

NODE=M008M;LINKAGE=BL
 NODE=M008M;LINKAGE=B
 NODE=M008M;LINKAGE=A
 NODE=M008M;LINKAGE=N1
 NODE=M008M;LINKAGE=T
 NODE=M008M;LINKAGE=P
 NODE=M008M;LINKAGE=S



$f_1(1285)$ WIDTH

NODE=M008W

Only experiments giving width error less than 20 MeV are kept for averaging.

NODE=M008W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
24.2 ± 1.1 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
[24.3 ± 1.1 MeV OUR 2011 AVERAGE Scale factor = 1.4]				

NODE=M008W
NEW

22.0 ± 3.1 ⁺ _{-1.5}	⁸ 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	BAI	04J	BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
29 ± 12	ABDALLAH	03H	DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
45 ± 9 ± 7	ADAMS	01B	B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$

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		⁹ 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	¹⁰ 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		¹¹ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-)$ p_{fast}	
19.4 ± 1.5		¹¹ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+)$ p_{fast}	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		¹² 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	¹³ DEFOIX	72	HBC	0.7 $\bar{p}p \rightarrow 7\pi$	
46 ± 9	180	¹³ DUBOC	72	HBC	1.2 $\bar{p}p \rightarrow 2K4\pi$	
37 ± 5	500	¹⁴ 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		¹³ LORSTAD	69	HBC	0.7 $\bar{p}p, 4,5\text{-body}$	
35 ± 10		¹³ DAHL	67	HBC	1.6–4.2 $\pi^- p$	

⁸ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

⁹ Supersedes ABATZIS 94, ARMSTRONG 89E.

¹⁰ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

¹¹ No systematic error given.

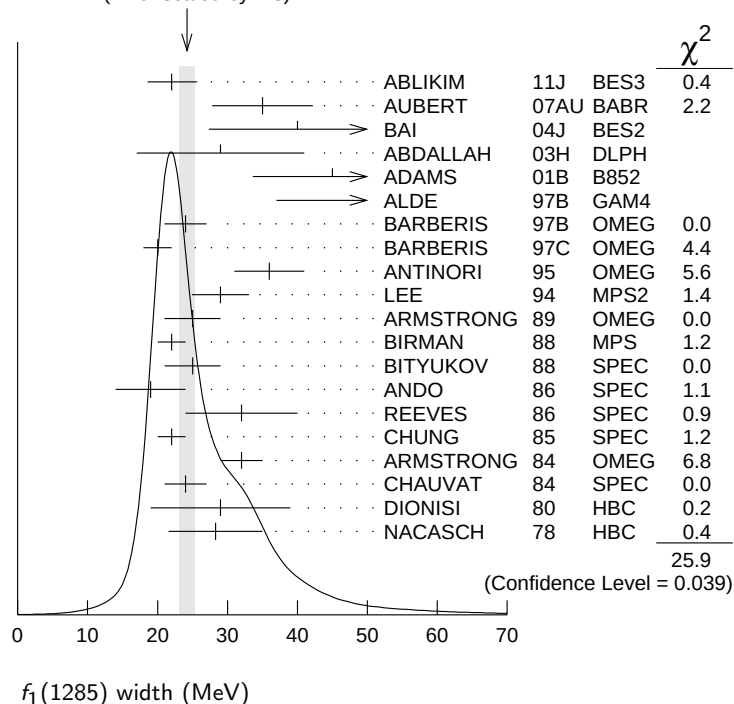
¹² From phase shift analysis of $\eta \pi^+ \pi^-$ system.

¹³ Resolution is not unfolded.

¹⁴ Seen in the missing mass spectrum.

NODE=M008W;LINKAGE=BL
 NODE=M008W;LINKAGE=B
 NODE=M008W;LINKAGE=A
 NODE=M008W;LINKAGE=N1
 NODE=M008W;LINKAGE=P
 NODE=M008W;LINKAGE=R
 NODE=M008W;LINKAGE=S

WEIGHTED AVERAGE
24.2±1.1 (Error scaled by 1.3)



$f_1(1285)$ 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;→ NOT CHECKED ←

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	^{15,16} AIHARA	88B	TPC $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
2.30 $\pm 0.61 \pm 0.42$		^{15,17} 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	¹⁸ ACHARD	02B L3	183-209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

NODE=M008G3
NODE=M008G3¹⁵ Assuming a ρ -pole form factor.¹⁶ Published value multiplied by $\eta\pi\pi$ branching ratio 0.49.¹⁷ Published value divided by 2 and multiplied by the $\eta\pi\pi$ branching ratio 0.49.¹⁸ 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	¹⁹ BARBERIS	97C	OMEG 450	$pp\,K_S^0\,K^\pm\pi^\mp$
0.28 ±0.05	²⁰ ARMSTRONG	89E	OMEG 300	$pp\,p\bar{p}\,f_1(1285)$
0.37 ±0.03 ±0.05	²¹ ARMSTRONG	89G	OMEG 85	$\pi p\rightarrow 4\pi X$

NODE=M008R1
NODE=M008R1¹⁹ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.²⁰ Assuming $\rho\pi\pi$ and $a_0(980)\pi$ intermediate states.²¹ 4π consistent with being entirely $\rho\pi\pi$.NODE=M008R1;LINKAGE=B
NODE=M008R1;LINKAGE=M
NODE=M008R1;LINKAGE=A

$\Gamma(\pi^0 \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$		$\Gamma_2 / \Gamma = \frac{2}{3} \Gamma_1 / \Gamma$	
VALUE	DOCUMENT ID		
$0.220^{+0.014}_{-0.012}$ OUR FIT	Error includes scale factor of 1.3.		

NODE=M008R18
NODE=M008R18

$\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$		$\Gamma_3/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$	
VALUE	DOCUMENT ID		
$0.110^{+0.007}_{-0.006}$ OUR FIT	Error includes scale factor of 1.3.		

NODE=M008R17
NODE=M008R17

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$		$\Gamma_4/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$	
VALUE	DOCUMENT ID		
$0.110^{+0.007}_{-0.006}$ OUR FIT	Error includes scale factor of 1.3.		

NODE=M008R19
NODE=M008R19

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

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 $\pi^\pm p$

$$\Gamma_4 / \Gamma_3$$

NODE=M008R6
NODE=M008R6

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

VALUE	DOCUMENT ID	COMMENT

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

seen	BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$

$$\Gamma_5 / \Gamma$$

NODE=M008R21
NODE=M008R21

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

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

<7	90	ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$

$$\Gamma_6 / \Gamma$$

NODE=M008R8
NODE=M008R8

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

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

0.86 ± 0.16 ± 0.20	2.3k	22 DOROFEEV	11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

22 Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+ \pi^-$ mass spectrum.

$$\Gamma_{13} / \Gamma_7$$

NODE=M008R02
NODE=M008R02

NODE=M008R02; LINKAGE=DO

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

VALUE	DOCUMENT ID

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

NODE=M008R22
NODE=M008R22

0.524^{+0.019}_{-0.022} OUR FIT Error includes scale factor of 1.2.

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

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	23 GRASSLER	77	HBC	16 $\pi^\mp p$

23 Assuming $\rho \pi \pi$ and $a_0(980) \pi$ intermediate states.

$$\Gamma_1 / \Gamma_8 = \Gamma_1 / (\Gamma_9 + \Gamma_{10})$$

NODE=M008R4
NODE=M008R4

NODE=M008R4; LINKAGE=M

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

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 $\pi^\mp p$

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

NODE=M008R3
NODE=M008R3

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

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	24 CORDEN	78	OMEG	12–15 $\pi^- p$

0.20 ± 0.08	25 DEFOIX	72	HBC	0.7 $\bar{p} p \rightarrow 7\pi$

0.16 ± 0.08	CAMPBELL	69	DBC	2.7 $\pi^+ d$

$$\Gamma_{11} / \Gamma_8 = \Gamma_{11} / (\Gamma_9 + \Gamma_{10})$$

NODE=M008R2
NODE=M008R2

NODE=M008R2; LINKAGE=CD

24 CORDEN 78 assumes low-mass $\eta \pi \pi$ region is dominantly 1^{++} . See BARBERIS 98C and MANAK 00A for discussion.

25 $K \bar{K}$ 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	²⁶ ACHARD 07	L3	$183-209 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$

²⁶ A clear signal of 19.8 ± 4.4 events observed at high Q^2 .

NODE=M008R5
NODE=M008R5

NODE=M008R5;LINKAGE=CH

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.055±0.074	2.3k	²⁷ DOROFEEV 11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

²⁷ 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±0.7±0.6		AMELIN 95	VES	$37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<5	95	BITYUKOV 91B	SPEC	$32 \pi^- p \rightarrow \pi^+ \pi^- \gamma n$

NODE=M008R15
NODE=M008R15

 $\Gamma(\gamma\rho^0)/\Gamma(2\pi^+2\pi^-)$ $\Gamma_{15}/\Gamma_3 = \Gamma_{15}/\frac{1}{3}\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
0.50±0.13 OUR FIT	Error includes scale factor of 2.5.		
0.45±0.18	²⁸ COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

²⁸ 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±1.0±2.0	BARBERIS 98C	OMEG 450	$pp \rightarrow p_f f_1(1285) p_s$
7.5±1.0	²⁹ ARMSTRONG 92C	OMEG 300	$pp \rightarrow pp\pi^+\pi^-\gamma, pp\eta\pi^+\pi^-$

²⁹ 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	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 $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma K\bar{K}\pi) < 0.72 \times 10^{-3}$.

NODE=M008R12
NODE=M008R12

NODE=M008R12;LINKAGE=F

 $\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{16}/Γ_{11}

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.82±0.21±0.20		19	BITYUKOV 88	SPEC	$32.5 \pi^- p \rightarrow K^+ K^- \pi^0 n$

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

<0.50	95	BARBERIS 98C	OMEG 450	$pp \rightarrow p_f f_1(1285) p_s$
<0.93	95	AMELIN 95	VES	$37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$

NODE=M008R9
NODE=M008R9

$f_1(1285)$ REFERENCES

NODE=M008

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, ITP)	REFID=16755
PDG	10	JPG 37 075021	K. Nakamura <i>et al.</i>	(PDG Collab.)	REFID=53229
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=51698
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49548
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=48574
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)	REFID=47989
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>		REFID=46937
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45396
		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

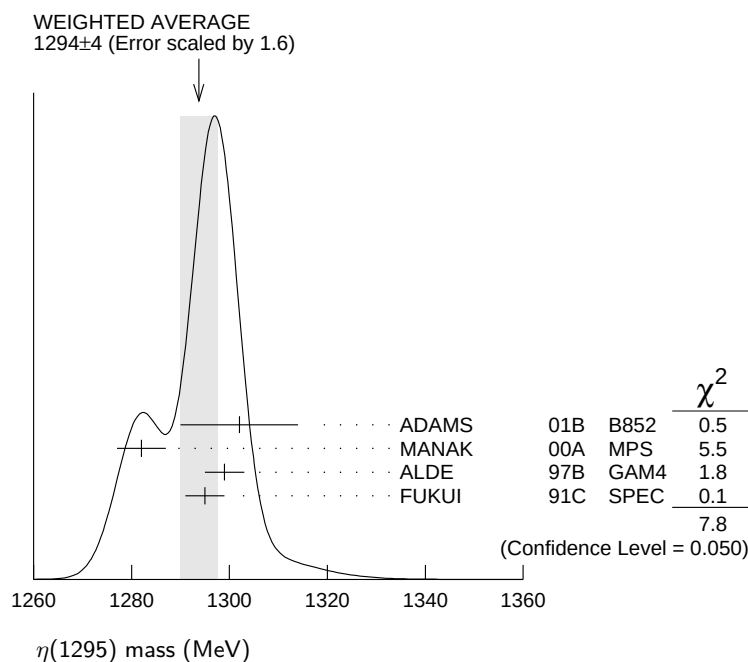
NODE=M037

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±9±8	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1282±5	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
1299±4	2100	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1295±4		FUKUI	91C SPEC	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1264±8		¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 1275		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$



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

NODE=M037M;LINKAGE=AG

 $\eta(1295)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
55± 5 OUR AVERAGE				
57±23±21	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
66±13	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
53± 6		FUKUI	91C SPEC	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<40	2100	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
44±20		² AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 70		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$

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

NODE=M037W

NODE=M037W

NODE=M037W;LINKAGE=AG

$\eta(1295)$ DECAY MODES

NODE=M037215;NODE=M037

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\pi^+\pi^-$	seen
Γ_2 $a_0(980)\pi$	seen
Γ_3 $\gamma\gamma$	
Γ_4 $\eta\pi^0\pi^0$	seen
Γ_5 $\eta(\pi\pi)_{S\text{-wave}}$	seen
Γ_6 $\sigma\eta$	
Γ_7 $K\bar{K}\pi$	

DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=1;OUR EST;→ NOT CHECKED ←
 DESIG=3
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=6
 DESIG=7

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

NODE=M037220

$\Gamma(\eta\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_3/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.066	95	ACCIARRI	01G L3	183–202 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.6	90	AIHARA	88C TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$	
<0.3		ANTREASYAN	87 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi\pi$	

NODE=M037G2
 NODE=M037G2

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_7\Gamma_3/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.014	90	3,4 AHOHE	05 CLE2	10.6 $e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$	

NODE=M037G3
 NODE=M037G3

³ Using $\eta(1295)$ mass and width 1294 MeV and 55 MeV, respectively.⁴ Assuming three-body phase-space decay to $K_S^0K^\pm\pi^\mp$.

NODE=M037G3;LINKAGE=AH
 NODE=M037G3;LINKAGE=B3

 $\eta(1295)$ BRANCHING RATIOS

NODE=M037225

$\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$	Γ_2/Γ			
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
not seen	BERTIN	97	OBLX	0.0 $\bar{p}p \rightarrow K^\pm(K^0)\pi^\mp\pi^+\pi^-$
seen	BIRMAN	88	MPS	8 $\pi^-p \rightarrow K^+\bar{K}^0\pi^-\eta$
large	ANDO	86	SPEC	8 $\pi^-p \rightarrow \eta\pi^+\pi^-n$
large	STANTON	79	CNTR	8.4 $\pi^-p \rightarrow n\eta 2\pi$

NODE=M037R1
 NODE=M037R1

$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi^0\pi^0)$	Γ_2/Γ_4		
VALUE	DOCUMENT ID	TECN	COMMENT
0.65±0.10	⁵ ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

NODE=M037R2
 NODE=M037R2

⁵ Assuming that $a_0(980)$ decays only to $\eta\pi$.

NODE=M037R2;LINKAGE=A

$\Gamma(\eta(\pi\pi)_{S\text{-wave}})/\Gamma(\eta\pi^0\pi^0)$	Γ_5/Γ_4		
VALUE	DOCUMENT ID	TECN	COMMENT
0.35±0.10	ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

NODE=M037R4
 NODE=M037R4

$\Gamma(a_0(980)\pi)/\Gamma(\sigma\eta)$					Γ_2/Γ_6
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.48±0.22	9082	MANAK	00A	MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M037R5
 NODE=M037R5

 $\eta(1295)$ REFERENCES

NODE=M037

AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
Translated from YAF 60 458.				
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2γ Collab.)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP

REFID=50764
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 REFID=49649
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 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

→ NOT CHECKED ←

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

→ NOT CHECKED ←

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;→ NOT CHECKED ←

DESIG=3;OUR EST;→ NOT CHECKED ←

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 **$\Gamma(\pi\pi\pi)_{S\text{-wave}}/\Gamma(\rho\pi)$** **$\Gamma_2/\Gamma_1$**

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.2 $\pm$ 0.4		90k	SALVINI	04	OBLX $\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
seen			CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ 2\pi^- p$
<0.15	90		ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
2.12			⁶ AARON	81	RVUE

⁶ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058220

NODE=M058R1
NODE=M058R1

NODE=M058R1;LINKAGE=E

 $\pi(1300)$ REFERENCES

SCHEGELSKY 06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SALVINI 04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
CHUNG 02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ABELE 01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI 97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT 97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BERTIN 97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE 96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ZIELINSKI 84	PR D30 1855	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
BELLINI 82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)
AARON 81	PR D24 1207	R.A. Aaron, R.S. Longacre	(NEAS, BNL)
BONESINI 81	PL 103B 75	M. Bonesini <i>et al.</i>	(MILA, LIVP, DARE+)
DANKOWYCH... 81	PRL 46 580	J.A. Dankowych <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM 81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM 80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
BOWLER 75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M058

REFID=51186
REFID=53226
REFID=48837
REFID=48334
REFID=45761
REFID=45418
REFID=45763
REFID=45011
REFID=20881
REFID=21134
REFID=20870
REFID=21130
REFID=20572
REFID=20872
REFID=20868
REFID=20571
 $a_2(1320)$

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

NODE=M012

 $a_2(1320)$ MASS

NODE=M012205

VALUE (MeV)	DOCUMENT ID

NODE=M012M0

1318.3 $^{+0.5}_{-0.6}$ OUR AVERAGE Includes data from the 4 datablocks that follow this one.
Error includes scale factor of 1.2.

3 π MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M012M1
NODE=M012M1

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

1319.0 $^{+1.0}_{-1.3}$ OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1321 $\pm$ 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. • • •

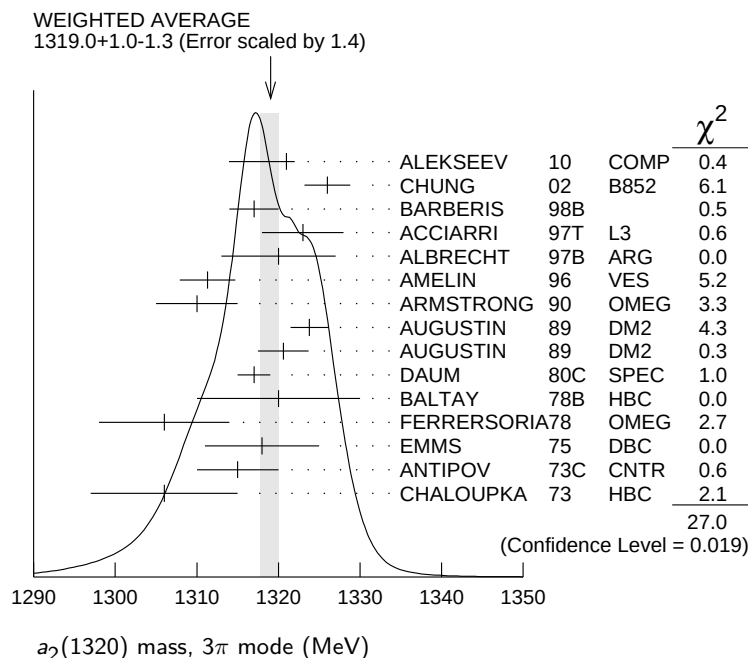
1300 ± 2 ± 4	18k	² SCHEGELSKY 06	RVUE 0	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$	
1305 ± 14		CONDO 93	SHF	$\gamma p \rightarrow \eta\pi^+\pi^+\pi^-$	
1310 ± 2		¹ EVANGELIS...	81 OMEG -	$12 \pi^- p \rightarrow 3\pi p$	
1343 ± 11	490	BALTAY 78B	HBC 0	$15 \pi^+ p \rightarrow \Delta 3\pi$	OCCUR=2
1309 ± 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 +	$7.0 \pi^+ p \rightarrow 3\pi p$	

¹ From a fit to $J^P = 2^+ \rho\pi$ partial wave.

² From analysis of L3 data at 183–209 GeV.

NODE=M012M1;LINKAGE=P

NODE=M012M1;LINKAGE=SC



K $\bar{K}$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

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 +	$12.7 \pi^+ p \rightarrow K^+ K_S^0 p$	

³ From a fit to $J^P = 2^+$ partial wave.

⁴ Number of events evaluated by us.

⁵ Systematic error in mass scale subtracted.

⁶ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012M2;LINKAGE=P

NODE=M012M2;LINKAGE=W

NODE=M012M2;LINKAGE=S

NODE=M012M2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

NODE=M012M3
 NODE=M012M3

1317.7±1.4 OUR AVERAGE

1308 ±9		BARBERIS	00H		450 $p p \rightarrow p_f \eta \pi^0 p_s$
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

 3π 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/ψ	$\rightarrow \rho^\pm a_2^\mp$
118.5	± 12.5		3562	AUGUSTIN	89	DM2 0	J/ψ	$\rightarrow \rho^0 a_2^0$
97	± 5			¹⁰ EVANGELIS...	81	OMEG $-$	12	$\pi^- p \rightarrow 3\pi p$
96	± 9		25k	¹⁰ DAUM	80C	SPEC $-$	63.94	$\pi^- p \rightarrow 3\pi p$
110	± 15		1097	¹⁰ BALTAY	78B	HBC $+0$	15	$\pi^+ p \rightarrow p 4\pi$
112	± 18		1.6k	¹⁰ EMMS	75	DBC 0	4	$\pi^+ n \rightarrow p(3\pi)^0$
122	± 14		1.2k	^{10,11} WAGNER	75	HBC 0	7	$\pi^+ p \rightarrow \Delta^{++}(3\pi)^0$
115	± 15			¹⁰ ANTIPOV	73C	CNTR $-$	25,40	$\pi^- p \rightarrow p \eta \pi^-$
99	± 15		1580	CHALOUPIKA	73	HBC $-$	3.9	$\pi^- p$
105	± 5		28k	BOWEN	71	MMS $-$	5	$\pi^- p$
99	± 5		24k	BOWEN	71	MMS $+$	5	$\pi^+ p$
103	± 5		17k	BOWEN	71	MMS $-$	7	$\pi^- p$

OCCUR=2

OCCUR=2

OCCUR=3

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

117 ± 6 ± 20	18k	¹² SCHEGELSKY	06	RVUE	0	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
120 ± 40		CONDO	93	SHF		$\gamma p \rightarrow \eta \pi^+ \pi^+ \pi^-$
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

→ NOT CHECKED ←

$K\bar{K}$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M012W2

NODE=M012W2

109.8 ± 2.4 OUR AVERAGE

112 ± 20	4700	^{13,14} CLELAND	82B	SPEC	+	$50 \pi^+ p \rightarrow K_S^0 K^+ p$
120 ± 25	5200	^{13,14} CLELAND	82B	SPEC	—	$50 \pi^- p \rightarrow K_S^0 K^- p$
106 ± 4	4000	CHABAUD	80	SPEC	—	$17 \pi^- A \rightarrow K_S^0 K^- A$
126 ± 11	11000	CHABAUD	78	SPEC	—	$9.8 \pi^- p \rightarrow K^- K_S^0 p$
101 ± 8	4730	CHABAUD	78	SPEC	—	$18.8 \pi^- p \rightarrow K^- K_S^0 p$
113 ± 4		^{13,15} MARTIN	78D	SPEC	—	$10 \pi^- p \rightarrow K_S^0 K^- p$
105 ± 8	2724	¹⁵ MARGULIE	76	SPEC	—	$23 \pi^- p \rightarrow K^- K_S^0 p$
113 ± 19	730	FOLEY	72	CNTR	—	$20.3 \pi^- p \rightarrow K^- K_S^0 p$
123 ± 13	1500	¹⁵ GRAYER	71	ASPK	—	$17.2 \pi^- p \rightarrow K^- K_S^0 p$

OCCUR=2

OCCUR=3

OCCUR=2

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

120 ± 15	870	¹⁶ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121 ± 51	1000	^{13,14} CLELAND	82B	SPEC	+	$30 \pi^+ p \rightarrow K_S^0 K^+ p$
110 ± 18	350	HYAMS	78	ASPK	+	$12.7 \pi^+ p \rightarrow K^+ K_S^0 p$

¹³ From a fit to $J^P = 2^+$ partial wave.

¹⁴ Number of events evaluated by us.

¹⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁶ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012W2;LINKAGE=P

NODE=M012W2;LINKAGE=W

NODE=M012W2;LINKAGE=S

NODE=M012W2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

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

NODE=M012W3

NODE=M012W3

111.1 ± 2.4 OUR AVERAGE

115 ± 20		BARBERIS	00H			$450 p p \rightarrow p_f \eta \pi^0 p_s$
112 ± 14		BARBERIS	00H			$450 p p \rightarrow$ $\Delta_f^{++} \eta \pi^- p_s$
112 ± 3 ± 2		¹⁷ AMSLER	94D	CBAR		$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
103 ± 6 ± 3		BELADIDZE	93	VES		$37 \pi^- N \rightarrow \eta \pi^- N$
112.2 ± 5.7	2561	DELFOSSSE	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$
116.6 ± 7.7	1653	DELFOSSSE	81	SPEC	—	$\pi^\pm p \rightarrow p \pi^\pm \eta$
108 ± 9	1000	KEY	73	OSPK	—	$6 \pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

OCCUR=2

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

110 ± 4		ANISOVICH	09	RVUE		$\bar{p} p, \pi N$
127 ± 2 ± 2		¹⁸ THOMPSON	97	MPS		$18 \pi^- p \rightarrow \eta \pi^- p$
118 ± 10		ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
104 ± 9	6200	¹⁹ CONFORTO	73	OSPK	—	$6 \pi^- p \rightarrow p \pi^- \eta$

¹⁷ The systematic error of 2 MeV corresponds to the spread of solutions.

¹⁸ Resolution is not unfolded.

¹⁹ Missing mass with enriched MMS = $\eta \pi^-$, $\eta = 2\gamma$.

NODE=M012W3;LINKAGE=DD

NODE=M012W3;LINKAGE=A

NODE=M012W3;LINKAGE=M

$\eta'\pi$ MODE

VALUE (MeV) DOCUMENT ID TECN COMMENT

119 ± 25 OUR AVERAGE

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

NODE=M012W4

NODE=M012W4

$a_2(1320)$ DECAY MODES

NODE=M012215;NODE=M012

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 3π	(70.1 $\pm$ 2.7) %	S=1.2	DESIG=1
Γ_2 $\rho(770)\pi$			DESIG=11
Γ_3 $f_2(1270)\pi$			DESIG=12
Γ_4 $\rho(1450)\pi$			DESIG=13
Γ_5 $\eta\pi$	(14.5 $\pm$ 1.2) %		DESIG=3
Γ_6 $\omega\pi\pi$	(10.6 $\pm$ 3.2) %	S=1.3	DESIG=4
Γ_7 $K\bar{K}$	(4.9 $\pm$ 0.8) %		DESIG=2
Γ_8 $\eta'(958)\pi$	(5.3 $\pm$ 0.9) $\times 10^{-3}$		DESIG=8
Γ_9 $\pi^\pm\gamma$	(2.68 $\pm$ 0.31) $\times 10^{-3}$		DESIG=7
Γ_{10} $\gamma\gamma$	(9.4 $\pm$ 0.7) $\times 10^{-6}$		DESIG=9
Γ_{11} e^+e^-	< 5 $\times 10^{-9}$	CL=90%	DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 18 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 9.3$ for 15 degrees of freedom.

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

x_5	10		
x_6	-89	-46	
x_7	-1	-2	-24
	x_1	x_5	x_6

 $a_2(1320)$ PARTIAL WIDTHS

NODE=M012220

 $\Gamma(\eta\pi)$ **Γ_5**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

18.5 $\pm$ 3.0 870 ²⁰ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

²⁰ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W6
NODE=M012W6

NODE=M012W6;LINKAGE=SC

 $\Gamma(K\bar{K})$ **Γ_7**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

7.0 $^{+2.0}_{-1.5}$ 870 ²¹ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

²¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W5
NODE=M012W5

NODE=M012W5;LINKAGE=SC

 $\Gamma(\pi^\pm\gamma)$ **Γ_9**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

287 $\pm$ 30 OUR AVERAGE

284 $\pm$ 25 $\pm$ 25 7100 MOLCHANOV 01 SELX 600 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
295 $\pm$ 60 CIHANGIR 82 SPEC + 200 $\pi^+ A$

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

461 $\pm$ 110 ²² MAY 77 SPEC $\pm$ 9.7 γA

²² Assuming one-pion exchange.

NODE=M012W7
NODE=M012W7

NODE=M012W;LINKAGE=M2

$\Gamma(\gamma\gamma)$ Γ_{10}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1.00±0.06 OUR AVERAGE					
0.98±0.05±0.09		ACCIARRI	97T L3		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
0.96±0.03±0.13		ALBRECHT	97B ARG		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.26±0.26±0.18	36	BARU	90 MD1		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.00±0.07±0.15	415	BEHREND	90C CELL 0		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.03±0.13±0.21		BUTLER	90 MRK2		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.01±0.14±0.22	85	OEST	90 JADE		$e^+e^- \rightarrow e^+e^-\pi^0\eta$
0.90±0.27±0.15	56	²³ ALTHOFF	86 TASS 0		$e^+e^- \rightarrow e^+e^-3\pi$
1.14±0.20±0.26		²⁴ ANTREASYAN	86 CBAL 0		$e^+e^- \rightarrow e^+e^-\pi^0\eta$
1.06±0.18±0.19		BERGER	84C PLUT 0		$e^+e^- \rightarrow e^+e^-3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.81±0.19 ^{+0.42} _{-0.11}	35	²³ BEHREND	83B CELL 0		$e^+e^- \rightarrow e^+e^-3\pi$
0.77±0.18±0.27	22	²⁴ EDWARDS	82F CBAL 0		$e^+e^- \rightarrow e^+e^-\pi^0\eta$
²³ From $\rho\pi$ decay mode.					
²⁴ From $\eta\pi^0$ decay mode.					

NODE=M012W9
 NODE=M012W9

NODE=M012W;LINKAGE=F
 NODE=M012W;LINKAGE=G

 $\Gamma(e^+e^-)$ Γ_{11}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.56	90	ACHASOV	00K SND	$e^+e^- \rightarrow \pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<25	90	VOROBYEV	88 ND	$e^+e^- \rightarrow \pi^0\eta$

NODE=M012W10
 NODE=M012W10

 $a_2(1320) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M012223

 $\Gamma(3\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{10}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65±0.02±0.02	18k	²⁵ SCHEGELSKY	06 RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
²⁵ From analysis of L3 data at 183–209 GeV.				

NODE=M012G2
 NODE=M012G2

NODE=M012G2;LINKAGE=SC

 $\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.145 ^{+0.097} _{-0.034}	²⁶ UEHARA	09A BELL	$e^+e^- \rightarrow e^+e^-\eta\pi^0$
²⁶ From the D_2 -wave. The fraction of the D_0 -wave is $3.4^{+2.3}_{-1.1}\%$.			

NODE=M012G01
 NODE=M012G01

NODE=M012G01;LINKAGE=UE

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.126±0.007±0.028	²⁷ ALBRECHT	90G ARG	$e^+e^- \rightarrow e^+e^-K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.081±0.006±0.027	²⁸ ALBRECHT	90G ARG	$e^+e^- \rightarrow e^+e^-K^+K^-$
²⁷ Using an incoherent background.			
²⁸ Using a coherent background.			

NODE=M012G1
 NODE=M012G1

OCCUR=2

NODE=M012G1;LINKAGE=A
 NODE=M012G1;LINKAGE=B

 $a_2(1320) \text{ BRANCHING RATIOS}$

NODE=M012225

 $[\Gamma(f_2(1270)\pi) + \Gamma(\rho(1450)\pi)]/\Gamma(\rho(770)\pi)$ $(\Gamma_3+\Gamma_4)/\Gamma_2$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.12	90	ABRAMOVI...	70B HBC	—	$3.93 \pi^- p$

NODE=M012R9
 NODE=M012R9

$\Gamma(\eta\pi)/\Gamma(3\pi)$ Γ_5/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.207±0.018 OUR FIT					
0.213±0.020 OUR AVERAGE					
0.18 ±0.05		FORINO	76	HBC	11 $\pi^- p$
0.22 ±0.05	52	ANTIPOV	73	CNTR	40 $\pi^- p$
0.211±0.044	149	CHALOUPKA	73	HBC	3.9 $\pi^- p$
0.246±0.042	167	ALSTON-...	71	HBC	7.0 $\pi^+ p$
0.25 ±0.09	15	BOECKMANN	70	HBC	5.0 $\pi^+ p$
0.23 ±0.08	22	ASCOLI	68	HBC	5 $\pi^- p$
0.12 ±0.08		CHUNG	68	HBC	3.2 $\pi^- p$
0.22 ±0.09		CONTE	67	HBC	11.0 $\pi^- p$

NODE=M012R3
 NODE=M012R3

 $\Gamma(\omega\pi\pi)/\Gamma(3\pi)$ Γ_6/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.15±0.05 OUR FIT	Error includes scale factor of 1.3.				
0.15±0.05 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
0.28±0.09	60	DIAZ	74	DBC	0 6 $\pi^+ n$
0.18±0.08	29	KARSHON	74	HBC	Avg. of above two
0.10±0.05	279	CHALOUPKA	73	HBC	3.9 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.29±0.08	140	29 KARSHON	74	HBC	0 4.9 $\pi^+ p$
0.10±0.04	60	29 KARSHON	74	HBC	+ 4.9 $\pi^+ p$
0.19±0.08		DEFOIX	73	HBC	0 0.7 $\bar{p} p$

NODE=M012R12
 NODE=M012R12

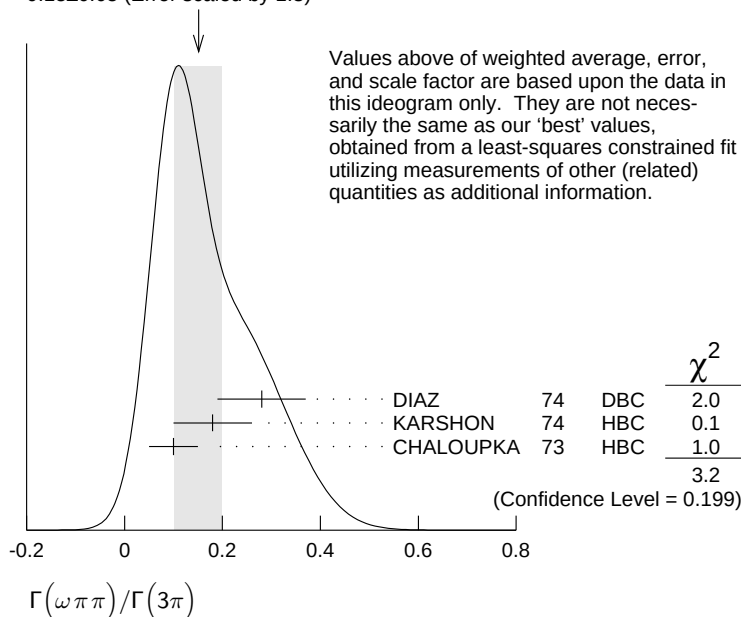
OCCUR=3

OCCUR=2

NODE=M012R12;LINKAGE=K

²⁹ KARSHON 74 suggest an additional $I = 0$ state strongly coupled to $\omega\pi\pi$ which could explain discrepancies in branching ratios and masses. We use a central value and a systematic spread.

WEIGHTED AVERAGE
 0.15±0.05 (Error scaled by 1.3)

 $\Gamma(K\bar{K})/\Gamma(3\pi)$ Γ_7/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.070±0.012 OUR FIT					
0.078±0.017		CHABAUD	78	RVUE	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.011±0.003	30	BERTIN	98B	OBLX	0.0 $\bar{p} p \rightarrow K^\pm K_s \pi^\mp$
0.056±0.014	50	31 CHALOUPKA	73	HBC	3.9 $\pi^- p$
0.097±0.018	113	31 ALSTON-...	71	HBC	+ 7.0 $\pi^+ p$
0.06 ±0.03		31 ABRAMOVI...	70B	HBC	3.93 $\pi^- p$
0.054±0.022	31	CHUNG	68	HBC	3.2 $\pi^- p$

NODE=M012R1
 NODE=M012R1

³⁰ Using 4 π data from BERTIN 97D.

³¹ Included in CHABAUD 78 review.

NODE=M012R1;LINKAGE=BE
 NODE=M012R1;LINKAGE=C

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$ Γ_7/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.08 ± 0.02	³² BERTIN	98B	OBLX 0.0 $\bar{p}p \rightarrow K^\pm K_s^\mp \pi^\mp$

³² Using $\eta\pi\pi$ data from AMSLER 94D.

NODE=M012R14
NODE=M012R14

NODE=M012R14;LINKAGE=BE

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

0.162 ± 0.012 OUR FIT

0.140 ± 0.028 OUR AVERAGE

0.13 ± 0.04		ESPIGAT	72	HBC	± 0.0 $\bar{p}p$
0.15 ± 0.04	34	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$

NODE=M012R2
NODE=M012R2

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

0.054 ± 0.009 OUR FIT

0.048 ± 0.012 OUR AVERAGE

0.05 ± 0.02		TOET	73	HBC	+ 5 $\pi^+ p$
0.09 ± 0.04		TOET	73	HBC	0 5 $\pi^+ p$
0.03 ± 0.02	8	DAMERI	72	HBC	− 11 $\pi^- p$
0.06 ± 0.03	17	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$

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

0.020 ± 0.004	³³ ESPIGAT	72	HBC	± 0.0 $\bar{p}p$

³³ Not averaged because of discrepancy between masses from $K\bar{K}$ and $\rho\pi$ modes.

NODE=M012R8
NODE=M012R8

OCCUR=2

NODE=M012R8;LINKAGE=A

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

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

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

<0.006	95	ALDE	92B	GAM2	38,100 $\pi^- p \rightarrow \eta' \pi^0 n$
<0.02	97	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$
0.004 ± 0.004		BOESEBECK	68	HBC	+ 8 $\pi^+ p$

NODE=M012R4
NODE=M012R4

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

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

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

<0.011	90	EISENSTEIN	73	HBC	− 5 $\pi^- p$
<0.04		ALSTON-...	71	HBC	+ 7.0 $\pi^+ p$
0.04 $^{+0.03}_{-0.04}$		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 $^{+0.005}_{-0.003}$	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
VOROBIEV	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
DELFOSE	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
CHABAUD	80	NP B175 189	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)	REFID=21274
DAUM	80C	PL 89B 276	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP	REFID=21275
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
CHABAUD	78	NP B145 349	V. Chabaud <i>et al.</i>	(CERN, MPIM)	REFID=21267
FERRERSORIA	78	PL 74B 287	A. Ferrer Soria <i>et al.</i>	(ORSAY, CERN, CDEF+)	REFID=21270
HYAMS	78	NP B146 303	B.D. Hyams <i>et al.</i>	(CERN, MPIM, ATEN)	REFID=21271
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA) JP	REFID=21272
MAY	77	PR D16 1983	E.N. May <i>et al.</i>	(ROCH, CORN)	REFID=20450
FORINO	76	NC 35A 465	A. Forino <i>et al.</i>	(BGNA, FIRZ, GENO, MILA+)	REFID=21259
MARGULIE	76	PR D14 667	M. Margulies <i>et al.</i>	(BNL, CUNY)	REFID=21261
EMMS	75	PL 58B 117	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL) JP	REFID=21254
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP	REFID=20843
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)	REFID=21248
KARSHON	74	PRL 32 852	U. Karshon <i>et al.</i>	(REHO)	REFID=21249
ANTIPOV	73	NP B63 175	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=21238
ANTIPOV	73C	NP B63 153	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=20817
CHALOUPKA	73	PL 44B 211	V. Chaloupka <i>et al.</i>	(CERN)	REFID=21242
CONFORTO	73	PL 45B 154	G. Conforto <i>et al.</i>	(EFI, FNAL, TNTO+)	REFID=21243
DEFOIX	73	PL 43B 141	C. Defoix <i>et al.</i>	(CDEF)	REFID=21244
EISENSTEIN	73	PR D7 278	L. Eisenstein <i>et al.</i>	(ILL)	REFID=21245
KEY	73	PRL 30 503	A.W. Key <i>et al.</i>	(TNTO, EFI, FNAL, WISC)	REFID=21246
TOET	73	NP B63 248	D.Z. Toet <i>et al.</i>	(NIJM, BONN, DURH, TORI)	REFID=20714
DAMERI	72	NC 9A 1	M. Dameri <i>et al.</i>	(GENO, MILA, SACL)	REFID=20338
EISENBERG	72	PR D5 15	Y. Eisenberg <i>et al.</i>	(REHO, SLAC, TELA)	REFID=20098
ESPIGAT	72	NP B36 93	P. Espigat <i>et al.</i>	(CERN, CDEF)	REFID=21232
FOLEY	72	PR D6 747	K.J. Foley <i>et al.</i>	(BNL, CUNY)	REFID=21233
ALSTON-...	71	PL 34B 156	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21214
BARNHAM	71	PRL 26 1494	K.W.J. Barnham <i>et al.</i>	(LBL)	REFID=21215
BINNIE	71	PL 36B 257	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=21217
BOWEN	71	PRL 26 1663	D.R. Bowen <i>et al.</i>	(NEAS, STON)	REFID=21219
GRAYER	71	PL 34B 333	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=21223
ABRAMOVI...	70B	NP B23 466	M. Abramovich <i>et al.</i>	(CERN) JP	REFID=21195
ALSTON-...	70	PL 33B 607	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21196
BOECKMANN	70	NP B16 221	K. Boeckmann <i>et al.</i>	(BONN, DURH, NIJM+)	REFID=21202
ASCOLI	68	PRL 20 1321	G. Ascoli <i>et al.</i>	(ILL) JP	REFID=21171
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
CHUNG	68	PR 165 1491	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
CONTE	67	NC 51A 175	F. Conte <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=21166

$f_0(1370)$

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

See also the mini-reviews on scalar mesons under $f_0(500)$ (see the index for the page number) and on non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

NODE=M147

NODE=M147

 $f_0(1370)$ T-MATRIX POLE POSITION

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

NODE=M147PP

NODE=M147PP

NODE=M147PP

→ NOT CHECKED ←

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	$\pi\pi \rightarrow \pi\pi, K\bar{K}$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ Another pole is found at $(1510 \pm 130) - i(800^{+100}_{-150})$ MeV.

² Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

³ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.

⁴ T-matrix pole on sheet – – –.

⁵ Supersedes ANISOVICH 94.

⁶ Coupled-channel analysis of $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$, and $\pi^0 \pi^0 \eta$ on sheet IV. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

⁷ Analysis of data from FALVARD 88.

⁸ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

⁹ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

¹⁰ Reanalysis of ANISOVICH 94 data.

¹¹ T-matrix pole on sheet III.

¹² Analysis of data from OCHS 73, GRAYER 74, BECKER 79, and CASON 83.

NODE=M147PP;LINKAGE=AO

NODE=M147PP;LINKAGE=BG

NODE=M147PP;LINKAGE=PC

NODE=M147PP;LINKAGE=TK

NODE=M147PP;LINKAGE=K

NODE=M147PP;LINKAGE=A

NODE=M147PP;LINKAGE=C

NODE=M147PP;LINKAGE=DD

NODE=M147PP;LINKAGE=BB

NODE=M147PP;LINKAGE=C1

NODE=M147PP;LINKAGE=KM

NODE=M147PP;LINKAGE=H

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

NODE=M147205

VALUE (MeV) DOCUMENT ID

1200 to 1500 OUR ESTIMATE

NODE=M147M

→ NOT CHECKED ←

$\pi\pi$ 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	4286	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	$450 p \bar{p} \rightarrow p_s p_f \pi^+ \pi^-$
1315 ± 50		BELLAZZINI 99	GAM4	$450 p \bar{p} \rightarrow p p \pi^0 \pi^0$
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	$300 p \bar{p} \rightarrow p p \pi\pi, p p K\bar{K}$
1275 ± 20		BREAKSTONE 90	SFM	$62 p \bar{p} \rightarrow p p \pi^+ \pi^-$
1420 ± 20		AKESSON 86	SPEC	$63 p \bar{p} \rightarrow p p \pi^+ \pi^-$
1256		FROGGATT 77	RVUE	$\pi^+ \pi^-$ channel

¹³ Breit-Wigner mass.¹⁴ Breit-Wigner mass. May also be the $f_0(1500)$.¹⁵ Reanalysis of ABELE 96C data.¹⁶ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.¹⁷ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.¹⁸ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decaysNODE=M147M1
NODE=M147M1NODE=M147M1;LINKAGE=BW
NODE=M147M1;LINKAGE=UE
NODE=M147M1;LINKAGE=BU
NODE=M147M1;LINKAGE=GR
NODE=M147M1;LINKAGE=BB

NODE=M147M1;LINKAGE=FF

 $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1440 ± 6	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1391 ± 10	TIKHOMIROV 03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1440 ± 50	BOLONKIN 88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1463 ± 9	ETKIN 82B	MPS	$23 \pi^- p \rightarrow n 2 K_S^0$
1425 ± 15	WICKLUND 80	SPEC	$6 \pi N \rightarrow K^+ K^- N$
~ 1300	POLYCHRO... 79	STRC	$7 \pi^- p \rightarrow n 2 K_S^0$

NODE=M147M2
NODE=M147M2 **4π MODE $2(\pi\pi)_S + \rho\rho$**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1395 ± 40		ABELE 01	CBAR	$0.0 \bar{p} d \rightarrow \pi^- 4\pi^0 p$
1374 ± 38		AMSLER 94	CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- 3\pi^0$
1345 ± 12		ADAMO 93	OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
1386 ± 30		GASPERO 93	DBC	$0.0 \bar{p} n \rightarrow 2\pi^+ 3\pi^-$
~ 1410	5751	¹⁹ BETTINI 66	DBC	$0.0 \bar{p} n \rightarrow 2\pi^+ 3\pi^-$
¹⁹ $\rho\rho$ dominant.				

NODE=M147M3
NODE=M147M3

NODE=M147M3;LINKAGE=BE

 $\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1262^{+51+82}_{-78-103}$	²⁰ UEHARA 10A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
1430	AMSLER 92	CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \eta\eta$
1220 ± 40	ALDE 86D	GAM4	$100 \pi^- p \rightarrow n 2\eta$

²⁰ Breit-Wigner mass. May also be the $f_0(1500)$.NODE=M147M4
NODE=M147M4

NODE=M147M4;LINKAGE=UE

COUPLED CHANNEL MODE

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>

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

1306 ± 20

²¹ ANISOVICH 03 RVUE

²¹ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$,
 $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$,
 $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

NODE=M147M5
 NODE=M147M5

NODE=M147M;LINKAGE=KM

 $f_0(1370)$ BREIT-WIGNER WIDTH

NODE=M147210

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>

200 to 500 OUR ESTIMATE

NODE=M147W
 → NOT CHECKED ←

 $\pi\pi$ MODE

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

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

300 ± 80		²² AUBERT	09L	BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
90 ⁺ ₁₋ 2 ⁺ ₁₋ 50 ₂₂		²³ UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
298 ± 21	2.6k	BONVICINI	07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
126 ± 25	4286	²⁴ GARMASH	06	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
265 ± 40		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
350 ± 100 ⁺ ₆₀		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
173 ± 32 ± 6	848	AITALA	01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
222 ± 20		BARBERIS	99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$
255 ± 60		BELLAZZINI	99	GAM4	450 $pp \rightarrow pp \pi^0 \pi^0$
190 ± 50		ALDE	98	GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
323 ± 13		BERTIN	98	OBLX	0.05–0.405 $\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
350		^{25,26} TORNQVIST	95	RVUE	$\pi\pi \rightarrow \pi\pi, K \bar{K}, K\pi, \eta\pi$
195 ± 33		ARMSTRONG	91	OMEG	300 $pp \rightarrow pp\pi\pi, ppK \bar{K}$
285 ± 60		BREAKSTONE	90	SFM	62 $pp \rightarrow pp\pi^+ \pi^-$
460 ± 50		AKESSON	86	SPEC	63 $pp \rightarrow pp\pi^+ \pi^-$
~ 400		²⁷ FROGGATT	77	RVUE	$\pi^+ \pi^-$ channel

²² The systematic errors are not reported.

²³ Breit-Wigner width. May also be the $f_0(1500)$.

²⁴ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.

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

²⁶ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays

²⁷ Width defined as distance between 45 and 135° phase shift.

NODE=M147W1;LINKAGE=NS
 NODE=M147W1;LINKAGE=UE
 NODE=M147W1;LINKAGE=GR
 NODE=M147W1;LINKAGE=BB

NODE=M147W1;LINKAGE=FF
 NODE=M147W1;LINKAGE=E

 $K \bar{K}$ MODE

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

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

121 ± 15		VLADIMIRSK...	06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
55 ± 26		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
250 ± 80		BOLONKIN	88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
118 ⁺ ₁₆ 138 ₁₆		ETKIN	82B	MPS	23 $\pi^- p \rightarrow n 2 K_S^0$
160 ± 30		WICKLUND	80	SPEC	6 $\pi N \rightarrow K^+ K^- N$
~ 150		POLYCHRO...	79	STRC	7 $\pi^- p \rightarrow n 2 K_S^0$

NODE=M147W2
 NODE=M147W2

 4π MODE $2(\pi\pi)_S + \rho\rho$

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

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

275 ± 55		ABELE	01	CBAR	0.0 $\bar{p} d \rightarrow \pi^- 4\pi^0 p$
375 ± 61		AMSLER	94	CBAR	0.0 $\bar{p} p \rightarrow \pi^+ \pi^- 3\pi^0$
398 ± 26		ADAMO	93	OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
310 ± 50		GASPERO	93	DBC	0.0 $\bar{p} n \rightarrow 2\pi^+ 3\pi^-$
~ 90	5751	²⁸ BETTINI	66	DBC	0.0 $\bar{p} n \rightarrow 2\pi^+ 3\pi^-$

²⁸ $\rho\rho$ dominant.

NODE=M147W3
 NODE=M147W3

NODE=M147W3;LINKAGE=BE

$\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

$484^{+246}_{-170} + 246_{-263}$	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	$100 \pi^- p \rightarrow n 2\eta$

²⁹Breit-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

³⁰K-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;→ NOT CHECKED ←
DESIG=10;OUR EST;→ NOT CHECKED ←
DESIG=4;OUR EST;→ NOT CHECKED ←
DESIG=5;OUR EST;→ NOT CHECKED ←
DESIG=6;OUR EST;→ NOT CHECKED ←
DESIG=14;OUR EST;→ NOT CHECKED ←
DESIG=15;OUR EST;→ NOT CHECKED ←
DESIG=16;OUR EVAL;
→ NOT CHECKED ←
DESIG=17;OUR EVAL;
→ NOT CHECKED ←
DESIG=2;OUR EST;→ NOT CHECKED ←
DESIG=11;OUR EST;→ NOT CHECKED ←
DESIG=18;OUR EVAL;
→ NOT CHECKED ←
DESIG=19;OUR EVAL;
→ NOT CHECKED ←
DESIG=20;OUR EVAL;
→ NOT CHECKED ←
DESIG=12;OUR EST;→ NOT CHECKED ←
DESIG=13;OUR EST;→ NOT CHECKED ←

 $f_0(1370)$ PARTIAL WIDTHS **$\Gamma(\gamma\gamma)$**

See $\gamma\gamma$ widths under $f_0(500)$ and MORGAN 90.

 Γ_{15}

NODE=M147217

NODE=M147W11

NODE=M147W11

NODE=M147W11

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

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

 Γ_{16}

NODE=M147W12
NODE=M147W12

 $f_0(1370) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$ **$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$** **$\Gamma_{10}\Gamma_{15}/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

$121^{+133}_{-53} + 169_{-106}$	³¹ UEHARA	10A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$

³¹Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=M147225

NODE=M147G01
NODE=M147G01

NODE=M147G01;LINKAGE=UE

$f_0(1370)$ BRANCHING RATIOS

NODE=M147220

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.26 ± 0.09	BUGG	96	RVUE	
< 0.15	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 $pp \rightarrow p_f \eta \eta p_s$

 $\Gamma_{10}/\Gamma_2 = \Gamma_{10}/(\Gamma_3 + \Gamma_4 + \Gamma_5)$

NODE=M147R14
 NODE=M147R14

³⁷ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), 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±0.15±0.11	BARBERIS	99D	OMEG 450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$

 Γ_{11}/Γ_1

NODE=M147R13
 NODE=M147R13

³⁸ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

NODE=M147R;LINKAGE=BG

³⁹ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=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	JPG 34 151	D.V. Bugg <i>et al.</i>	
GARMASH	07	PR D75 012006	A. Garmash <i>et al.</i>	(BELLE Collab.)
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i>	(BELLE Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
		Translated from YAF 66 860.		
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	
		Translated from YAF 65 1583.		

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
JANSSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
TORNQVIST	95	ZPHY C68 647	N.A. Tornqvist	(HELS)	REFID=44529
AMSLER	94	PL B322 431	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.) JPC	REFID=43660
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.) JPC	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i>	(OBELIX Collab.) JPC	REFID=43657
GASPERO	93	NP A562 407	M. Gaspero	(ROMAI) JPC	REFID=43658
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43169
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)	REFID=40580
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
AU	87	PR D35 1633	K.L. Au, D. Morgan, M.R. Pennington	(DURH, RAL)	REFID=40064
AKESSON	86	NP B264 154	T. Akesson <i>et al.</i>	(Axial Field Spec. Collab.)	REFID=21123
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
WICKLUND	80	PRL 45 1469	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20383
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)	REFID=21084
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)	REFID=20349
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i>	(PENN)	REFID=44530
BETTINI	66	NC 42A 695	A. Bettini <i>et al.</i>	(PADO, PISA)	REFID=21361

NODE=M109

$h_1(1380)$

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

OMITTED FROM SUMMARY TABLE

Seen in partial-wave analysis of the $K\bar{K}\pi$ system. Needs confirmation.

NODE=M109

$h_1(1380)$ MASS

NODE=M109M

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 $K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

NODE=M109M

$h_1(1380)$ WIDTH

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 $K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

NODE=M109W

$h_1(1380)$ 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

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)

REFID=45765
REFID=40282

NODE=M111

$\pi_1(1400)$

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

NODE=M111

See also the mini-review under non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

$\pi_1(1400)$ MASS

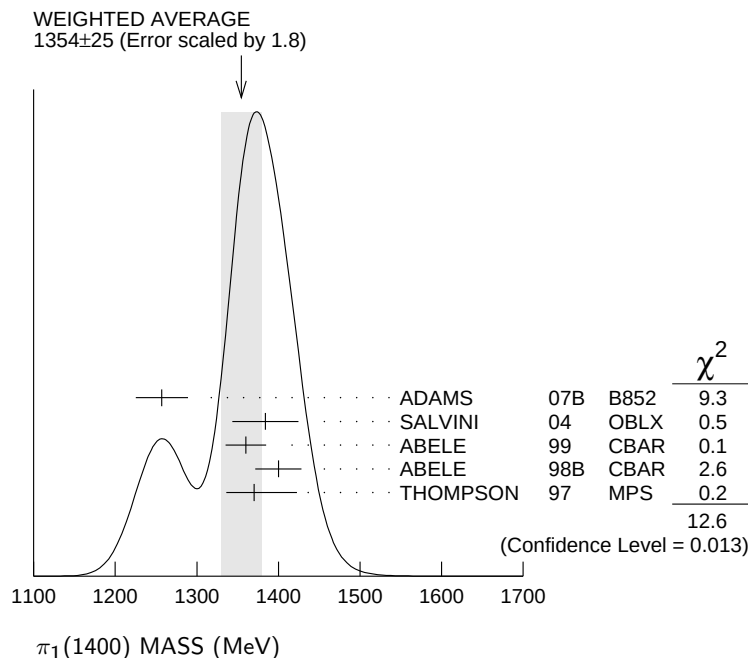
NODE=M111M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1354 ±25 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.			
1257 ±20 ±25	23.5k	ADAMS	07B B852		18 $\pi^- p \rightarrow \eta \pi^0 n$
1384 ±20 ±35	90k	SALVINI	04 OBLX		$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1360 ±25		ABELE	99 CBAR		0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1400 ±20 ±20		ABELE	98B CBAR		0.0 $\bar{p}n \rightarrow \pi^- \pi^0 \eta$
1370 ±16 $^{+50}_{-30}$		¹ THOMPSON	97 MPS		18 $\pi^- p \rightarrow \eta \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1323.1± 4.6		² AOYAGI	93 BKEI		$\pi^- p \rightarrow \eta \pi^- p$
1406 ±20		³ ALDE	88B GAM4	0	100 $\pi^- p \rightarrow \eta \pi^0 n$

NODE=M111M

¹ Natural parity exchange, questioned by DZIERBA 03.
² Unnatural parity exchange.
³ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

NODE=M111M;LINKAGE=B
NODE=M111M;LINKAGE=C
NODE=M111M;LINKAGE=A



$\pi_1(1400)$ WIDTH

NODE=M111W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
330 ±35 OUR AVERAGE					
354 ±64 ± 58	23.5k	ADAMS	07B	B852	18 $\pi^- p \rightarrow \eta \pi^0 n$
378 ±50 ± 50	90k	SALVINI	04	OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
220 ±90		ABELE	99	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
310 ±50 + 50 - 30		ABELE	98B	CBAR	0.0 $\bar{p} n \rightarrow \pi^- \pi^0 \eta$
385 ±40 + 65 - 105		⁴ THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta \pi^- p$
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.

NODE=M111W

NODE=M111W;LINKAGE=QQ

NODE=M111W;LINKAGE=C

NODE=M111W;LINKAGE=A

$\pi_1(1400)$ DECAY MODES

NODE=M111215;NODE=M111

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta \pi^0$	seen
$\Gamma_2 \quad \eta \pi^-$	seen
$\Gamma_3 \quad \eta' \pi$	

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=3

$\pi_1(1400)$ BRANCHING RATIOS

NODE=M111220

$\Gamma(\eta \pi^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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 $\pi^- p \rightarrow \eta \pi^0 n$

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

⁷ Using Crystal Barrel data.

⁸ A general fit allowing S , D , and P waves (including $m=0$) is not done because of limited statistics.

NODE=M111R1

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	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
DZIERBA	03	PR D67 094015	A.R. Dzierba <i>et al.</i>	
ABELE	99	PL B446 349	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	98B	PL B423 175	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)
PROKOSHKIN	95B	PAN 58 606	Y.D. Prokoshkin, S.A. Sadovsky	(SERP)
Translated from YAF 58 662.				
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)
BOUTEMEUR	90	Hadron 89 Conf. p 119	M. Boutemeur, M. Poulet	(SERP, BELG, LANL+)
ALDE	88B	PL B205 397	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP) IGJPC
APEL	81	NP B193 269	W.D. Apel <i>et al.</i>	(SERP, CERN)

REFID=52048
REFID=51004
REFID=53226
REFID=49412
REFID=46602
REFID=45864
REFID=45584
REFID=44619

REFID=44078
REFID=43599
REFID=43598
REFID=41751
REFID=40558
REFID=22913

$\eta(1405)$

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

NODE=M027

A REVIEW GOES HERE – Check our WWW List of Reviews

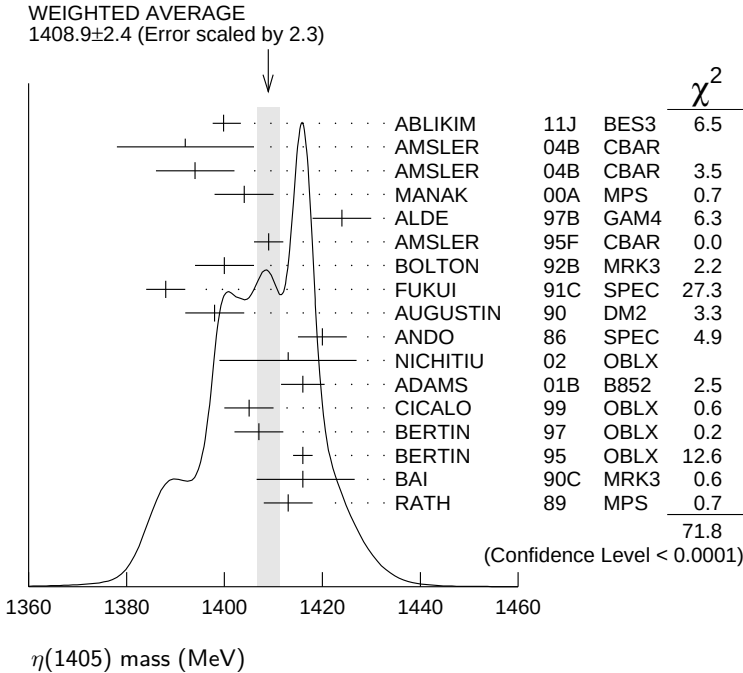
NODE=M027

$\eta(1405)$ MASS

NODE=M027205

VALUE (MeV)	DOCUMENT ID
1408.9±2.4 OUR AVERAGE	Includes data from the 2 datablocks that follow this one.
Error includes scale factor of 2.3. See the ideogram below. [1409.8 ± 2.5 MeV OUR 2011 AVERAGE Scale factor = 2.2]	

NODE=M027MX
NEW



$\eta\pi\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

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

NODE=M027M1
NODE=M027M1

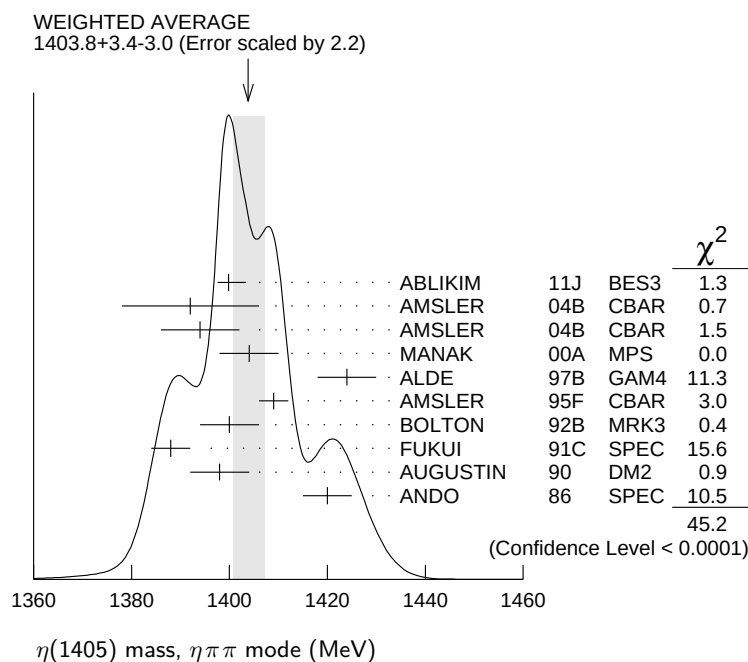
1403.8^{+3.4}_{-3.0} OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below. [1405 ± 4 MeV OUR 2011 AVERAGE Scale factor = 2.3]

NEW

1399.8 ± 2.2 ^{+2.8} _{-0.1}		¹ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
1392 ± 14	900 ± 375	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
1394 ± 8	6.6 ± 2.0k	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$
1404 ± 6	9082	MANAK	00A MPS	$18 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$
1424 ± 6	2200	ALDE	97B GAM4	$100 \pi^-\rho \rightarrow \eta\pi^0\pi^0n$
1409 ± 3		AMSLER	95F CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$
1400 ± 6		² BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
1388 ± 4		FUKUI	91C SPEC	$8.95 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$
1398 ± 6	261	³ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
1420 ± 5		ANDO	86 SPEC	$8 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$
1385 ± 7		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

OCCUR=2

• • • 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.

NODE=M027M4
NODE=M027M4

1413.9 ± 1.7 OUR AVERAGE Error includes scale factor of 1.1.

1413 ± 14	3651	⁴ NICHITIU	02 OBLX	
1416 ± 4 ± 2	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^-\rho \rightarrow K^+K^-\pi^0n$
1405 ± 5		⁵ CICALO	99 OBLX	$0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+\pi^-$
1407 ± 5		⁵ BERTIN	97 OBLX	$0 \bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+\pi^-$
1416 ± 2		⁵ BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
1416 ± 8 ⁺⁷ ₋₅	700	⁶ BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1413 ± 5		⁶ RATH	89 MPS	$21.4 \pi^-\rho \rightarrow n K_S^0 K_S^0 \pi^0$
1459 ± 5		⁷ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$

OCCUR=2

OCCUR=3

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

 $\pi\pi\gamma$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

1390 ± 12 235 ± 91 AMSLER 04B CBAR $0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$

NODE=M027M2
NODE=M027M2

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

1424 ± 10 ± 11	547	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
1401 ± 18		^{8,9} AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+\pi^-\gamma\gamma$
1432 ± 8		⁹ COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+\pi^-\pi^0\gamma$

OCCUR=4

4 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1420 $\pm$ 20		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1489 $\pm$ 12	3270	¹⁰ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi \gamma$

NODE=M027M3
 NODE=M027M3

K $\bar{K}$ π MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1437.6 $\pm$ 3.2	249 $\pm$ 35	^{11,12} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^+ \pi^- + \text{c.c.}$
1445.9 $\pm$ 5.7	62 $\pm$ 18	^{11,12} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
1442 $\pm$ 10	410	¹¹ BAI	98C BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1445 $\pm$ 8	693	¹¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1433 $\pm$ 8	296	¹¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1413 $\pm$ 8	500	¹¹ DUCH	89 ASTE	$\bar{p} p \rightarrow \pi^+ \pi^- K^\pm \pi^\mp K^0$
1453 $\pm$ 7	170	¹¹ RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
1419 $\pm$ 1	8800	¹¹ BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
1424 $\pm$ 3	620	¹¹ REEVES	86 SPEC	$6.6 p \bar{p} \rightarrow K \bar{K} \pi X$
1421 $\pm$ 2		¹¹ CHUNG	85 SPEC	$8 \pi^- p \rightarrow K \bar{K} \pi n$
1440 $\begin{smallmatrix} +20 \\ -15 \end{smallmatrix}$	174	¹¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1440 $\begin{smallmatrix} +10 \\ -15 \end{smallmatrix}$		¹¹ SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 $\pm$ 7	800	^{11,13} BAILLON	67 HBC	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$

NODE=M027M6
 NODE=M027M6

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ The selected process is $J/\psi \rightarrow \omega a_0(980) \pi$.
- ² From fit to the $a_0(980) \pi 0^- +$ partial wave.
- ³ Best fit with a single Breit Wigner.
- ⁴ Decaying dominantly directly to $K^+ K^- \pi^0$.
- ⁵ Decaying into $(K \bar{K})_S \pi$, $(K \pi)_S \bar{K}$, and $a_0(980) \pi$.
- ⁶ From fit to the $a_0(980) \pi 0^- +$ partial wave. Cannot rule out a $a_0(980) \pi 1^- +$ partial wave.
- ⁷ Excluded from averaging because averaging would be meaningless.
- ⁸ Best fit with a single Breit Wigner.
- ⁹ This peak in the $\gamma \rho$ channel may not be related to the $\eta(1405)$.
- ¹⁰ Estimated by us from various fits.
- ¹¹ These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.
- ¹² Systematic uncertainty not evaluated.
- ¹³ From best fit of $0^- +$ partial wave , 50% $K^*(892) K$, 50% $a_0(980) \pi$.

NODE=M027M1;LINKAGE=BL
 NODE=M027M1;LINKAGE=J1
 NODE=M027M1;LINKAGE=A1
 NODE=M027M;LINKAGE=NC
 NODE=M027M4;LINKAGE=FX
 NODE=M027M4;LINKAGE=C2

NODE=M027M4;LINKAGE=AA
 NODE=M027M2;LINKAGE=E
 NODE=M027M2;LINKAGE=X
 NODE=M027M3;LINKAGE=E
 NODE=M027M;LINKAGE=NP

NODE=M027M;LINKAGE=NS
 NODE=M027M6;LINKAGE=H

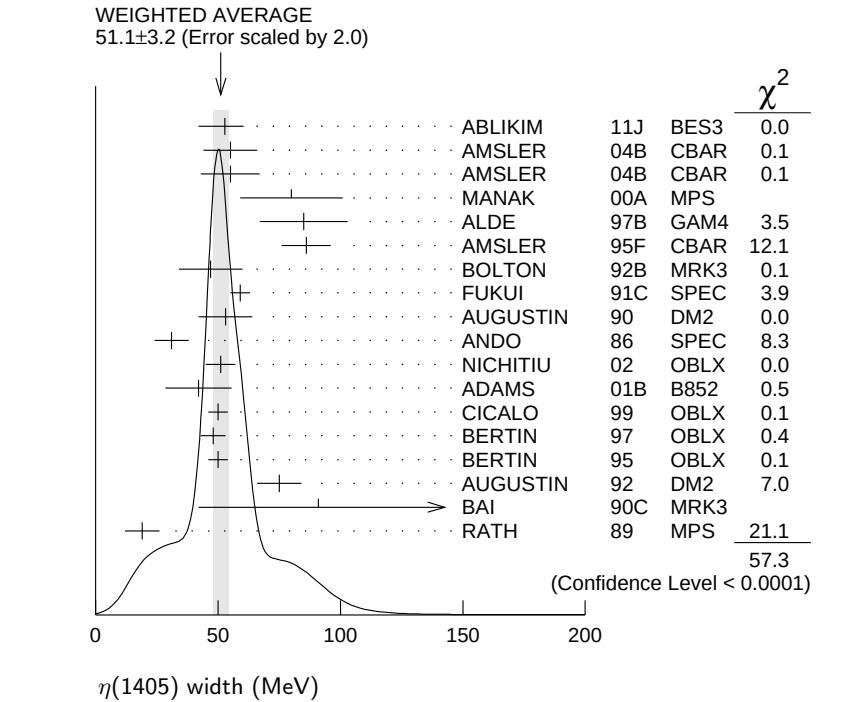
 $\eta(1405)$ WIDTH

NODE=M027210

VALUE (MeV) DOCUMENT ID

51.1 $\pm$ 3.2 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 2.0. See the ideogram below. [51.1 $\pm$ 3.4 MeV OUR 2011 AVERAGE Scale factor = 2.0]

NODE=M027WX
 NEW



$\eta\pi\pi$ MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.				

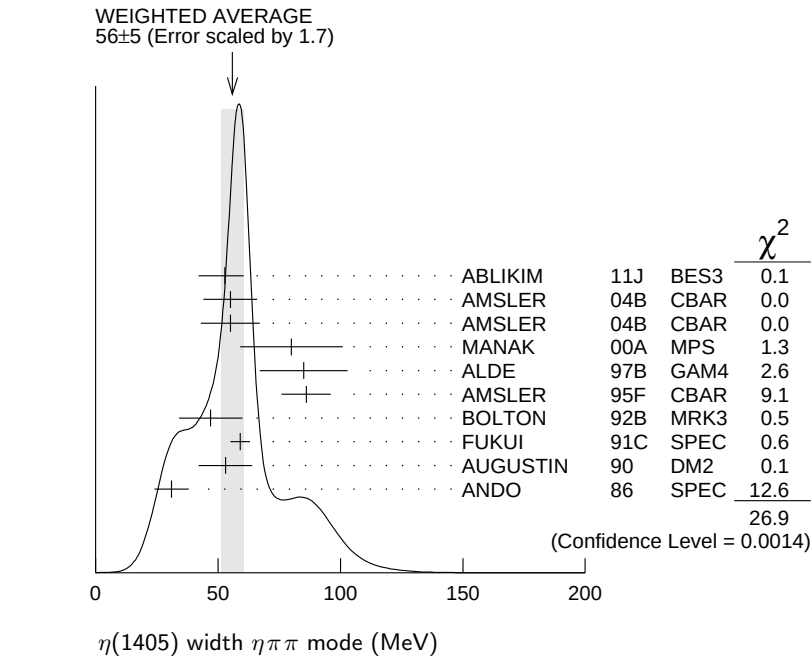
NODE=M027W1
NODE=M027W1

56 ± 5 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.
[56 ± 5 MeV OUR 2011 AVERAGE Scale factor = 1.8]

NEW

52.8 ± 7.6 ^{+0.1} _{-7.6}	14	ABLIKIM	11J	BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
55 ± 11	900 ± 375	AMSLER	04B	CBAR	$0 \bar{p} p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
55 ± 12	6.6 ± 2.0k	AMSLER	04B	CBAR	$0 \bar{p} p \rightarrow \pi^+\pi^-\pi^0\pi^0\gamma$
80 ± 21	9082	MANAK	00A	MPS	$18 \pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$
85 ± 18	2200	ALDE	97B	GAM4	$100 \pi^-\pi^+ \rightarrow \eta\pi^0\pi^0n$
86 ± 10		AMSLER	95F	CBAR	$0 \bar{p} p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$
47 ± 13		15 BOLTON	92B	MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
59 ± 4		FUKUI	91C	SPEC	$8.95 \pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$
53 ± 11		16 AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
31 ± 7		ANDO	86	SPEC	$8 \pi^-\pi^+ \rightarrow \eta\pi^+\pi^-n$

OCCUR=2



$K\bar{K}\pi$ MODE ($a_0(980)\pi$ or direct $K\bar{K}\pi$)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

NODE=M027W4
NODE=M027W4

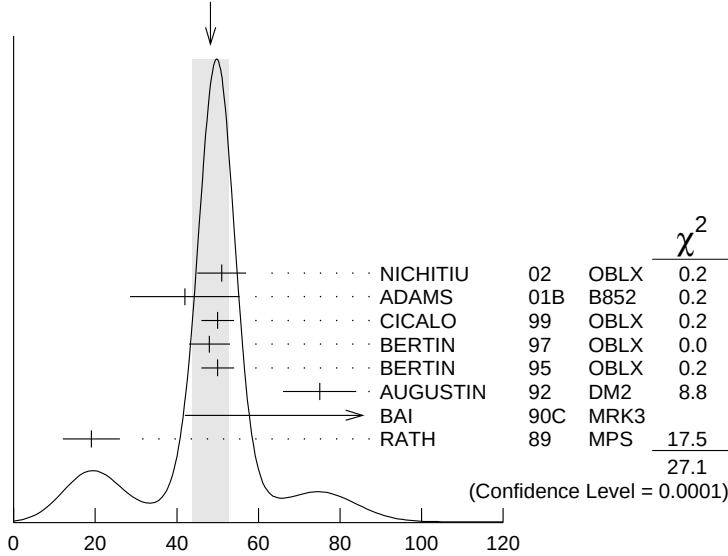
48 ± 4 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.

51 ± 6	3651	17 NICHITIU	02 OBLX	
42 ± 10 ± 9	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
50 ± 4		CICALO	99 OBLX	0 $\bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
48 ± 5		18 BERTIN	97 OBLX	0.0 $\bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
50 ± 4		18 BERTIN	95 OBLX	0 $\bar{p} p \rightarrow K\bar{K}\pi\pi\pi$
75 ± 9		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$
91 +67 -31 -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

160 ± 30 BUGG 95 MRK3 $J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$

144 ± 13 3270 21 BISELLO 89B DM2 $J/\psi \rightarrow 4\pi\gamma$

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

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. • • •

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	$J/\psi \rightarrow \omega K^\pm K^- \pi^0$
93 ± 14	296	22 AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
105 ± 10	693	22 AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
62 ± 16	500	22 DUCH	89 ASTE	$\bar{p} p \rightarrow K\bar{K}\pi\pi\pi$
100 ± 11	170	22 RATH	89 MPS	21.4 $\pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
66 ± 2	8800	22 BIRMAN	88 MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
60 ± 10	620	22 REEVES	86 SPEC	6.6 $p\bar{p} \rightarrow K K \pi X$
60 ± 10		22 CHUNG	85 SPEC	8 $\pi^- p \rightarrow K\bar{K}\pi n$
55 +20 -30	174	22 EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
50 +30 -20		22 SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
80 ± 10	800	22,24 BAILLON	67 HBC	0.0 $\bar{p} p \rightarrow K\bar{K}\pi\pi\pi$

NODE=M027W6
NODE=M027W6

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

- 14 The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.
 15 From fit to the $a_0(980)\pi 0^-+$ partial wave.
 16 From $\eta\pi^+\pi^-$ mass distribution - mainly $a_0(980)\pi$ - no spin-parity determination available.
 17 Decaying dominantly directly to $K^+K^-\pi^0$.
 18 Decaying into $(K\bar{K})_S\pi$, $(K\pi)_S\bar{K}$, and $a_0(980)\pi$.
 19 From fit to the $a_0(980)\pi 0^-+$ partial wave, but $a_0(980)\pi 1^{++}$ cannot be excluded.
 20 This peak in the $\gamma\rho$ channel may not be related to the $\eta(1405)$.
 21 Estimated by us from various fits.
 22 These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.
 23 Systematic uncertainty not evaluated.
 24 From best fit to 0^-+ partial wave, 50% $K^*(892)K$, 50% $a_0(980)\pi$.

NODE=M027W1;LINKAGE=BL
 NODE=M027W1;LINKAGE=A1
 NODE=M027W1;LINKAGE=D1

 NODE=M027W;LINKAGE=NC
 NODE=M027W4;LINKAGE=FX
 NODE=M027W4;LINKAGE=C
 NODE=M027W2;LINKAGE=X
 NODE=M027W3;LINKAGE=F2
 NODE=M027W;LINKAGE=NP

 NODE=M027W;LINKAGE=NS
 NODE=M027W6;LINKAGE=H1

$\eta(1405)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\bar{K}\pi$	seen	
Γ_2 $\eta\pi\pi$	seen	
Γ_3 $a_0(980)\pi$	seen	
Γ_4 $\eta(\pi\pi)_S\text{-wave}$	seen	
Γ_5 $f_0(980)\eta$	seen	
Γ_6 4π	seen	
Γ_7 $\rho\rho$	<58 %	99.85%
Γ_8 $\gamma\gamma$		
Γ_9 $\rho^0\gamma$	seen	
Γ_{10} $\phi\gamma$		
Γ_{11} $K^*(892)K$	seen	

NODE=M027215;NODE=M027

DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=9;OUR EST;→ NOT CHECKED ←
 DESIG=10;OUR EST;→ NOT CHECKED ←
 DESIG=6;OUR EST;→ NOT CHECKED ←
 DESIG=12
 DESIG=7
 DESIG=8;OUR EST;→ NOT CHECKED ←
 DESIG=13
 DESIG=11;OUR EST;→ NOT CHECKED ←

$\eta(1405) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_8/\Gamma$
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	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
~ 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	$6.6 \bar{p} p \rightarrow K K \pi X$

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	$0 \bar{p} p \rightarrow \eta \pi^0 \pi^0 \pi^0$
0.19 ± 0.04	2200	29 ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
$0.56 \pm 0.04 \pm 0.03$		29 AMSLER	95F CBAR	$0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0 \pi^0 \eta$

NODE=M027R2
 NODE=M027R2

 $\Gamma(a_0(980)\pi)/\Gamma(\eta(\pi\pi)s\text{-wave})$ Γ_3/Γ_4

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

0.91 ± 0.12		ANISOVICH	01 SPEC	$0.0 \bar{p} p \rightarrow \eta \pi^+ \pi^- \pi^+ \pi^-$
0.15 ± 0.04	9082	30 MANAK	00A MPS	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
$0.70 \pm 0.12 \pm 0.20$		31 BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M027R9
 NODE=M027R9

 $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$ Γ_9/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.0152 ± 0.0038	32 COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$

NODE=M027R7
 NODE=M027R7

 $\Gamma(\eta(\pi\pi)s\text{-wave})/\Gamma(\eta\pi\pi)$ Γ_4/Γ_2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

0.81 ± 0.04	2200	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$

NODE=M027R8
 NODE=M027R8

 $\Gamma(f_0(980)\eta)/\Gamma(\eta\pi\pi)$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.32 ± 0.07	33 ANISOVICH	00 SPEC	$0.9\text{--}1.2 \bar{p} p \rightarrow \eta 3\pi^0$

NODE=M027R10
 NODE=M027R10

 $\Gamma(\rho\rho)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.58	99.85	27,34 AMSLER	04B CBAR	$0 \bar{p} p$

NODE=M027R13
 NODE=M027R13

 $\Gamma(K^*(892)K)/\Gamma(a_0(980)\pi)$ Γ_{11}/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.084 ± 0.024	30 ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$

NODE=M027R11
 NODE=M027R11

 $\Gamma(\phi\gamma)/\Gamma(\rho^0\gamma)$ Γ_{10}/Γ_9

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.77	95	35 BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma K^+ K^-$

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	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+) JP	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 $e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$
1426 ± 6	711	ABDALLAH	03H DLPH	91.2 $e^+e^- \rightarrow K_S^0K^\pm\pi^\mp + X$
1420 ± 14	3651	NICHITIU	02 OBLX	
1428 ± 4 ± 2	20k	ADAMS	01B B852	18 GeV $\pi^-p \rightarrow K^+K^-\pi^0n$
1426 ± 1		BARBERIS	97C OMEG	450 $pp \rightarrow ppK_S^0K^\pm\pi^\mp$
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 $\pi^-p \rightarrow \eta\pi^0\pi^0n$
1430 ± 4		² ARMSTRONG	92E OMEG	85,300 $\pi^+p, pp \rightarrow \pi^+p, pp(K\bar{K}\pi)$
1462 ± 20		³ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$
1443 $\begin{smallmatrix} +7 \\ -6 \end{smallmatrix}$ $\begin{smallmatrix} +3 \\ -2 \end{smallmatrix}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0K^\pm\pi^\mp$
1425 ± 10	17	BEHREND	89 CELL	$\gamma\gamma \rightarrow K_S^0K^\pm\pi^\mp$
1442 ± 5 $\begin{smallmatrix} +10 \\ -17 \end{smallmatrix}$	111	BECKER	87 MRK3	$e^+e^- \rightarrow \omega K\bar{K}\pi$
1423 ± 4		GIDAL	87B MRK2	$e^+e^- \rightarrow e^+e^-K\bar{K}\pi$
1417 ± 13	13	AIHARA	86C TPC	$e^+e^- \rightarrow e^+e^-K\bar{K}\pi$
1422 ± 3		CHAUVAT	84 SPEC	ISR 31.5 pp
1440 ± 10		⁴ BROMBERG	80 SPEC	100 $\pi^-p \rightarrow K\bar{K}\pi X$
1426 ± 6	221	DIONISI	80 HBC	4 $\pi^-p \rightarrow K\bar{K}\pi n$
1420 ± 20		DAHL	67 HBC	1.6-4.2 π^-p

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

1430.8 ± 0.9		⁵ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
1433.4 ± 0.8		⁵ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
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;→ NOT CHECKED ←

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

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;→ NOT CHECKED ←

$f_1(1420) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M006220

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$

NODE=M006G2
 NODE=M006G2

VALUE (keV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
1.9±0.4 OUR AVERAGE					
3.2±0.6±0.7		133	9,10 ACHARD	07 L3	183–209 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
3.0±0.9±0.7			11,12 BEHREND	89 CELL	$e^+e^- \rightarrow e^+e^- K_S^0 K\pi$
2.3 $^{+1.0}_{-0.9}$ ±0.8			HILL	89 JADE	$e^+e^- \rightarrow e^+e^- K^\pm K_S^0 \pi^\mp$
1.3±0.5±0.3			AIHARA	88B TPC	$e^+e^- \rightarrow e^+e^- K^\pm K_S^0 \pi^\mp$
1.6±0.7±0.3			11,13 GIDAL	87B MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.0	95		JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$

⁹ From a fit with a width fixed at 55 MeV.

¹⁰ The form factor parameter from the fit is 926 ± 78 MeV.

¹¹ Assume a ρ -pole form factor.

¹² A ϕ - pole form factor gives considerably smaller widths.

¹³ Published value divided by 2.

NODE=M006G2;LINKAGE=CH
 NODE=M006G2;LINKAGE=CR
 NODE=M006G2;LINKAGE=A
 NODE=M006G2;LINKAGE=D
 NODE=M006G2;LINKAGE=B

$f_1(1420)$ BRANCHING RATIOS

NODE=M006225

$\Gamma(K\bar{K}^*(892) + \text{c.c.}) / \Gamma(K\bar{K}\pi)$

 Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.76±0.06	BROMBERG	80 SPEC	100 $\pi^- p \rightarrow K\bar{K}\pi X$
0.86±0.12	DIONISI	80 HBC	4 $\pi^- p \rightarrow K\bar{K}\pi n$

NODE=M006R1
 NODE=M006R1

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

 Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.3	95	CORDEN	78 OMEG	12–15 $\pi^- p$
<2.0		DAHL	67 HBC	1.6–4.2 $\pi^- p$

NODE=M006R2
 NODE=M006R2

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

 Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	ARMSTRONG	91B OMEG	300 $p\bar{p} \rightarrow p\eta\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.35±0.75		KOPKE	89 MRK3	$J/\psi \rightarrow \omega\eta\pi\pi(K\bar{K}\pi)$
<0.6	90	GIDAL	87 MRK2	$e^+e^- \rightarrow e^+e^- \eta\pi^+\pi^-$
<0.5	95	CORDEN	78 OMEG	12–15 $\pi^- p$
1.5 ±0.8		DEFOIX	72 HBC	0.7 $\bar{p}p$

NODE=M006R3
 NODE=M006R3

$\Gamma(a_0(980)\pi) / \Gamma(\eta\pi\pi)$

 Γ_4/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
>0.1	90	PROKOSHKIN	97B GAM4	100 $\pi^- p \rightarrow \eta\pi^0\pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen in either mode		ANDO	86 SPEC	8 $\pi^- p$
not seen in either mode		CORDEN	78 OMEG	12–15 $\pi^- p$
0.4±0.2		DEFOIX	72 HBC	0.7 $\bar{p}p \rightarrow 7\pi$

NODE=M006R4
 NODE=M006R4

$\Gamma(4\pi) / \Gamma(K\bar{K}^*(892) + \text{c.c.})$

 Γ_6/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.90	95	DIONISI	80 HBC	4 $\pi^- p$

NODE=M006R5
 NODE=M006R5

$$\Gamma(K\bar{K}\pi)/[\Gamma(K\bar{K}^*(892)+\text{c.c.})+\Gamma(a_0(980)\pi)] \quad \Gamma_1/(\Gamma_2+\Gamma_4)$$

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.65±0.27 ¹⁴ DIONISI 80 HBC 4 $\pi^- p$

¹⁴ Calculated using $\Gamma(K\bar{K})/\Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.

NODE=M006R6
NODE=M006R6

NODE=M006R6;LINKAGE=C

$$\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}^*(892)+\text{c.c.}) \quad \Gamma_4/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.04±0.01±0.01

BARBERIS 98C OMEG 450 $p p \rightarrow p_f \bar{f}_1(1420) p_S$

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

<0.04 68 ARMSTRONG 84 OMEG 85 $\pi^+ p$

NODE=M006R7
NODE=M006R7

$$\Gamma(4\pi)/\Gamma(K\bar{K}\pi) \quad \Gamma_6/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.62 95 ARMSTRONG 89G OMEG 85 $\pi p \rightarrow 4\pi X$

NODE=M006R8
NODE=M006R8

$$\Gamma(\rho^0\gamma)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.08 95 ¹⁵ ARMSTRONG 92C SPEC 300 $p p \rightarrow p p \pi^+ \pi^- \gamma$

¹⁵ Using the data on the $\bar{K} K \pi$ mode from ARMSTRONG 89.

NODE=M006R9
NODE=M006R9

NODE=M006R9;LINKAGE=A

$$\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi) \quad \Gamma_7/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.02 95 BARBERIS 98C OMEG 450 $p p \rightarrow p_f \bar{f}_1(1420) p_S$

NODE=M006R10
NODE=M006R10

$$\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi) \quad \Gamma_8/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.003±0.001±0.001 BARBERIS 98C OMEG 450 $p p \rightarrow p_f \bar{f}_1(1420) p_S$

NODE=M006R11
NODE=M006R11

$\bar{f}_1(1420)$ REFERENCES

NODE=M006

ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>	
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
PROKOSHKIN	97B	SPD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky	
Translated from DANS 354 751.				
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
ARMSTRONG	92E	ZPHY C56 29	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JPC
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+) JPC
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
HILL	89	ZPHY C42 355	P. Hill <i>et al.</i>	(JADE Collab.) JP
KOPKE	89	PRPL 174 67	L. Kopke <i>et al.</i>	(CERN)
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.) JP
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
GIDAL	87B	PRL 59 2016	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
AIHARA	86C	PRL 57 2500	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP
BITYUKOV	84	SJNP 39 735	S. Bitjukov <i>et al.</i>	(SERP)
Translated from YAF 39 1165.				
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+) IJP
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP
Also		PRL 14 1074	D.H. Miller <i>et al.</i>	(LRL, UCB)

REFID=51698
REFID=49548
REFID=48848
REFID=49649
REFID=46937
REFID=46346
REFID=45759
REFID=45417
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REFID=20922
REFID=20924
REFID=20452
REFID=20435
REFID=20321
REFID=21291

$\omega(1420)$

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

NODE=M125

 $\omega(1420)$ MASS

NODE=M125M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M125M

(1400–1450) OUR ESTIMATE

→ NOT CHECKED ←

• • • 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

→ NOT CHECKED ←

• • • 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;→ NOT CHECKED ←
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=3;OUR EST;→ NOT CHECKED ←
 DESIG=6

 $\omega(1420) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M125230

$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma \times \Gamma_4/\Gamma$

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

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma \times \Gamma_4/\Gamma$

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

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_5/\Gamma \times \Gamma_4/\Gamma$

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

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

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

$\Gamma(\omega\pi\pi)/\Gamma(b_1(1235)\pi)$ Γ_2/Γ_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 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$

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

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	$0.44\text{--}2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
23 ± 1		22	HENNER	02 RVUE	$1.2\text{--}2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

22 Assuming that the $\omega(1420)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.
 23 Calculated by us from the cross section at the peak.
 24 Assuming that the $\omega(1420)$ decays into $\rho\pi$ only.

NODE=M125R4
 NODE=M125R4

NODE=M125R;LINKAGE=AC
 NODE=M125R;LINKAGE=AW
 NODE=M125R;LINKAGE=GS

 $\omega(1420)$ REFERENCES

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
 REFID=21586
 REFID=20553

 $f_2(1430)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

This entry lists nearby peaks observed in the D wave of the $K\bar{K}$ and $\pi^+\pi^-$ systems. Needs confirmation.

NODE=M066

NODE=M066

 $f_2(1430)$ MASS

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	$17\text{--}18 \pi^- p \rightarrow K^+ K^- n$
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
 → NOT CHECKED ←

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	$17\text{--}18 \pi^- p \rightarrow K^+ K^- n$
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

f₂(1430) DECAY MODES

NODE=M066215;NODE=M066

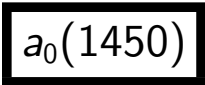
Mode	
Γ_1	$K\bar{K}$
Γ_2	$\pi\pi$

DESIG=1
DESIG=2

f₂(1430) REFERENCES

VLADIMIRSK... 01	PAN 64 1895 Translated from YAF 64 1979.	V.V. Vladimirsky <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. Wetzel <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



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

See minireview on scalar mesons under f₀(500).

NODE=M149

NODE=M149

a₀(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 $\bar{p}p, \pi N$
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 $\pi^- p \rightarrow n 2 K_S^0$
~ 1300		MARTIN 78	SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$
1255 ± 5		⁹ CASON 76		
¹ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.				
² From the pole position.				
³ May be a different state.				
⁴ Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.				
⁵ Statistical error only.				
⁶ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.				
⁷ T-matrix pole.				
⁸ Not confirmed by BUGG 08A.				
⁹ Isospin 0 not excluded.				

NODE=M149M;LINKAGE=AB
NODE=M149M;LINKAGE=PP
NODE=M149M;LINKAGE=UE
NODE=M149M;LINKAGE=BU
NODE=M149M;LINKAGE=ST
NODE=M149M;LINKAGE=BG
NODE=M149M;LINKAGE=AN
NODE=M149M;LINKAGE=BE
NODE=M149M;LINKAGE=CC

a₀(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)
Γ_1 $\pi \eta$	seen
Γ_2 $\pi \eta'(958)$	seen
Γ_3 $K \bar{K}$	seen
Γ_4 $\omega \pi \pi$	seen
Γ_5 $a_0(980) \pi \pi$	seen
Γ_6 $\gamma \gamma$	seen

NODE=M149215;NODE=M149

DESIG=1;OUR EST; $\rightarrow$ NOT CHECKED $\leftarrow$
 DESIG=2;OUR EST; $\rightarrow$ NOT CHECKED $\leftarrow$
 DESIG=3;OUR EST; $\rightarrow$ NOT CHECKED $\leftarrow$
 DESIG=4;OUR EST; $\rightarrow$ NOT CHECKED $\leftarrow$
 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 ± 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	$\gamma\gamma \rightarrow \pi^0 \eta$

²³ May be a different state.

NODE=M149R03
 NODE=M149R03

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=46331

REFID=46351
 REFID=45531
 REFID=45076
 REFID=44377
 REFID=44440
 REFID=44441
 REFID=44093
 REFID=44078
 REFID=20391
 REFID=22446
 REFID=21064

$\rho(1450)$

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

See our mini-review under the $\rho(1700)$.

NODE=M105

NODE=M105

$\rho(1450)$ MASS

NODE=M105205

VALUE (MeV)	DOCUMENT ID

1465±25 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M105M0

→ NOT CHECKED ←

$\eta\rho^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1497±14	¹ AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1421±15	² AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1470±20	ANTONELLI 88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1446±10	FUKUI 88	SPEC	$8.95 \pi^- p \rightarrow \eta\pi^+\pi^- n$

¹ Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

² Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105M;LINKAGE=SW

NODE=M105M1;LINKAGE=KL

$\omega\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

1582±17±25	2382	³ AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1349±25 ⁺¹⁰ ₋₅	341	⁴ ALEXANDER 01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
1523±10		⁵ EDWARDS 00A	CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$
1463±25		⁶ CLEGG 94	RVUE	
1250		⁷ ASTON 80C	OMEG	$20-70 \gamma p \rightarrow \omega\pi^0 p$
1290±40		⁷ BARBER 80C	SPEC	$3-5 \gamma p \rightarrow \omega\pi^0 p$

NODE=M105M3
 NODE=M105M3

³ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

⁴ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

⁵ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁶ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁷ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

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	⁸ ARMSTRONG	89E	OMEG 300 $pp \rightarrow pp2(\pi^+\pi^-)$

⁸ 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. • • •				
1446 $\pm$ 7 $\pm$ 28	5.4M	^{9,10} FUJIKAWA	08	BELL $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1328 $\pm$ 15		¹¹ SCHAEEL	05C	ALEP $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1406 $\pm$ 15	87k	^{9,12} ANDERSON	00A	CLE2 $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
$\sim$ 1368		¹³ 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		¹⁴ ABELE	97	CBAR $\bar{p}n \rightarrow \pi^- \pi^0 \pi^0$
1370 $\begin{smallmatrix} +90 \\ -70 \end{smallmatrix}$		ACHASOV	97	RVUE $e^+e^- \rightarrow \pi^+ \pi^-$
1359 $\pm$ 40		¹² 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		¹⁵ KURDADZE	83	OLYA 0.64–1.4 $e^+e^- \rightarrow \pi^+ \pi^-$

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

¹⁰ $|F_\pi(0)|^2$ fixed to 1.

¹¹ 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.

¹² $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

¹³ $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

¹⁴ T-matrix pole.

¹⁵ 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	¹⁶ ABELE	99D	CBAR $\pm$	0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
¹⁶ K-matrix pole. Isospin not determined, could be $\omega(1420)$.					

$K\bar{K}^*(892) + \text{c.c.}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1505 $\pm$ 19 $\pm$ 7	AUBERT	08S	BABR 10.6 $e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

$\rho(1450)$ WIDTH

VALUE (MeV)	DOCUMENT ID
400$\pm$60 OUR ESTIMATE	This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M105M3;LINKAGE=HK

NODE=M105M3;LINKAGE=3Z

NODE=M105M;LINKAGE=E1

NODE=M105M3;LINKAGE=B

NODE=M105M3;LINKAGE=A

NODE=M105M6

NODE=M105M6

NODE=M105M6;LINKAGE=A

NODE=M105M5

NODE=M105M5

NODE=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

NODE=M105210

NODE=M105W0

→ NOT CHECKED ←

$\eta\rho^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

226±44	17 AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
211±31	18 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	$8.95 \pi^- p \rightarrow \eta\pi^+\pi^- n$

17 Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

18 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	19 AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
547± 86 ⁺⁴⁶ ₋₄₅	341	20 ALEXANDER 01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
400± 35		21 EDWARDS 00A	CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$
311± 62		22 CLEGG 94	RVUE	
300		23 ASTON 80C	OMEG	$20-70 \gamma p \rightarrow \omega\pi^0 p$
320±100		23 BARBER 80C	SPEC	$3-5 \gamma p \rightarrow \omega\pi^0 p$

19 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.

20 Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

21 Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

22 Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

23 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. • • •

434±16±60	5.4M	24,25 FUJIKAWA 08	BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
468±41		26 SCHAEAL 05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
455±41	87k	24,27 ANDERSON 00A	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
~ 374		28 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		29 ABELE 97	CBAR	$\bar{p} n \rightarrow \pi^- \pi^0 \pi^0$
310±40		27 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		30 KURDADZE 83	OLYA	$0.64-1.4 e^+e^- \rightarrow \pi^+ \pi^-$

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

25 $|F_\pi(0)|^2$ fixed to 1.

26 From the combined fit of the τ^- data from ANDERSON 00A and SCHAEAL 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. $\rho(1700)$ mass and width fixed at 1713 MeV and 235 MeV, respectively. Supersedes BARATE 97M.

27 $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

28 $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

29 T-matrix pole.

30 Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105W5
NODE=M105W5

NODE=M105W;LINKAGE=1K

NODE=M105W5;LINKAGE=FU
NODE=M105W5;LINKAGE=SC

NODE=M105W5;LINKAGE=A

NODE=M105W5;LINKAGE=C5

NODE=M105W5;LINKAGE=QQ

NODE=M105W5;LINKAGE=KD

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

146.5±10.5	27k	31 ABELE 99D	CBAR	$\pm$	$0.0 \bar{p} p \rightarrow K^+ K^- \pi^0$

31 K-matrix pole. Isospin not determined, could be $\omega(1420)$.

NODE=M105W7
NODE=M105W7

NODE=M105W7;LINKAGE=AN

$K\bar{K}^*(892) + \text{c.c.}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$418 \pm 25 \pm 4$	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105W8
 NODE=M105W8

 $\rho(1450)$ DECAY MODES

NODE=M105215;NODE=M105

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	seen
$\Gamma_2 \quad 4\pi$	seen
$\Gamma_3 \quad \omega\pi$	
$\Gamma_4 \quad a_1(1260)\pi$	
$\Gamma_5 \quad h_1(1170)\pi$	
$\Gamma_6 \quad \pi(1300)\pi$	
$\Gamma_7 \quad \rho\rho$	
$\Gamma_8 \quad \rho(\pi\pi)S\text{-wave}$	
$\Gamma_9 \quad e^+e^-$	seen
$\Gamma_{10} \quad \eta\rho$	possibly seen
$\Gamma_{11} \quad a_2(1320)\pi$	not seen
$\Gamma_{12} \quad K\bar{K}$	not seen
$\Gamma_{13} \quad K\bar{K}^*(892) + \text{c.c.}$	possibly seen
$\Gamma_{14} \quad \eta\gamma$	possibly seen
$\Gamma_{15} \quad f_0(500)\gamma$	not seen
$\Gamma_{16} \quad f_0(980)\gamma$	not seen
$\Gamma_{17} \quad f_0(1370)\gamma$	not seen
$\Gamma_{18} \quad f_2(1270)\gamma$	not seen

DESIG=1;OUR EST;→ NOT CHECKED ←
 DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=6
 DESIG=10
 DESIG=11
 DESIG=12
 DESIG=13
 DESIG=14
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=3;OUR EVAL;→ NOT CHECKED ←
 DESIG=8;OUR EST;→ NOT CHECKED ←
 DESIG=7;OUR EVAL;→ NOT CHECKED ←
 DESIG=15;OUR EST;→ NOT CHECKED ←
 DESIG=9;OUR EST;→ NOT CHECKED ←
 DESIG=16;OUR EST;→ NOT CHECKED ←
 DESIG=17;OUR EST;→ NOT CHECKED ←
 DESIG=18;OUR EST;→ NOT CHECKED ←
 DESIG=19;OUR EST;→ NOT CHECKED ←

 $\rho(1450) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M105220

$\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_9/\Gamma$
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.12	³² DIEKMANN	88	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
$0.027^{+0.015}_{-0.010}$	³³ KURDADZE	83	OLYA	$0.64\text{--}1.4 e^+e^- \rightarrow \pi^+\pi^-$

NODE=M105G3
 NODE=M105G3

$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_9/\Gamma$		
VALUE (eV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
74 ± 20	³⁴ AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
91 ± 19	ANTONELLI 88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$

NODE=M105G4
 NODE=M105G4

$\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{14}\Gamma_9/\Gamma$		
VALUE (eV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
<16.4	³⁵ AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \rightarrow \eta\gamma$
2.2±0.5±0.3	³⁶ AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

NODE=M105G6
 NODE=M105G6

$\Gamma(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_{13}\Gamma_9/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$127 \pm 15 \pm 6$	AUBERT	08S BABR	$10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$	
³² Using total width = 235 MeV.				
³³ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.				
³⁴ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.				
³⁵ From 2γ decay mode of η using 1465 MeV and 310 MeV for the $\rho(1450)$ mass and width. Recalculated by us.				
³⁶ Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$. Recalculated by us using width of 226 MeV.				

NODE=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

$\Gamma(f_0(500)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{15}/\Gamma \times \Gamma_9/\Gamma$
VALUE (units 10^{-9})	CL%	DOCUMENT ID		TECN	COMMENT
<4.0	90	ACHASOV	11	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R01
NODE=M105R01

$\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{16}/\Gamma \times \Gamma_9/\Gamma$
VALUE (units 10^{-9})	CL%	DOCUMENT ID		TECN	COMMENT
<2.6	90	ACHASOV	11	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R02
NODE=M105R02

$\Gamma(f_0(1370)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{17}/\Gamma \times \Gamma_9/\Gamma$
VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT	
<3.5	90	ACHASOV	11	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M105R03
NODE=M105R03

$\Gamma(f_2(1270)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{18}/\Gamma \times \Gamma_9/\Gamma$
VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.8	90	³⁷ ACHASOV	11	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$	

NODE=M105R04
NODE=M105R04

³⁷ Using Breit-Wigner parametrization of the $\rho(1450)$ with mass and width of 1465 MeV and 400 MeV, respectively.

NODE=M105R01;LINKAGE=AC

 $\rho(1450)$ BRANCHING RATIOS

NODE=M105225

$\Gamma(\pi\pi)/\Gamma(4\pi)$					Γ_1/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.37 ± 0.10	^{38,39} ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$	

NODE=M105R15
NODE=M105R15

$\Gamma(\omega\pi)/\Gamma_{\text{total}}$				Γ_3/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 0.21	CLEGG	94	RVUE	

NODE=M105R5
NODE=M105R5

$\Gamma(\pi\pi)/\Gamma(\omega\pi)$	Γ_1/Γ_3		
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 0.32	CLEGG	94	RVUE

NODE=M105R6
NODE=M105R6

$\Gamma(\omega\pi)/\Gamma(4\pi)$	Γ_3/Γ_2		
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.14	CLEGG	88	RVUE

NODE=M105R3
NODE=M105R3

$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$					Γ_4/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.27 ± 0.08	³⁸ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$	

NODE=M105R10
NODE=M105R10

$\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$				Γ_5/Γ_2
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.08 ± 0.04	³⁸ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R11
NODE=M105R11

$\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$				Γ_6/Γ_2
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.37 ± 0.13	³⁸ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

NODE=M105R12
NODE=M105R12

$\Gamma(\rho\rho)/\Gamma(4\pi)$				Γ_7/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.11 ± 0.05	³⁸ ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

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	38 ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

 Γ_8/Γ_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

 Γ_{10}/Γ

NODE=M105R2
NODE=M105R2

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

~ 0.24	40 DONNACHIE	91	RVUE
>2	FUKUI	91	SPEC 8.95 $\pi^- p \rightarrow \omega\pi^0 n$

 Γ_{10}/Γ_3

NODE=M105R4
NODE=M105R4

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

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

not seen	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

 Γ_{11}/Γ

NODE=M105R9
NODE=M105R9

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

<0.08	40 DONNACHIE	91	RVUE

 Γ_{12}/Γ_3

NODE=M105R8
NODE=M105R8

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

possibly seen	COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

 Γ_{13}/Γ

NODE=M105R16
NODE=M105R16

38 $\omega\pi$ not included.

39 Using ABELE 97.

40 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

ACHASOV	11	JETP 113 75	M.N. Achasov <i>et al.</i>	(SND Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)
SCHAEF	05C	PRPL 421 191	S. Schaefer <i>et al.</i>	(ALEPH Collab.)
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALEXANDER	01B	PR D64 092001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANDERSON	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ABELE	99C	PL B450 275	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)
BARATE	97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)
DUBNICKA	89	JPG 15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)
CLEGG	88	ZPHY C40 313	A.B. Clegg, A. Donnachie	(MCHS, LANC)
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)
ASTON	80C	PL 92B 211	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
BARBER	80C	ZPHY C4 169	D.P. Barber <i>et al.</i>	(DARE, LANC, SHEF)
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

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REFID=20652

REFID=20653

REFID=48054

$\eta(1475)$

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

See also the $\eta(1405)$.

NODE=M175

NODE=M175

NODE=M175205

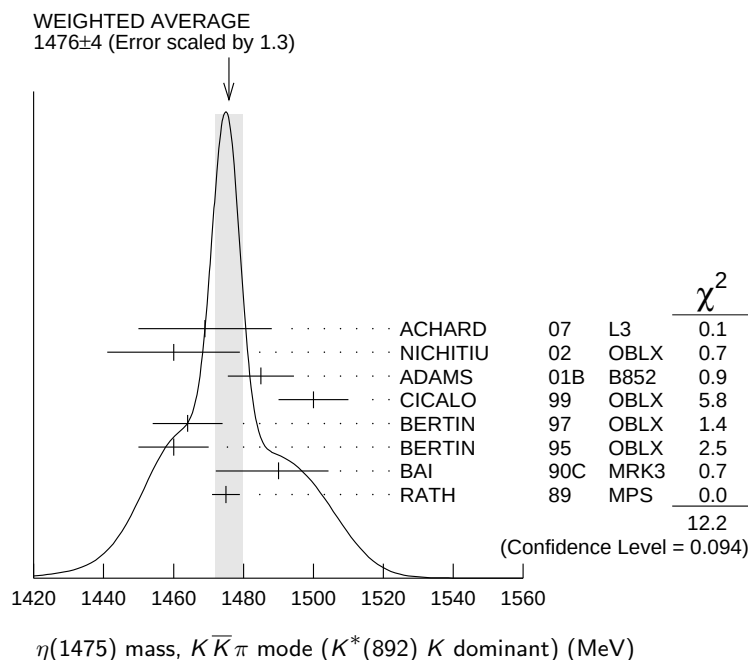
NODE=M175M5
NODE=M175M5 **$\eta(1475)$ MASS** **$K\bar{K}\pi$ MODE ($K^*(892)$ K dominant)**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1476 ± 4 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
$1469 \pm 14 \pm 13$	74	ACHARD	07 L3	$183-209 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
1460 ± 19	3651	NICHITIU	02 OBLX	
$1485 \pm 8 \pm 5$	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1500 ± 10		CICALO	99 OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
1464 ± 10		BERTIN	97 OBLX	$0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1460 ± 10		BERTIN	95 OBLX	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
1490^{+14+3}_{-8-16}	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

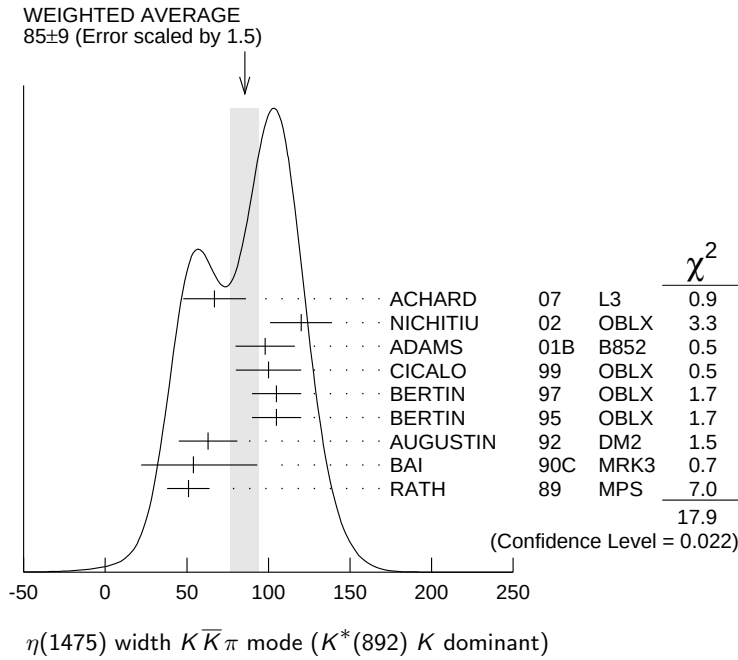
 $K\bar{K}\pi$ MODE ($K^*(892)$ K dominant)NODE=M175W5
NODE=M175W5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
85 ± 9 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
$67 \pm 18 \pm 7$	74	ACHARD	07 L3	$183-209 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
120 ± 19	3651	NICHITIU	02 OBLX	
$98 \pm 18 \pm 3$	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
100 ± 20		CICALO	99 OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
105 ± 15		BERTIN	97 OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
105 ± 15		BERTIN	95 OBLX	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
63 ± 18		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
54^{+37+13}_{-21-24}		BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
51 ± 13		RATH	89 MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=2

OCCUR=2



η(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;→ NOT CHECKED ←
DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=4;OUR EST;→ NOT CHECKED ←
DESIG=7;OUR EST;→ NOT CHECKED ←

η(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 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
< 0.089	90 ^{2,3} AHOHE 05 CLE2 10.6 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$

NODE=M175220

NODE=M175G2
NODE=M175G2

¹Supersedes ACCIARRI 01G. Compatible with $K^* K$ decay. Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6895$.

²Using $\eta(1475)$ mass of 1481 MeV and width of 48 MeV. The upper limit increases to 0.140 keV if the world average value, 87 MeV, of the width is used.

³Assuming three-body phase-space decay to $K_S^0 K^\pm \pi^\mp$.

NODE=M175G2;LINKAGE=CH

NODE=M175G2;LINKAGE=AH

NODE=M175G2;LINKAGE=B3

η(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	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.50±0.10	⁴ BAILLON 67 HBC 0.0 $\bar{p} p \rightarrow K \bar{K} \pi \pi \pi$

NODE=M175225

NODE=M175R1
NODE=M175R1

$\Gamma(K \bar{K}^*(892) + \text{c.c.})/[\Gamma(K \bar{K}^*(892) + \text{c.c.}) + \Gamma(a_0(980) \pi)]$	$\Gamma_2/(\Gamma_2 + \Gamma_3)$
VALUE CL% DOCUMENT ID TECN COMMENT	

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

<0.25 90 EDWARDS 82E CBAL $J/\psi \rightarrow K^+ K^- \pi^0 \gamma$

⁴Data could also refer to $\eta(1405)$.

NODE=M175R6
NODE=M175R6

NODE=M175R;LINKAGE=BL

$\eta(1475)$ REFERENCES

ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)

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 $f_0(1500)$

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

See also the mini-reviews on scalar mesons under $f_0(500)$ (see the index for the page number) and on non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

NODE=M152

NODE=M152

 $f_0(1500)$ MASS

NODE=M152M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1505 ± 6 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
1466 ± 6 ± 20		ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1515 ± 12		1 BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta p_s$
1511 ± 9		1,2 BARBERIS	00C	450 $pp \rightarrow p_f4\pi p_s$
1510 ± 8		1 BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
1522 ± 25		BERTIN	98 OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
1449 ± 20		1 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1515 ± 20		ABELE	96B CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
1500 ± 15		3 AMSLER	95B CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
1505 ± 15		4 AMSLER	95C CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1486 ± 10		1 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
1470 ± 60	568	5 KLEMP	08 E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$
1470 $^{+6}_{-7} \pm 25$		6 UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
1495 ± 4		AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1539 ± 20	9.9k	AUBERT	06O BABR	$B^+ \rightarrow K^+K^+K^-$
1473 ± 5	80k	7,8 UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
1478 ± 6		VLADIMIRSK...	06 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$
1493 ± 7		7 BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
1524 ± 14	1400	9 GARMASH	05 BELL	$B^+ \rightarrow K^+K^+K^-$
1489 $^{+8}_{-4}$		10 ANISOVICH	03 RVUE	
1490 ± 30		7 ABELE	01 CBAR	0.0 $\bar{p}d \rightarrow \pi^-\pi^+\pi^0 p$
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.

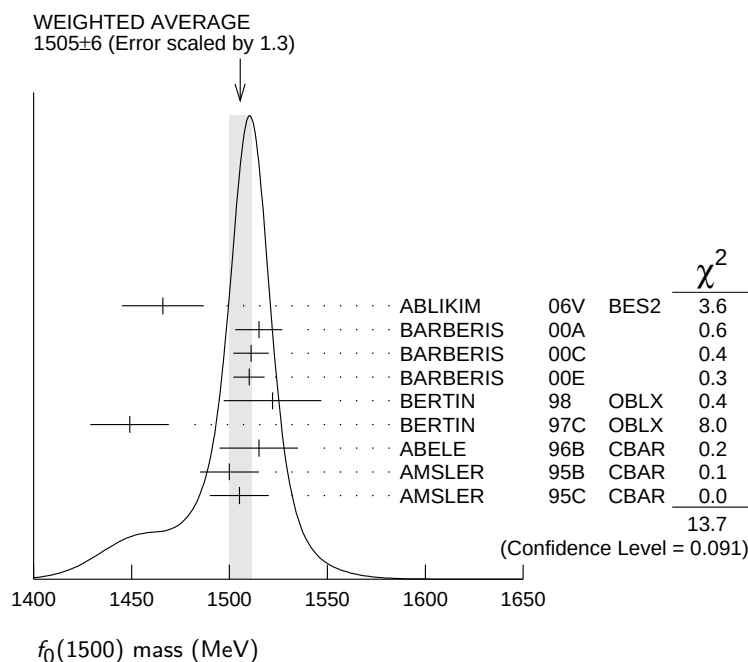
¹⁰ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0\pi^0 n$, $\pi^- p \rightarrow K\bar{K}n$, $\pi^+\pi^- \rightarrow \pi^+\pi^-$, $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta$, $\pi^0\pi^0\eta$, $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^-\pi^-\pi^+$, $K_S^0 K^-\pi^0$, $K_S^0 K_S^0 \pi^-$ 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=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 $\bar{p}p \rightarrow \pi^+\pi^+\pi^-$
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
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 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
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 NODE=M152W;LINKAGE=B
 NODE=M152W;LINKAGE=A
 NODE=M152W;LINKAGE=C1
 NODE=M152W;LINKAGE=AZ

$f_0(1500)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1	$\pi\pi$	$(34.9 \pm 2.3) \%$	1.2
Γ_2	$\pi^+\pi^-$	seen	
Γ_3	$2\pi^0$	seen	
Γ_4	4π	$(49.5 \pm 3.3) \%$	1.2
Γ_5	$4\pi^0$	seen	
Γ_6	$2\pi^+2\pi^-$	seen	
Γ_7	$2(\pi\pi)_{S\text{-wave}}$	seen	
Γ_8	$\rho\rho$	seen	
Γ_9	$\pi(1300)\pi$	seen	
Γ_{10}	$a_1(1260)\pi$	seen	
Γ_{11}	$\eta\eta$	$(5.1 \pm 0.9) \%$	1.4
Γ_{12}	$\eta\eta'(958)$	$(1.9 \pm 0.8) \%$	1.7
Γ_{13}	$K\bar{K}$	$(8.6 \pm 1.0) \%$	1.1
Γ_{14}	$\gamma\gamma$	not seen	

NODE=M152215;NODE=M152

DESIG=8
 DESIG=9
 DESIG=3;OUR EST;→ NOT CHECKED ←
 DESIG=7
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=6;OUR EST;→ NOT CHECKED ←
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 DESIG=12;OUR EST;→ NOT CHECKED ←
 DESIG=13;OUR EST;→ NOT CHECKED ←
 DESIG=14;OUR EST;→ NOT CHECKED ←
 DESIG=1
 DESIG=2
 DESIG=4
 DESIG=10;OUR EST;→ NOT CHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 10 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 11.4$ for 6 degrees of freedom.

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

x_4	−83			
x_{11}	11	−52		
x_{12}	−5	−31	29	
x_{13}	39	−67	33	6
	x_1	x_4	x_{11}	x_{12}

$f_0(1500) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_{14}/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$33^{+12}_{-6} + 1809_{21}$		34 UEHARA	08A BELL	$10.6 e^+e^- \rightarrow e^+e^-\pi^0\pi^0$	
not seen		ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$	
<460	95	BARATE	00E ALEP	$\gamma\gamma \rightarrow \pi^+\pi^-$	
34 May also be the $f_0(1370)$. Multiplied by us by 3 to obtain the $\pi\pi$ value.					

NODE=M152217

NODE=M152G1
 NODE=M152G1

NODE=M152G1;LINKAGE=UE

$f_0(1500)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE		DOCUMENT ID	TECN	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.454 ± 0.104		BUGG	96 RVUE	

NODE=M152220

NODE=M152R8
 NODE=M152R8

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BERTIN	98	OBLX 0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

NODE=M152R10
 NODE=M152R10

 $\Gamma(4\pi)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
1.42±0.18 OUR FIT			Error includes scale factor of 1.2.
1.42±0.18 OUR AVERAGE			Error includes scale factor of 1.2.
1.37±0.16	BARBERIS	00D	450 $pp \rightarrow p_f 4\pi p_s$
2.1 ±0.6	35 AMSLER	98	RVUE
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.1 ±0.2	36 ANISOVICH	02D	SPEC Combined fit
3.4 ±0.8	35 ABELE	96	CBAR 0.0 $\bar{p}p \rightarrow 5\pi^0$

NODE=M152R6
 NODE=M152R6

 $\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(\pi\pi)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.42±0.26	37 ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$

NODE=M152R14
 NODE=M152R14

 $\Gamma(2(\pi\pi)_{\text{S-wave}})/\Gamma(4\pi)$ Γ_7/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.26±0.07	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R15
 NODE=M152R15

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_8/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13±0.08	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R16
 NODE=M152R16

 $\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{\text{S-wave}})$ Γ_8/Γ_7

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
3.3±0.5	BARBERIS	00C 450 $pp \rightarrow p_f \pi^+ \pi^- 2\pi^0 p_s$
2.6±0.4	BARBERIS	00C 450 $pp \rightarrow p_f 2(\pi^+ \pi^-) p_s$

NODE=M152R11
 NODE=M152R11

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_9/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.50±0.25	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R17
 NODE=M152R17

 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_{10}/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.12±0.05	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

NODE=M152R18
 NODE=M152R18

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
large	ALDE	88	GAM4 300 $\pi^- N \rightarrow \eta\eta\pi^- N$
large	BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

NODE=M152R1
 NODE=M152R1

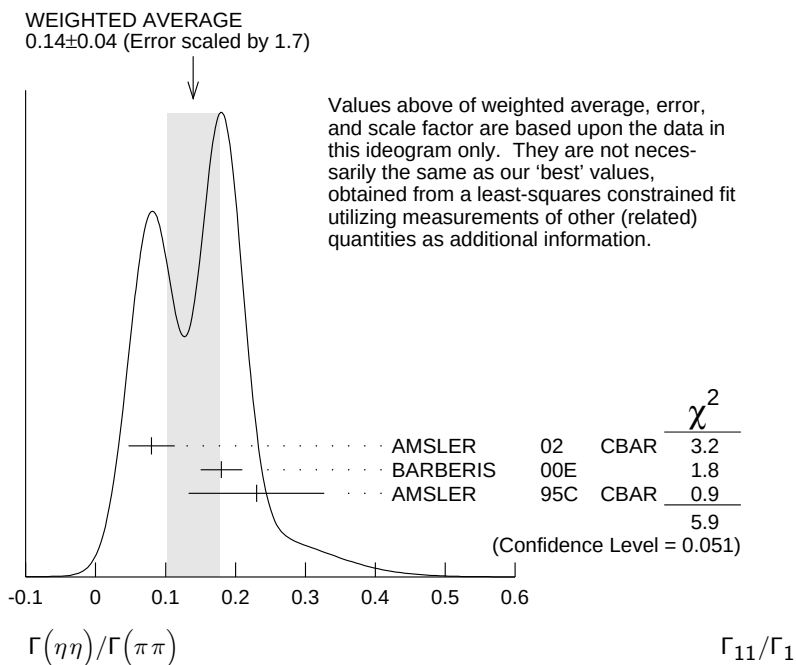
 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.145±0.027 OUR FIT			Error includes scale factor of 1.5.
0.14 ±0.04 OUR AVERAGE			Error includes scale factor of 1.7. See the ideogram below.
0.080±0.033	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta\eta, \pi^0 \pi^0 \pi^0$
0.18 ±0.03	BARBERIS	00E	450 $pp \rightarrow p_f \eta\eta p_s$
0.230±0.097	38 AMSLER	95C	CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$

NODE=M152R13
 NODE=M152R13

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

0.11 ±0.03	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.078±0.013	³⁹ ABELE	96C	RVUE	Compilation
0.157±0.060	⁴⁰ AMSLER	95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$



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

Γ_5/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R5
NODE=M152R5

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

0.8±0.3	ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$

$\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$

Γ_{12}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R12
NODE=M152R12

0.055±0.024 OUR FIT Error includes scale factor of 1.8.

0.095±0.026	BARBERIS	00A	450 $p\bar{p} \rightarrow p_f \eta \eta p_s$

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

0.005±0.003	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	COMMENT

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 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
0.16 ±0.05	³⁶ ANISOVICH	02D	SPEC	Combined fit
0.33 ±0.03 ±0.07	BARBERIS	99D	OMEG	450 $p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$
0.20 ±0.08	⁴⁴ ABELE	96B	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$

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

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

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 NODE=M152R7;LINKAGE=D
 NODE=M152R4;LINKAGE=BZ
 NODE=M152R4;LINKAGE=A

 $f_0(1500)$ REFERENCES

ANISOVICH 09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
KLEMP 08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)
UEHARA 08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM 06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)
AMSLER 06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
AUBERT 06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG 06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
Translated from YAF 69 515			
BINON 05	PAN 68 960	F. Binon <i>et al.</i>	
Translated from YAF 68 998			
GARMASH 05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)
ANISOVICH 03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
BARGIOTTI 03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
AMSLER 02	EPJ C23 29	C. Amsler <i>et al.</i>	
ANISOVICH 02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	
Translated from YAF 65 1583			
ABELE 01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI 01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
AITALA 01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BARATE 00E	PL B472 189	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS 00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00D	PL B474 423	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS 99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS 99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)
BELLAZZINI 99	PL B467 296	R. Bellazzini <i>et al.</i>	
FRENCH 99	PL B460 213	B. French <i>et al.</i>	(WA76 Collab.)
KAMINSKI 99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)
ABELE 98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ALDE 98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also	PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
Translated from YAF 62 446			
AMSLER 98	RMP 70 1293	C. Amsler	
ANISOVICH 98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
Translated from UFN 168 481			
BERTIN 98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
REYES 98	PRL 81 4079	M.A. Reyes <i>et al.</i>	
BARBERIS 97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN 97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
FRABETTI 97D	PL B407 79	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ABELE 96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 96B	PL B385 425	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE 96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMELIN 96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
Translated from YAF 59 1021			
BUGG 96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou	(LOQM, PNPI)
AMSLER 95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANTINORI 95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)
BUGG 95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
ABATZIS 94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)
AMSLER 94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER 94E	PL B340 259	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH 94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)
BUGG 94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER 92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE 92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitukov, G.V. Borisov	(SERP+)
Translated from YAF 55 2748			
PROKOSHKIN 91	SPD 36 155	V.D. Prokoshkin	(GAM2, GAM4 Collab.)
Translated from DANS 316 900			
ARMSTRONG 89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ALDE 88	PL B201 160	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ASTON 88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ALDE 87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE 86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
BINON 84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
BINON 83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Also	SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Translated from YAF 38 934			
GRAY 83	PR D27 307	L. Gray <i>et al.</i>	(SYRA)
ETKIN 82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
COHEN 80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL)

NODE=M152

REFID=52719
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 REFID=51136
 REFID=51141
 REFID=51004
 REFID=51063
 REFID=51191

REFID=50780

REFID=50641
 REFID=49401
 REFID=49217
 REFID=48580
 REFID=48831

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 REFID=48321
 REFID=48004
 REFID=47428
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 REFID=43169
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 REFID=20765
 REFID=21418
 REFID=20750
 REFID=20751

REFID=21370
 REFID=20390
 REFID=20381

NODE=M084

$f_1(1510)$

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

OMITTED FROM SUMMARY TABLE
See the minireview under $\eta(1405)$.

NODE=M084

NODE=M084M

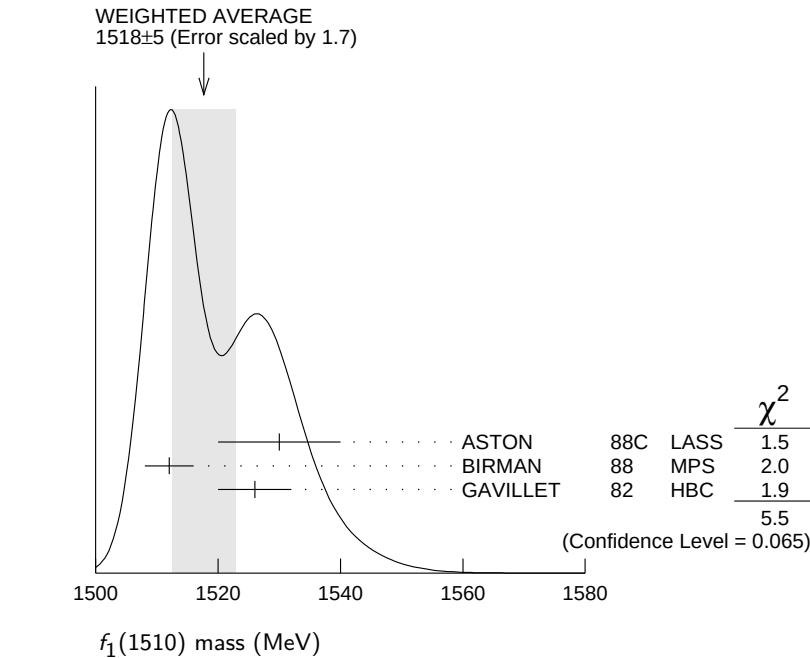
NODE=M084M

$f_1(1510)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1518± 5 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
1530±10		ASTON	88C LASS	11 $K^-p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$
1512± 4	600	¹ BIRMAN	88 MPS	8 $\pi^-p \rightarrow K^+ \bar{K}^0 \pi^- n$
1526± 6	271	GAVILLET	82 HBC	4.2 $K^-p \rightarrow \Lambda K K \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1525		² BAUER	93B	$\gamma \gamma^* \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
¹ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ state.				
² Not seen by AIHARA 88C in the $K_S^0 K^\pm \pi^\mp$ final state.				

NODE=M084M;LINKAGE=A

NODE=M084M;LINKAGE=C



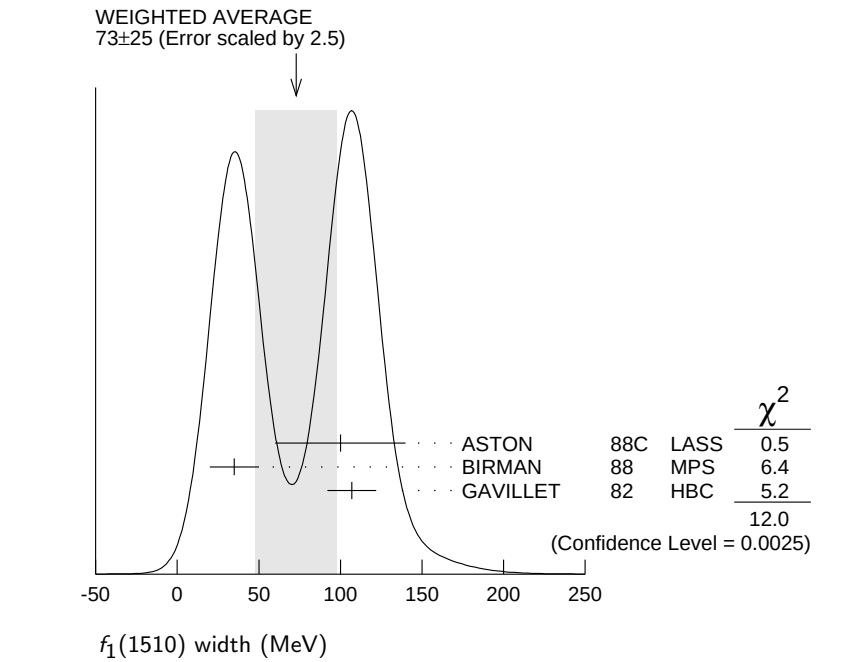
$f_1(1510)$ WIDTH

NODE=M084W

NODE=M084W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
73±25 OUR AVERAGE		Error includes scale factor of 2.5. See the ideogram below.		
100±40		ASTON	88C LASS	11 $K^-p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$
35±15	600	³ BIRMAN	88 MPS	8 $\pi^-p \rightarrow K^+ \bar{K}^0 \pi^- n$
107±15	271	GAVILLET	82 HBC	4.2 $K^-p \rightarrow \Lambda K K \pi$
³ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ state.				

NODE=M084W;LINKAGE=A



$f_1(1510)$ DECAY MODES

NODE=M084215;NODE=M084

Mode		Fraction (Γ_i/Γ)
Γ_1	$K \bar{K}^*(892) + \text{c.c.}$	seen
Γ_2	$\pi^+ \pi^- \eta'$	seen

DESIG=1;OUR EST;→ NOT CHECKED ←
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

→ NOT CHECKED ←

PRODUCED BY PION BEAM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

1521±13		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1547 $^{+10}_{-2}$		¹ LONGACRE 86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1496 $^{+9}_{-8}$		² CHABAUD 81	ASPK	6 $\pi^- p \rightarrow K^+ K^- n$
1497 $^{+8}_{-9}$		CHABAUD 81	ASPK	18.4 $\pi^- p \rightarrow K^+ K^- n$
1492±29		GORLICH 80	ASPK	17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$
1502±25		³ CORDEN 79	OMEG	12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$
1480	14	CRENNELL 66	HBC	6.0 $\pi^- p \rightarrow K_S^0 K_S^0 n$

NODE=M013M1
NODE=M013M1

OCCUR=2

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

1523.4± 1.3 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 1.1.NODE=M013M2
NODE=M013M2

1526.8± 4.3		ASTON 88D	LASS	11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1504 ±12		BOLONKIN 86	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 Y$
1529 ± 3		ARMSTRONG 83B	OMEG	18.5 $K^- p \rightarrow K^- K^+ \Lambda$
1521 ± 6	650	AGUILAR-... 81B	HBC	4.2 $K^- p \rightarrow \Lambda K^+ K^-$
1521 ± 3	572	ALHARRAN 81	HBC	8.25 $K^- p \rightarrow \Lambda K \bar{K}$
1522 ± 6	123	BARREIRO 77	HBC	4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$
1528 ± 7	166	EVANGELIS... 77	OMEG	10 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1527 ± 3	120	BRANDENB... 76C	ASPK	13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1519 ± 7	100	AGUILAR-... 72B	HBC	3.9,4.6 $K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$

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

1514 ± 8	61	BINON 07	GAMS	32.5 $K^- p \rightarrow \eta \eta (\Lambda/\Sigma^0)$
1513 ±10		⁴ BARKOV 99	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 y$

PRODUCED IN e^+e^- ANNIHILATION

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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

NODE=M013M3
NODE=M013M3**1520.7± 2.0 OUR AVERAGE**

1521 ± 5		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
1518 ± 1 ± 3		ABE 04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1519 ± 2 $^{+15}_{-5}$		BAI 03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$
1523 ± 6	331	⁵ ACCIARRI 01H	L3	91, 183-209 $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$
1535 ± 5 ± 4		ABREU 96C	DLPH	$Z^0 \rightarrow K^+ K^- + X$
1516 ± 5 $^{+9}_{-15}$		BAI 96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$
1531.6±10.0		AUGUSTIN 88	DM2	$J/\psi \rightarrow \gamma K^+ K^-$
1515 ± 5		⁶ FALVARD 88	DM2	$J/\psi \rightarrow \phi K^+ K^-$
1525 ±10 ±10		BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

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

1523 ± 5	870	⁷ SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$
1496 ± 2		⁸ FALVARD 88	DM2	$J/\psi \rightarrow \phi K^+ K^-$

OCCUR=2

PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

1530±12		⁹ ANISOVICH 09	RVUE	0.0 $\bar{p}p, \pi N$
1513± 4		AMSLER 06	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
1508± 9		¹⁰ AMSLER 02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$

NODE=M013M9
NODE=M013M9

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1515±15	BARBERIS	99	OMEG 450 $pp \rightarrow p_s p_f K^+ K^-$

NODE=M013M4
NODE=M013M4

PRODUCED IN ep COLLISIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1512±3^{+1.4}_{-0.5}	11	CHEKANOV	08	ZEUS $ep \rightarrow K_S^0 K_S^0 X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1537 ⁺⁹ ₋₈	84	12 CHEKANOV	04	ZEUS $ep \rightarrow K_S^0 K_S^0 X$

NODE=M013M10
NODE=M013M10

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±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
80.2± 2.6 OUR AVERAGE	Includes data from the datablock that follows this one.			
90 ±12		ASTON	88D	LASS 11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
73 ±18		BOLONKIN	86	SPEC 40 $K^- p \rightarrow K_S^0 K_S^0 \gamma$
83 ±15		ARMSTRONG	83B	OMEG 18.5 $K^- p \rightarrow K^- K^+ \Lambda$
85 ±16	650	AGUILAR-...	81B	HBC 4.2 $K^- p \rightarrow \Lambda K^+ K^-$
80 ⁺¹⁴ ₋₁₁	572	ALHARRAN	81	HBC 8.25 $K^- p \rightarrow \Lambda K \bar{K}$
72 ±25	166	EVANGELIS...	77	OMEG 10 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
69 ±22	100	AGUILAR-...	72B	HBC 3.9,4.6 $K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
92 ⁺²⁵ ₋₁₆	61	BINON	07	GAMS 32.5 $K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$
75 ±20		¹⁷ BARKOV	99	SPEC 40 $K^- p \rightarrow K_S^0 K_S^0 \gamma$
62 ⁺¹⁹ ₋₁₄	123	BARREIRO	77	HBC 4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$
61 ± 8	120	BRANDENB...	76C	ASPK 13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$

NODE=M013W2
NODE=M013W2

PRODUCED IN e^+e^- ANNIHILATION

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

79.9$\pm$ 3.3 OUR AVERAGE Error includes scale factor of 1.1.				
77 $\pm$ 15		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi K^+ K^-$
82 $\pm$ 2 $\pm$ 3		ABE	04 BELL	10.6 $e^+e^- \rightarrow e^+e^- K^+ K^-$
75 $\pm$ 4 $\pm$ 15 -5		BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
100 $\pm$ 15	331	18 ACCIARRI	01H L3	91, 183–209 $e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
60 $\pm$ 20 $\pm$ 19		ABREU	96C DLPH	$Z^0 \rightarrow K^+ K^- + X$
60 $\pm$ 23 $\pm$ 13 -20		BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
103 $\pm$ 30		AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
62 $\pm$ 10	19	FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-$
85 $\pm$ 35		BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
104 $\pm$ 10	870	20 SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
100 $\pm$ 3	21	FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-$

NODE=M013W3
NODE=M013W3

OCCUR=2

PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

79$\pm$ 8	22 AMSLER	02 CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
128 $\pm$ 20	23 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
76 $\pm$ 6	AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$

NODE=M013W9
NODE=M013W9

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

70$\pm$ 25	BARBERIS	99 OMEG	450 $pp \rightarrow p_s p_f K^+ K^-$

NODE=M013W4
NODE=M013W4

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

83$\pm$ 9$\pm$ 5 -4	24	CHEKANOV	08 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
50 $\pm$ 34 -22	84	25 CHEKANOV	04 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$

NODE=M013W10
NODE=M013W10

- 13 From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
14 CHABAUD 81 is a reanalysis of PAWLICKI 77 data.
15 From an amplitude analysis where the $f_2'(1525)$ width and elasticity are in complete disagreement with the values obtained from $K \bar{K}$ channel, making the solution dubious.
16 From a fit to the D with $f_2(1270)$ - $f_2'(1525)$ interference. Mass fixed at 1516 MeV.
17 Systematic errors not estimated.
18 Supersedes ACCIARRI 95J.
19 From an analysis ignoring interference with $f_0(1710)$.
20 From analysis of L3 data at 91 and 183–209 GeV.
21 From an analysis including interference with $f_0(1710)$.
22 T-matrix pole.
23 4-poles, 5-channel K matrix fit.
24 In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.
25 Systematic errors not estimated.

NODE=M013W;LINKAGE=L
NODE=M013W;LINKAGE=D
NODE=M013W;LINKAGE=N

NODE=M013W;LINKAGE=M
NODE=M013W2;LINKAGE=SK
NODE=M013W;LINKAGE=HA
NODE=M013W;LINKAGE=F1
NODE=M013W3;LINKAGE=SC
NODE=M013W;LINKAGE=F2
NODE=M013W;LINKAGE=TT
NODE=M013W9;LINKAGE=AN
NODE=M013W10;LINKAGE=HE

NODE=M013W10;LINKAGE=CH

 $f_2'(1525)$ DECAY MODES

NODE=M013215;NODE=M013

Mode	Fraction (Γ_i/Γ)

Γ_1 $K \bar{K}$	(88.7 $\pm$ 2.2) %
Γ_2 $\eta \eta$	(10.4 $\pm$ 2.2) %
Γ_3 $\pi \pi$	(8.2 $\pm$ 1.5) $\times 10^{-3}$
Γ_4 $K \bar{K}^*(892) + \text{c.c.}$	
Γ_5 $\pi K \bar{K}$	
Γ_6 $\pi \pi \eta$	
Γ_7 $\pi^+ \pi^+ \pi^- \pi^-$	
Γ_8 $\gamma \gamma$	(1.11 $\pm$ 0.14) $\times 10^{-6}$

DESIG=2
DESIG=4
DESIG=1
DESIG=3
DESIG=6
DESIG=5
DESIG=7
DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 2 partial widths, a combination of partial widths obtained from integrated cross sections, and 3 branching ratios uses 16 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 14.0$ for 12 degrees of freedom.

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

x_2	-100			
x_3	-6	-1		
x_8	-6	6	1	
Γ	-23	23	-1	-55
	x_1	x_2	x_3	x_8

Mode	Rate (MeV)
$\Gamma_1 \quad K\bar{K}$	65 $^{+5}_{-4}$
$\Gamma_2 \quad \eta\eta$	7.6 ± 1.8
$\Gamma_3 \quad \pi\pi$	0.60 ± 0.12
$\Gamma_8 \quad \gamma\gamma$	(8.1 ± 0.9) $\times 10^{-5}$

DESIG=2

DESIG=4

DESIG=1

DESIG=8

$f'_2(1525)$ PARTIAL WIDTHS

NODE=M013220

$\Gamma(K\bar{K})$	Γ_1
VALUE (MeV)	DOCUMENT ID

NODE=M013W6
NODE=M013W6 **65^{+5}_{-4} OUR FIT**

63^{+6}_{-5} ²⁶ LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

$\Gamma(\eta\eta)$	Γ_2
VALUE (MeV)	EVTS

NODE=M013W7
NODE=M013W7 **7.6 ± 1.8 OUR FIT**

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

5.0 ± 0.8 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$
 24 $^{+3}_{-1}$ ²⁶ LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

$\Gamma(\pi\pi)$	Γ_3
VALUE (MeV)	EVTS

NODE=M013W5
NODE=M013W5 **0.60 ± 0.12 OUR FIT**

$1.4^{+1.0}_{-0.5}$ ²⁶ LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

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

0.2 $^{+1.0}_{-0.2}$ 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\gamma\gamma)$	Γ_8
VALUE (keV)	EVTS

NODE=M013W8
NODE=M013W8 **0.081 ± 0.009 OUR FIT**

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

0.13 ± 0.03 870 ²⁷ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

²⁶ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

²⁷ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f'_2(1525) \rightarrow K\bar{K}) = 68$ MeV and SU(3) relations.

NODE=M013PW;LINKAGE=L

NODE=M013W8;LINKAGE=SC

$f'_2(1525) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M013223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_8/\Gamma$ NODE=M013G1
NODE=M013G1

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.072 ± 0.007 OUR FIT**0.072 ± 0.007 OUR AVERAGE**

0.0564 ± 0.0048 ± 0.0116		ABE	04	BELL	10.6 $e^+e^- \rightarrow e^+e^- K^+K^-$
0.076 ± 0.006 ± 0.011	331	28 ACCIARRI	01H	L3	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.067 ± 0.008 ± 0.015		29 ALBRECHT	90G	ARG	$e^+e^- \rightarrow e^+e^- K^+K^-$
0.11 $^{+0.03}_{-0.02}$ ± 0.02		BEHREND	89c	CELL	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.10 $^{+0.04}_{-0.03}$ ± 0.03		BERGER	88	PLUT	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.12 ± 0.07 ± 0.04		29 AIHARA	86B	TPC	$e^+e^- \rightarrow e^+e^- K^+K^-$
0.11 ± 0.02 ± 0.04		29 ALTHOFF	83	TASS	$e^+e^- \rightarrow e^+e^- K\bar{K}$

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

0.0314 ± 0.0050 ± 0.0077 ³⁰ ALBRECHT 90G ARG $e^+e^- \rightarrow e^+e^- K^+K^-$ ²⁸ Supersedes ACCIARRI 95J. From analysis of L3 data at 91 and 183–209 GeV,²⁹ Using an incoherent background.³⁰ Using a coherent background.

OCCUR=2

NODE=M013G;LINKAGE=HA

NODE=M013G1;LINKAGE=A

NODE=M013G1;LINKAGE=B

 $f'_2(1525) \text{ BRANCHING RATIOS}$

NODE=M013225

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ NODE=M013R8
NODE=M013R8

VALUE	DOCUMENT ID	TECN	COMMENT

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

seen UEHARA 10A BELL 10.6 $e^+e^- \rightarrow e^+e^- \eta\eta$ 0.10 ± 0.03 ³¹ PROKOSHKIN 91 GAM4 300 $\pi^- p \rightarrow \pi^- p \eta\eta$ ³¹ Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.

NODE=M013R8;LINKAGE=B

 $\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1 NODE=M013R3
NODE=M013R3

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.118 ± 0.028 OUR FIT**0.115 ± 0.028 OUR AVERAGE**

0.119 ± 0.015 ± 0.036	61	32 BINON	07	GAMS	32.5 $K^- p \rightarrow \eta\eta(\Lambda/\Sigma^0)$
0.11 ± 0.04		33 PROKOSHKIN 91	GAM4	300 $\pi^- p \rightarrow \pi^- p \eta\eta$	

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

< 0.14 90 BARBERIS 00E 450 $pp \rightarrow p_f \eta\eta p_s$ < 0.50 BARNES 67 HBC 4.6,5.0 $K^- p$ ³² Using the compilation of the cross sections for $f'_2(1525)$ production in $K^- p$ collisions from ASTON 88D.³³ Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.

NODE=M013R3;LINKAGE=BI

NODE=M013R3;LINKAGE=B

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ NODE=M013R1
NODE=M013R1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.0082 ± 0.0016 OUR FIT**0.0075 ± 0.0016 OUR AVERAGE**0.007 ± 0.002 COSTA... 80 OMEG 10 $\pi^- p \rightarrow K^+ K^- n$ 0.027 $^{+0.071}_{-0.013}$ ³⁴ GORLICH 80 ASPK 17,18 $\pi^- p$ 0.0075 ± 0.0025 ^{34,35} MARTIN 79 RVUE

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

< 0.06 95 AGUILAR... 81B HBC 4.2 $K^- p \rightarrow \Lambda K^+ K^-$ 0.19 ± 0.03 CORDEN 79 OMEG 12–15 $\pi^- p \rightarrow \pi^+ \pi^- n$ < 0.045 95 BARREIRO 77 HBC 4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$ 0.012 ± 0.004 ³⁴ PAWLICKI 77 SPEC 6 $\pi N \rightarrow K^+ K^- N$ < 0.063 90 BRANDENB... 76C ASPK 13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$ < 0.0086 ³⁴ BEUSCH 75B OSPK 8.9 $\pi^- p \rightarrow K^0 \bar{K}^0 n$ ³⁴ Assuming that the $f'_2(1525)$ is produced by an one-pion exchange production mechanism.³⁵ MARTIN 79 uses the PAWLICKI 77 data with different input value of the $f'_2(1525) \rightarrow K\bar{K}$ branching ratio.

NODE=M013R1;LINKAGE=C

NODE=M013R1;LINKAGE=D

$\Gamma(\pi\pi)/\Gamma(K\bar{K})$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.0092±0.0018 OUR FIT**0.075 ±0.035**AUGUSTIN 87 DM2 $J/\psi \rightarrow \gamma\pi^+\pi^-$ NODE=M013R7
NODE=M013R7 $[\Gamma(K\bar{K}^*(892)+c.c.)+\Gamma(\pi K\bar{K})]/\Gamma(K\bar{K})$ $(\Gamma_4+\Gamma_5)/\Gamma_1$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.35	95	AGUILAR-...	72B	HBC	3.9,4.6 K^-p
<0.4	67	AMMAR	67	HBC	

NODE=M013R5
NODE=M013R5 $\Gamma(\pi\pi\eta)/\Gamma(K\bar{K})$ Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.41	95	AGUILAR-...	72B	HBC	3.9,4.6 K^-p
<0.3	67	AMMAR	67	HBC	

NODE=M013R4
NODE=M013R4 $\Gamma(\pi^+\pi^+\pi^-\pi^-)/\Gamma(K\bar{K})$ Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.32	95	AGUILAR-...	72B	HBC	3.9,4.6 K^-p

NODE=M013R6
NODE=M013R6 **$f'_2(1525)$ REFERENCES**

NODE=M013

UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
BINON	07	PAN 70 1713	F. Binon <i>et al.</i>	(GAMS Collab.)
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
CHEKANOV	04	PL B578 33	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
BARKOV	99	JETPL 70 248	B.P. Barkov <i>et al.</i>	
ABREU	96C	PL B379 309	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)
ACCIARRI	95J	PL B363 118	M. Acciarri <i>et al.</i>	(L3 Collab.)
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2, GAM4 Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
PDG	90	PL B239 1	J.J. Hernandez <i>et al.</i>	(IFIC, BOST, CIT+)
BEHREND	89C	ZPHY C43 91	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
BERGER	88	ZPHY C37 329	C. Berger <i>et al.</i>	(PLUTO Collab.)
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
BALTRUSAITIS	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BOLONKIN	86	SJNP 43 776	B.V. Bolonkin <i>et al.</i>	(ITEP) JP
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
ALTHOFF	83	PL 121B 216	M. Althoff <i>et al.</i>	(TASSO Collab.)
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
AGUILAR-...	81B	ZPHY C8 313	M. Aguilar-Benitez <i>et al.</i>	(CERN, CDEF+)
ALHARRAN	81	NP B191 26	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)
BARREIRO	77	NP B121 237	F. Barreiro <i>et al.</i>	(CERN, AMST, NIJ+)
EVANGELIS...	77	NP B127 384	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJP
BRANDENB...	76C	NP B104 413	G.W. Brandenburg <i>et al.</i>	(SLAC)
BEUSCH	75B	PL 60B 101	W. Beusch <i>et al.</i>	(CERN, ETH)
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)
AMMAR	67	PRL 19 1071	R. Ammar <i>et al.</i>	(NWES, ANL) JP
BARNES	67	PRL 19 964	V.E. Barnes <i>et al.</i>	(BNL, SYRA) IJPC
CRENNELL	66	PRL 16 1025	D.J. Crennell <i>et al.</i>	(BNL) I

REFID=53641
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REFID=20317

$f_2(1565)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

Seen mostly in antinucleon-nucleon annihilation. Needs confirmation in other channels.

NODE=M123

NODE=M123

NODE=M123M

NODE=M123M

 $f_2(1565)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1562±13 OUR AVERAGE	Error includes scale factor of 2.1. See the ideogram below.		
1590±10	¹ AMELIN	06 VES	$36 \pi^- p \rightarrow \omega \omega n$
1552±13	² AMSLER	02 CBAR	$0.9 \bar{p} p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
1550±10±20	AMELIN	00 VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1575±18	BERTIN	98 OBLX	$0.05-0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1507±15	² BERTIN	97C OBLX	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
1565±20	MAY	90 ASTE	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1560±15	³ ANISOVICH	09 RVUE	$0.0 \bar{p} p, \pi N$
1598±11±9	BAKER	99B SPEC	$0 \bar{p} p \rightarrow \omega \omega \pi^0$
1534±20	⁴ ABELE	96C RVUE	Compilation
~ 1552	⁵ AMSLER	95D CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$
1598±72	BALOSHIN	95 SPEC	$40 \pi^- C \rightarrow K_S^0 K_S^0 X$
1566 ⁺⁸⁰ ₋₅₀	⁶ ANISOVICH	94 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0, \eta \eta \pi^0$
1502±9	ADAMO	93 OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1488±10	⁷ ARMSTRONG	93C E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1508±10	⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow 3\pi^0 \rightarrow 6\gamma$
1525±10	⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 1504	⁸ WEIDENAUER	93 ASTE	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$
1540±15	⁷ ADAMO	92 OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
1515±10	⁹ AKER	91 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$
1477±5	BRIDGES	86C DBC	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$

¹ Supersedes the $\omega \omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.

² T-matrix pole.

³ On sheet II in a two-pole solution.

⁴ T-matrix pole, large coupling to $\rho \rho$ and $\omega \omega$, could be $f_2(1640)$.

⁵ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

⁶ From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.

⁷ J^P not determined, could be partly $f_0(1500)$.

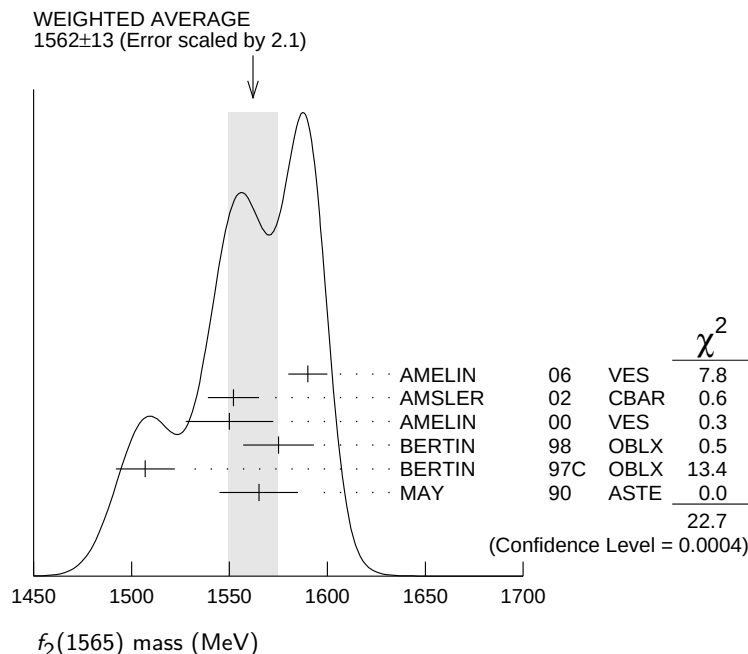
⁸ J^P not determined.

⁹ Superseded by AMSLER 95B.

OCCUR=2

NODE=M123M;LINKAGE=AM
 NODE=M123M;LINKAGE=G
 NODE=M123M;LINKAGE=AN
 NODE=M123M;LINKAGE=AA
 NODE=M123M;LINKAGE=AB
 NODE=M123M;LINKAGE=C

NODE=M123M;LINKAGE=E
 NODE=M123M;LINKAGE=F
 NODE=M123M;LINKAGE=BA



$f_2(1565)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
134± 8 OUR AVERAGE			
140± 11	¹⁰ AMELIN	06 VES	$36 \pi^- p \rightarrow \omega \omega n$
113± 23	¹¹ AMSLER	02 CBAR	$0.9 \bar{p} p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
130± 20±40	AMELIN	00 VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
119± 24	BERTIN	98 OBLX	$0.05-0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
130± 20	¹¹ BERTIN	97C OBLX	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
170± 40	MAY	90 ASTE	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
280± 40	¹² ANISOVICH	09 RVUE	$0.0 \bar{p} p, \pi N$
180± 60	¹³ ABELE	96C RVUE	Compilation
~ 142	¹⁴ AMSLER	95D CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$
263±101	BALOSHIN	95 SPEC	$40 \pi^- C \rightarrow K_S^0 K_S^0 X$
166 ⁺ ₋₂₀	¹⁵ ANISOVICH	94 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0, \eta \eta \pi^0$
130± 10	¹⁶ ADAMO	93 OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
148± 27	¹⁷ ARMSTRONG	93C E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
103± 15	¹⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow 3\pi^0 \rightarrow 6\gamma$
111± 10	¹⁷ ARMSTRONG	93D E760	$\bar{p} p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 206	¹⁸ WEIDENAUER	93 ASTE	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$
132± 37	¹⁷ ADAMO	92 OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
120± 10	¹⁹ AKER	91 CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$
116± 9	BRIDGES	86C DBC	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$
¹⁰ Supersedes the $\omega\omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.			
¹¹ T-matrix pole.			
¹² On sheet II in a two-pole solution.			
¹³ T-matrix pole, large coupling to $\rho\rho$ and $\omega\omega$, could be $f_2(1640)$.			
¹⁴ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.			
¹⁵ From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.			
¹⁶ Supersedes ADAMO 92.			
¹⁷ J^P not determined, could be partly $f_0(1500)$.			
¹⁸ J^P not determined.			
¹⁹ Superseded by AMSLER 95B.			

NODE=M123W

NODE=M123W

OCCUR=2

NODE=M123W;LINKAGE=AM
 NODE=M123W;LINKAGE=G
 NODE=M123W;LINKAGE=AN
 NODE=M123W;LINKAGE=CC
 NODE=M123W;LINKAGE=AB
 NODE=M123W;LINKAGE=D

NODE=M123W;LINKAGE=C
 NODE=M123W;LINKAGE=E
 NODE=M123W;LINKAGE=F
 NODE=M123W;LINKAGE=BA

 $f_2(1565)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	seen
$\Gamma_2 \pi^+ \pi^-$	seen
$\Gamma_3 \pi^0 \pi^0$	seen
$\Gamma_4 \rho^0 \rho^0$	seen
$\Gamma_5 2\pi^+ 2\pi^-$	seen
$\Gamma_6 \eta\eta$	seen
$\Gamma_7 a_2(1320)\pi$	
$\Gamma_8 \omega\omega$	seen
$\Gamma_9 K\bar{K}$	
$\Gamma_{10} \gamma\gamma$	

NODE=M123215;NODE=M123

DESIG=6;OUR EST;→ NOT CHECKED ←
 DESIG=1;OUR EST;→ NOT CHECKED ←
 DESIG=3;OUR EST;→ NOT CHECKED ←
 DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=8
 DESIG=7;OUR EST;→ NOT CHECKED ←
 DESIG=9
 DESIG=10

 $f_2(1565)$ PARTIAL WIDTHS

$\Gamma(\eta\eta)$					Γ_6
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.2±0.3	870	²⁰ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
$\Gamma(K\bar{K})$					Γ_9
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.0±1.0	870	²⁰ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M123225

NODE=M123W3
 NODE=M123W3

NODE=M123W1
 NODE=M123W1

$\Gamma(\gamma\gamma)$ Γ_{10}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

0.70±0.14	870	20 SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

²⁰ From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

NODE=M123W2
NODE=M123W2

NODE=M123W1;LINKAGE=SC

$f_2(1565)$ BRANCHING RATIOS

NODE=M123220

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

seen	BAKER	99B	SPEC	$0 \bar{p} p \rightarrow \omega \omega \pi^0$

NODE=M123R5
NODE=M123R5

 $\Gamma(\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

seen	BERTIN	98	OBLX	$0.05\text{--}0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$

not seen	²¹ ANISOVICH	94B	RVUE	$\bar{p} p \rightarrow \pi^+ \pi^- \pi^0$

seen	MAY	89	ASTE	$\bar{p} p \rightarrow \pi^+ \pi^- \pi^0$

²¹ ANISOVICH 94B is from a reanalysis of MAY 90.

NODE=M123R1
NODE=M123R1

NODE=M123R1;LINKAGE=A

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

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AMSLER	95B	CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$

NODE=M123R3
NODE=M123R3

 $\Gamma(\pi^+ \pi^-)/\Gamma(\rho^0 \rho^0)$ Γ_2/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.042±0.013	BRIDGES	86B	DBC	$\bar{p} N \rightarrow 3\pi^- 2\pi^+$

NODE=M123R2
NODE=M123R2

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.024±0.005±0.012	²² ARMSTRONG	93C	E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$

²² J^P not determined, could be partly $f_0(1500)$.

NODE=M123R4
NODE=M123R4

NODE=M123R4;LINKAGE=E

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

seen	BAKER	99B	SPEC	$0 \bar{p} p \rightarrow \omega \omega \pi^0$

NODE=M123R6
NODE=M123R6

$f_2(1565)$ REFERENCES

NODE=M123

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
SCHEGELSKY	06A	Translated from YAF 69 715.	V.A. Schegelsky <i>et al.</i>	
AMSLER	02	EPJ A27 207	C. Amsler <i>et al.</i>	
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
BAKER	99B	PL B467 147	C.A. Baker <i>et al.</i>	
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BALOSHIN	95	PAN 58 46	O.N. Baloshin <i>et al.</i>	(ITEP)
AMSLER	94D	Translated from YAF 58 50.	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	94B	PR D50 1972	V.V. Anisovich <i>et al.</i>	(LOQM)
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i>	(OBELIX Collab.)
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)
BELADIDZE	92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)
MAY	90	ZPHY C46 203	B. May <i>et al.</i>	(ASTERIX Collab.)
MAY	89	PL B225 450	B. May <i>et al.</i>	(ASTERIX Collab.) IJP
BRIDGES	86B	PRL 56 215	D.L. Bridges <i>et al.</i>	(SYRA, CASE)
BRIDGES	86C	PRL 57 1534	D.L. Bridges <i>et al.</i>	(SYRA)

REFID=52719
REFID=51574

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REFID=43585
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REFID=41587
REFID=41365
REFID=40921
REFID=21376
REFID=21377

$\rho(1570)$

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

OMITTED FROM SUMMARY TABLE

May be an OZI-violating decay mode of $\rho(1700)$. See our mini-review under the $\rho(1700)$.

 $\rho(1570)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1570 \pm 36 \pm 62$	54	¹ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1480 ± 40		² BITYUKOV	87 SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$
¹ From the fit with two resonances.				
² Systematic errors not estimated.				

 $\rho(1570)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$144 \pm 75 \pm 43$	54	³ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
130 ± 60		⁴ BITYUKOV	87 SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$
³ From the fit with two resonances.				
⁴ Systematic errors not estimated.				

 $\rho(1570)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $\phi \pi$	not seen
Γ_3 $\omega \pi$	

 $\rho(1570)$ $\Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_2 \Gamma_1 / \Gamma$
$3.5 \pm 0.9 \pm 0.3$		54	⁵ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 70	90		⁶ AULCHENKO	87B ND	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0$	
⁵ From the fit with two resonances.						
⁶ Using mass and width of BITYUKOV 87.						

 $\rho(1570)$ BRANCHING RATIOS

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
not seen	ABELE	97H CBAR	$\bar{p} p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.01	⁷ DONNACHIE	91 RVUE		
⁷ Using data from BISELLO 91B, DOLINSKY 86, and ALBRECHT 87L.				

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_3
> 0.5	95	BITYUKOV	87 SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$	

 $\rho(1570)$ REFERENCES

AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45765
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)	REFID=41752
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=41632
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40418
AULCHENKO	87B	JETPL 45 145	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=41373
		Translated from ZETFP 45 118.			
BITYUKOV	87	PL B188 383	S.I. Bitjukov <i>et al.</i>	(SERP)	REFID=40011
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=20246

NODE=M188

NODE=M188

NODE=M188M

NODE=M188M

NODE=M188M;LINKAGE=AU
NODE=M188M;LINKAGE=BI

NODE=M188W

NODE=M188W

NODE=M188W;LINKAGE=AU
NODE=M188W;LINKAGE=BI

NODE=M188215;NODE=M188

DESIG=1

DESIG=2

DESIG=3

NODE=M188225

NODE=M188G01
NODE=M188G01

NODE=M188G01;LINKAGE=AU
NODE=M188G01;LINKAGE=AL

NODE=M188220

NODE=M188R01
NODE=M188R01

NODE=M188R01;LINKAGE=DO

NODE=M188R02
NODE=M188R02

NODE=M188

$h_1(1595)$

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

OMITTED FROM SUMMARY TABLE

Seen in a partial-wave analysis of the $\omega\eta$ system produced in the reaction $\pi^- p \rightarrow \omega\eta n$ at 18 GeV/c.

NODE=M166

NODE=M166

 $h_1(1595)$ MASS

NODE=M166M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1594 \pm 15^{+10}_{-60}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

NODE=M166M

 $h_1(1595)$ WIDTH

NODE=M166W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$384 \pm 60^{+70}_{-100}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

NODE=M166W

 $h_1(1595)$ DECAY MODES

NODE=M166215;NODE=M166

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega\eta$	seen

DESIG=1;OUR EST;→ NOT CHECKED ←

 $h_1(1595)$ REFERENCESEUGENIO 01 PL B497 190 P. Eugenio *et al.*

NODE=M166

REFID=48010

NODE=M164

 $\pi_1(1600)$

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

 $\pi_1(1600)$ MASS

NODE=M164M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1662 \pm 8^{+8}_{-9}$ OUR AVERAGE				

NODE=M164M

$1660 \pm 10^{+0}_{-64}$	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$1664 \pm 8 \pm 10$	145k	¹ LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
$1709 \pm 24 \pm 41$	69k	² KUHN	04	B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
$1597 \pm 10^{+45}_{-10}$		² IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$

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

$1593 \pm 8^{+29}_{-47}$	^{2,3} ADAMS	98B	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

¹ May be a different state: natural and unnatural parity exchanges.² Natural parity exchange.³ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.

NODE=M164M;LINKAGE=LU

NODE=M164M;LINKAGE=A

NODE=M164M;LINKAGE=DZ

 $\pi_1(1600)$ WIDTH

NODE=M164W

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
241±40 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.			
269±21 ⁺ ₋₆₄	420k	ALEKSEEV	10	COMP	190 π ⁻ Pb → π ⁻ π ⁻ π ⁺ Pb'
185±25±28	145k	⁴ LU	05	B852	18 π ⁻ p → ω π ⁻ π ⁰ p
403±80±115	69k	⁵ KUHN	04	B852	18 π ⁻ p → η π ⁺ π ⁻ π ⁻ p
340±40±50		⁵ IVANOV	01	B852	18 π ⁻ p → η' π ⁻ p

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

$168 \pm 20^{+150}_{-12}$	^{5,6} ADAMS	98B	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M164W

⁴ May be a different state: natural and unnatural parity exchanges.

⁵ Natural parity exchange.

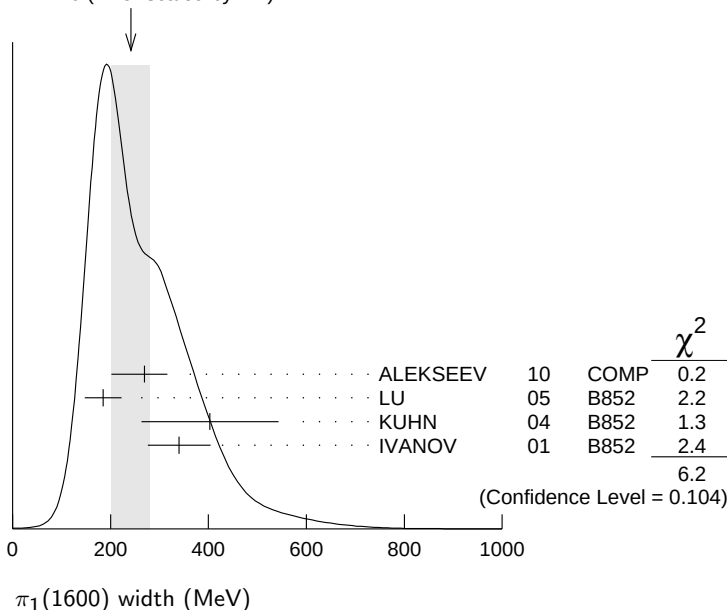
⁶ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.

NODE=M164W;LINKAGE=LU

NODE=M164W;LINKAGE=A

NODE=M164W;LINKAGE=DZ

WEIGHTED AVERAGE
241±40 (Error scaled by 1.4)



$\pi_1(1600)$ DECAY MODES

NODE=M164215;NODE=M164

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi \pi \pi$	not seen
Γ_2 $\rho^0 \pi^-$	not seen
Γ_3 $f_2(1270) \pi^-$	not seen
Γ_4 $b_1(1235) \pi$	seen
Γ_5 $\eta'(958) \pi^-$	seen
Γ_6 $f_1(1285) \pi$	seen

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=2

DESIG=4

DESIG=5

DESIG=3

DESIG=6;OUR EST;→ NOT CHECKED ←

$\pi_1(1600)$ BRANCHING RATIOS

NODE=M164220

$\Gamma(\rho^0 \pi^-)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	NOZAR	09	CLAS $\gamma p \rightarrow 2\pi^+ \pi^- n$	
not seen	⁷ DZIERBA	06	B852 $18 \pi^- p$	

NODE=M164R1

NODE=M164R1

⁷ From the PWA analysis of 2.6 M $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. Supersedes ADAMS 98B.

NODE=M164R1;LINKAGE=DZ

$\Gamma(f_2(1270) \pi^-)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	⁸ DZIERBA	06	B852 $18 \pi^- p$	

NODE=M164R3

NODE=M164R3

⁸ From the PWA analysis of 2.6 M $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. Supersedes CHUNG 02.

NODE=M164R3;LINKAGE=DZ

$\Gamma(b_1(1235) \pi)/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	35280	⁹ BAKER	03	SPEC $\bar{p} p \rightarrow \omega \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	145k	LU	05	B852 $18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$

NODE=M164R4

NODE=M164R4

⁹ $B((b_1 \pi)_{D\text{-wave}})/B((b_1 \pi)_{S\text{-wave}}) = 0.3 \pm 0.1$.

NODE=M164R;LINKAGE=RB

$\Gamma(\eta'(958) \pi^-)/\Gamma_{\text{total}}$				Γ_5/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	IVANOV	01	B852 $18 \pi^- p \rightarrow \eta' \pi^- p$	

NODE=M164R2

NODE=M164R2

$\Gamma(f_1(1285)\pi)/\Gamma(\eta'(958)\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
3.80±0.78	69k	¹⁰ KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
¹⁰ Using $\eta'(958)\pi$ data from IVANOV 01.				

NODE=M164R5
 NODE=M164R5

NODE=M164R;LINKAGE=KU

 $\pi_1(1600)$ REFERENCES

ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
NOZAR	09	PRL 102 102002	M. Nozar <i>et al.</i>	(CLAS Collab.)
DZIERBA	06	PR D73 072001	A.R. Dzierba <i>et al.</i>	(BNL E852 Collab.)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
ADAMS	98B	PRL 81 5760	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)

NODE=M164

REFID=53356
 REFID=52758
 REFID=51077
 REFID=50459
 REFID=49773
 REFID=49414
 REFID=48837
 REFID=48317
 REFID=46610

NODE=M161

 $a_1(1640)$

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

OMITTED FROM SUMMARY TABLE

Seen in the amplitude analysis of the $3\pi^0$ system produced in $\bar{p}p \rightarrow 4\pi^0$. Possibly seen in the study of the hadronic structure in decay $\tau \rightarrow 3\pi\nu_\tau$ (ABREU 98G and ASNER 00). Needs confirmation.

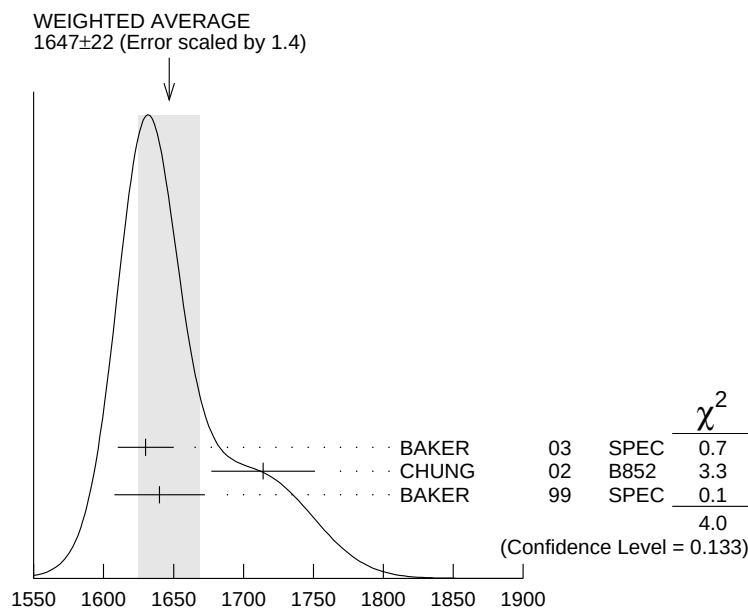
NODE=M161

 $a_1(1640)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1647±22 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
1630±20	35280	¹ BAKER	03 SPEC	$\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
1714± 9±36		CHUNG	02 B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1640±12±30		BAKER	99 SPEC	1.94 $\bar{p}p \rightarrow 4\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1670±90		BELLINI	85 SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

NODE=M161M

NODE=M161M



$a_1(1640)$ mass (MeV)

¹ Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161M;LINKAGE=KB

 $a_1(1640)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
254± 27 OUR AVERAGE		Error includes scale factor of 1.1.		
225± 30	35280	² BAKER	03 SPEC	$\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
308± 37±62		CHUNG	02 B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
300± 22±40		BAKER	99 SPEC	1.94 $\bar{p}p \rightarrow 4\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
300±100		BELLINI	85 SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

NODE=M161W

NODE=M161W

² Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161W;LINKAGE=KB

$a_1(1640)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi\pi$	seen
$\Gamma_2 \quad f_2(1270)\pi$	seen
$\Gamma_3 \quad \sigma\pi$	seen
$\Gamma_4 \quad \rho\pi S\text{-wave}$	seen
$\Gamma_5 \quad \rho\pi D\text{-wave}$	seen
$\Gamma_6 \quad \omega\pi\pi$	seen
$\Gamma_7 \quad f_1(1285)\pi$	seen
$\Gamma_8 \quad a_1(1260)\eta$	not seen

NODE=M161215;NODE=M161

DESIG=3;OUR EST;→ NOT CHECKED ←
 DESIG=1;OUR EST;→ NOT CHECKED ←
 DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=7;OUR EST;→ NOT CHECKED ←
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=6;OUR EST;→ NOT CHECKED ←
 DESIG=8

$a_1(1640)$ BRANCHING RATIOS

$\Gamma(f_2(1270)\pi)/\Gamma(\sigma\pi)$ Γ_2/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.24 ± 0.07	BAKER	99	SPEC $1.94 \bar{p}p \rightarrow 4\pi^0$

NODE=M161220

NODE=M161R1
 NODE=M161R1

$\Gamma(\rho\pi D\text{-wave})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
seen	AMELIN	95B	VES $36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M161R2
 NODE=M161R2

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	35280	³ BAKER	03	SPEC $\bar{p}p \rightarrow \omega\pi^+ \pi^- \pi^0$

NODE=M161R3
 NODE=M161R3

$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	KUHN	04	B852 $18 \pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$
seen	LEE	94	MPS2 $18 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- \pi^- p$

NODE=M161R4
 NODE=M161R4

$\Gamma(a_1(1260)\eta)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	KUHN	04	B852 $18 \pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$

NODE=M161R5
 NODE=M161R5

³ Assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

NODE=M161R;LINKAGE=KB

$a_1(1640)$ REFERENCES

KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	
ABREU	98G	PL B426 411	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	

Translated from YAF 41 1223.

NODE=M161

REFID=49773
 REFID=49414
 REFID=48837
 REFID=47339
 REFID=46888
 REFID=45909
 REFID=44433
 REFID=44092
 REFID=40578
 REFID=47490

NODE=M117

$f_2(1640)$

$I^G(J^{PC}) = 0^+(2^{++})$

OMITTED FROM SUMMARY TABLE

$f_2(1640)$ MASS

NODE=M117M

NODE=M117M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1639± 6 OUR AVERAGE	Error includes scale factor of 1.2.		
1620±16	BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1647± 7	ADAMO	92	OBLX $\bar{n} p \rightarrow 3 \pi^+ 2 \pi^-$
1635± 7	ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1640± 5	AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
1659± 6	VLADIMIRSK...	06	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1643± 7	¹ ALDE	89B	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
¹ Superseded by ALDE 90.			

NODE=M117M;LINKAGE=BB

$f_2(1640)$ WIDTH

NODE=M117W

NODE=M117W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
99 ⁺⁶⁰ ₋₄₀ OUR AVERAGE	Error includes scale factor of 2.9.			
140 ⁺⁶⁰ ₋₂₀		BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
58±20		ADAMO	92	OBLX $\bar{n} p \rightarrow 3 \pi^+ 2 \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
44± 9		AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
152±18		VLADIMIRSK...	06	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
< 70	90	ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega \omega n$

$f_2(1640)$ DECAY MODES

NODE=M117215;NODE=M117

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega \omega$	seen
$\Gamma_2 \quad 4 \pi$	seen
$\Gamma_3 \quad K \bar{K}$	seen

DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=2;OUR EST;→ NOT CHECKED ←
DESIG=3

$f_2(1640)$ BRANCHING RATIOS

NODE=M117220

NODE=M117R2
NODE=M117R2

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
seen	AMSLER	06	CBAR $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$	

$f_2(1640)$ REFERENCES

NODE=M117

REFID=51136
REFID=51191

REFID=44438
REFID=42177
REFID=40935
REFID=40735

AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH) JP
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE	89B	PL B216 451	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+) IGJPC

$\eta_2(1645)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

NODE=M154

 $\eta_2(1645)$ MASS

NODE=M154M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1617± 5 OUR AVERAGE				
1613± 8	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
1617± 8	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
1620±20	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1645±14±15	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1645± 6±20	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154M

 $\eta_2(1645)$ WIDTH

NODE=M154W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
181±11 OUR AVERAGE				
185±17	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
177±18	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
180±25	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
180 ⁺⁴⁰ ₋₂₁ ±25	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
200±25	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154W

 $\eta_2(1645)$ DECAY MODES

NODE=M154215;NODE=M154

Mode	Fraction (Γ_i/Γ)
Γ_1 $a_2(1320)\pi$	seen
Γ_2 $K\bar{K}\pi$	seen
Γ_3 $K^*\bar{K}$	seen
Γ_4 $\eta\pi^+\pi^-$	seen
Γ_5 $a_0(980)\pi$	seen
Γ_6 $f_2(1270)\eta$	not seen

DESIG=1;OUR EST;→ NOT CHECKED ←
 DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=3;OUR EST;→ NOT CHECKED ←
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=6;OUR EST;→ NOT CHECKED ←

 $\eta_2(1645)$ BRANCHING RATIOS

NODE=M154220

$\Gamma(K\bar{K}\pi)/\Gamma(a_2(1320)\pi)$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.07±0.03	¹ BARBERIS	97C	OMEG 450	$p p \rightarrow p p K \bar{K} \pi$
¹ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.				

NODE=M154R1
 NODE=M154R1

NODE=M154R1;LINKAGE=A

$\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi)$				Γ_1/Γ_5
VALUE	DOCUMENT ID	TECN	COMMENT	
13.1±2.3 OUR AVERAGE				
13.5±4.6	² ANISOVICH	11	SPEC	0.9–1.94 $p\bar{p}$
13.0±2.7	BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$	

NODE=M154R3
 NODE=M154R3

NODE=M154R3;LINKAGE=AN

$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$				Γ_6/Γ
VALUE	DOCUMENT ID	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	BARBERIS	00B 450	$pp \rightarrow p_f \eta \pi^+ \pi^- p_s$	

NODE=M154R4
 NODE=M154R4

 $\eta_2(1645)$ REFERENCES

NODE=M154

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)

REFID=53631
 REFID=47945
 REFID=47958
 REFID=47959
 REFID=45758
 REFID=45759
 REFID=45202

$\omega(1650)$

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

NODE=M126

 $\omega(1650)$ MASS

NODE=M126M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1670± 30 OUR ESTIMATE				
● ● ● 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

NODE=M126M

→ NOT CHECKED ←

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=4

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

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.

 $\omega(1650)$ WIDTH

NODE=M126W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
315± 35 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
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

NODE=M126W

→ NOT CHECKED ←

OCCUR=2

OCCUR=5

OCCUR=4

- ¹⁰ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
- ¹¹ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.
- ¹² Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.
- ¹³ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ¹⁴ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

NODE=M126W;LINKAGE=VH

NODE=M126W;LINKAGE=AB

NODE=M126W;LINKAGE=KI

NODE=M126W;LINKAGE=AD

NODE=M126W;LINKAGE=AE

NODE=M126215;NODE=M126

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=3;OUR EST;→ NOT CHECKED ←

NODE=M126230

NODE=M126G3
NODE=M126G3NODE=M126G4
NODE=M126G4NODE=M126G5
NODE=M126G5NODE=M126G;LINKAGE=AW
NODE=M126G;LINKAGE=VH

NODE=M126G;LINKAGE=AD

NODE=M126G;LINKAGE=SE
NODE=M126G;LINKAGE=AE
NODE=M126G;LINKAGE=ES
NODE=M126G;LINKAGE=KL

NODE=M126G5;LINKAGE=KH

NODE=M126225

NODE=M126R2
NODE=M126R2 **$\omega(1650)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\omega\pi\pi$	seen
Γ_3 $\omega\eta$	seen
Γ_4 e^+e^-	seen

 $\omega(1650) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma \times \Gamma_4/\Gamma$

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 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma \times \Gamma_4/\Gamma$

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 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

$\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma \times \Gamma_4/\Gamma$

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**

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.35	1.2M	23	ACHASOV	03D RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.620 ± 0.014		24	HENNER	02 RVUE 1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.65	1.2M	²³ ACHASOV	03D	RVUE $0.44\text{--}2.00\ e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.380 ± 0.014		²⁴ HENNER	02	RVUE $1.2\text{--}2.0\ e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M126R3
 NODE=M126R3

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 18	1.2M	^{24,25} ACHASOV	03D	RVUE $0.44\text{--}2.00\ e^+e^- \rightarrow \pi^+\pi^-\pi^0$
32 ± 1		²⁴ HENNER	02	RVUE $1.2\text{--}2.0\ e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
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;→ NOT CHECKED ←
DESIG=2;OUR EST;→ NOT CHECKED ←
DESIG=3;OUR EST;→ NOT CHECKED ← $\omega_3(1670)$ 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

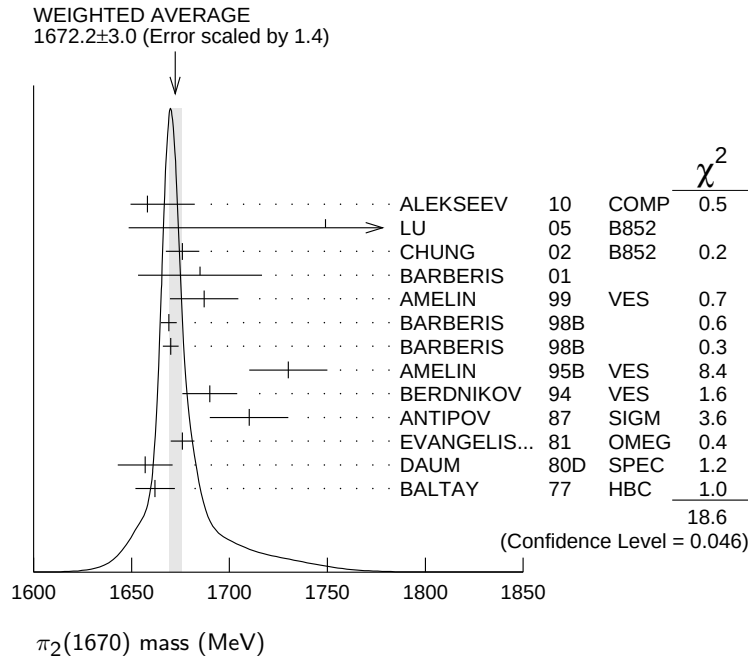
OCCUR=2

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

NODE=M034W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
260± 9 OUR AVERAGE		Error includes scale factor of 1.2.			
271± 9 ⁺ ₂₄	420k	ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
408± 60±250	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
254± 3± 31		⁹ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
265± 30± 40		¹⁰ BARBERIS	01		450 $pp \rightarrow p_f 3\pi^0 p_s$
168± 43± 53		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
268± 15		BARBERIS	98B		450 $pp \rightarrow p_f \rho \pi p_s$
256± 15		BARBERIS	98B		450 $pp \rightarrow p_f f_2(1270) \pi p_s$
310± 20		¹¹ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
190± 50		¹² BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
170± 80	700	ANTIPOV	87	SIGM	50 $\pi^- Cu \rightarrow \mu^+ \mu^- \pi^- Cu$
260± 20		¹² EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow 3\pi p$
219± 20		^{12,13} DAUM	80D	SPEC	63-94 $\pi p \rightarrow 3\pi X$
285± 60	2000	¹² BALTAY	77	HBC	15 $\pi^+ p \rightarrow p 3\pi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
236± 49± 36		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$
304± 22		⁹ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
404±108		¹⁴ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
330± 90		¹⁵ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
312± 50		¹⁶ DAUM	81B	SPEC	63,94 $\pi^- p$
270± 60		¹² ASCOLI	73	HBC	5-25 $\pi^- p \rightarrow p \pi_2$

OCCUR=2

OCCUR=2

OCCUR=3

⁹ From $f_2(1270)\pi$ decay.¹⁰ From a fit to the invariant mass distribution.¹¹ From a fit to $J^{PC} = 2^- + f_2(1270)\pi, f_0(1370)\pi$ waves.¹² From a fit to $J^P = 2^- f_2(1270)\pi$ partial wave.¹³ Clear phase rotation seen in $2^- S, 2^- P, 2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.¹⁴ From $\rho\pi$ decay.¹⁵ From $\sigma\pi$ decay.¹⁶ From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.

NODE=M034W;LINKAGE=F2
 NODE=M034W;LINKAGE=BR
 NODE=M034W;LINKAGE=AX
 NODE=M034W;LINKAGE=P
 NODE=M034W;LINKAGE=D

NODE=M034W;LINKAGE=R2
 NODE=M034W;LINKAGE=S2
 NODE=M034W;LINKAGE=L

$\pi_2(1670)$ DECAY MODES

NODE=M034215;NODE=M034

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	3π	$(95.8 \pm 1.4) \%$	
Γ_2	$\pi^+ \pi^- \pi^0$		
Γ_3	$\pi^0 \pi^0 \pi^0$		
Γ_4	$f_2(1270)\pi$	$(56.3 \pm 3.2) \%$	
Γ_5	$\rho\pi$	$(31 \pm 4) \%$	
Γ_6	$\sigma\pi$	$(10.9 \pm 3.4) \%$	
Γ_7	$(\pi\pi)_{S\text{-wave}}$	$(8.7 \pm 3.4) \%$	
Γ_8	$K\bar{K}^*(892) + \text{c.c.}$	$(4.2 \pm 1.4) \%$	
Γ_9	$\omega\rho$	$(2.7 \pm 1.1) \%$	
Γ_{10}	$\gamma\gamma$	$< 2.8 \times 10^{-7}$	90%
Γ_{11}	$\eta\pi$		
Γ_{12}	$\pi^\pm 2\pi^+ 2\pi^-$		
Γ_{13}	$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%
Γ_{14}	$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%
Γ_{15}	$\eta 3\pi$		
Γ_{16}	$f_1(1285)\pi$	possibly seen	
Γ_{17}	$a_2(1320)\pi$	not seen	

DESIG=20
DESIG=22
DESIG=23
DESIG=8
DESIG=2
DESIG=13
DESIG=11
DESIG=5
DESIG=14
DESIG=12
DESIG=3
DESIG=4
DESIG=15
DESIG=16
DESIG=24
DESIG=25
DESIG=26

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 1.9$ for 3 degrees of freedom.

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

x_5	-53		
x_7	-29	-59	
x_8	-8	-21	-9
	x_4	x_5	x_7

 $\pi_2(1670)$ PARTIAL WIDTHS

NODE=M034217

$\Gamma(\gamma\gamma)$					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

¹⁷Decaying into $f_2(1270)\pi$ and $\rho\pi$.

¹⁸Constructive interference between $f_2(1270)\pi, \rho\pi$ and background.

¹⁹Incoherent Ansatz.

NODE=M034W1;LINKAGE=QQ
NODE=M034W1;LINKAGE=C
NODE=M034W1;LINKAGE=G

 $\pi_2(1670) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M034230

$\Gamma(\pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$					$\Gamma_2 \Gamma_{10} / \Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.1	95	²⁰ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	

²⁰From analysis of L3 data at 183–209 GeV.

NODE=M034G01
NODE=M034G01

NODE=M034G01;LINKAGE=SC

$\pi_2(1670)$ BRANCHING RATIOS

NODE=M034220

 $\Gamma(3\pi)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_4 + \Gamma_5 + \Gamma_7)/\Gamma$ NODE=M034R20
NODE=M034R20

VALUE

DOCUMENT ID

0.958±0.014 OUR FIT $\Gamma(\pi^0\pi^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_3/Γ_2 NODE=M034R21
NODE=M034R21

VALUE

DOCUMENT ID

COMMENT

0.29±0.03±0.05

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, TINTO, 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
REFID=50459
REFID=49773
REFID=48837
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REFID=21573
REFID=20847
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REFID=20689
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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

→ NOT CHECKED ←

• • • 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 $p\bar{p} \rightarrow K^+K^-\pi^0$

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.

→ NOT CHECKED ←

• • • 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;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

DESIG=3;OUR EST;→ NOT CHECKED ←

DESIG=9

DESIG=6;OUR EST;→ NOT CHECKED ←

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=11

DESIG=12;OUR EVAL;

DESIG=10, NOT CHECKED ←

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 031101R	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
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 REFID=48827
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 REFID=46323
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 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

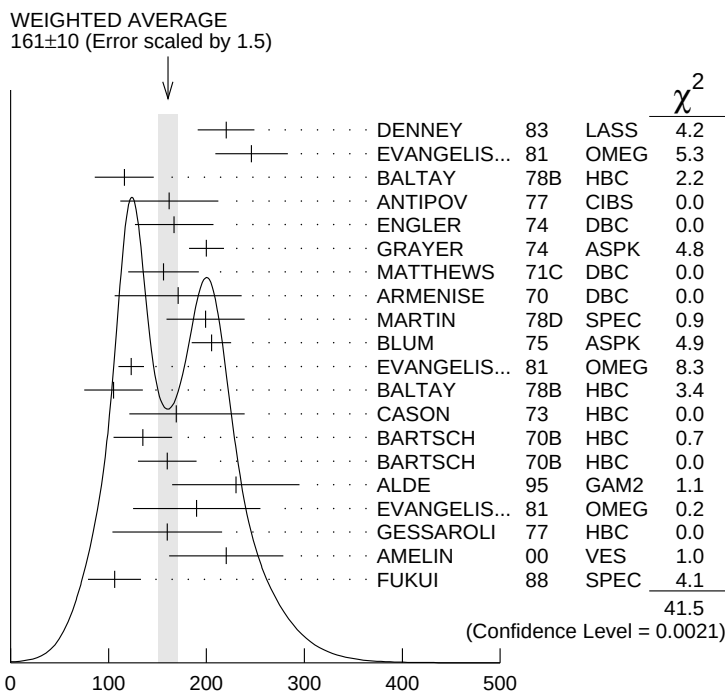
2 π , $K\bar{K}$, AND $K\bar{K}\pi$ MODES

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



$\rho_3(1690)$ 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.

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

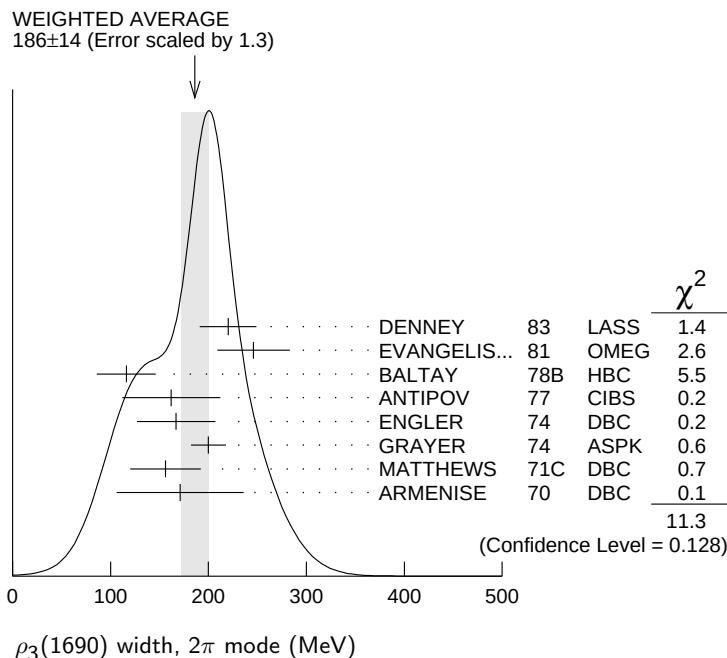
NODE=M015W1

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)

NODE=M015W6;LINKAGE=R

²⁷ Not seen by BOWEN 72.

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;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

DESIG=6;OUR EST;→ NOT CHECKED ←

DESIG=8;OUR EST;→ NOT CHECKED ←

DESIG=9

DESIG=10

DESIG=12

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 10 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 14.7$ for 7 degrees of freedom.

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

x_4	-77		
x_5	-74	17	
x_6	-15	2	0
	x_1	x_4	x_5

$\rho_3(1690)$ BRANCHING RATIOS

NODE=M015220

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.236$\pm$0.013 OUR FIT					
0.243$\pm$0.013 OUR AVERAGE					
0.259 $^{+0.018}_{-0.019}$	BECKER	79	ASPK	0	17 $\pi^- p$ polarized
0.23 $\pm$ 0.02	CORDEN	79	OMEG		12-15 $\pi^- p \rightarrow n^2\pi$
0.22 $\pm$ 0.04	²⁸ MATTHEWS	71C	HDBC	0	7 $\pi^+ n \rightarrow \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.245 $\pm$ 0.006	²⁹ ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$

NODE=M015R1
NODE=M015R1²⁸ One-pion-exchange model used in this estimation.²⁹ From phase-shift analysis of HYAMS 75 data.NODE=M015R1;LINKAGE=P
NODE=M015R1;LINKAGE=G

$\Gamma(\pi\pi)/\Gamma(\pi^\pm \pi^\pm \pi^- \pi^0)$					Γ_4/Γ_2
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.35$\pm$0.11	CASON	73	HBC	-	8,18.5 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.2	HOLMES	72	HBC	+	10-12 $K^+ p$
<0.12	BALLAM	71B	HBC	-	16 $\pi^- p$

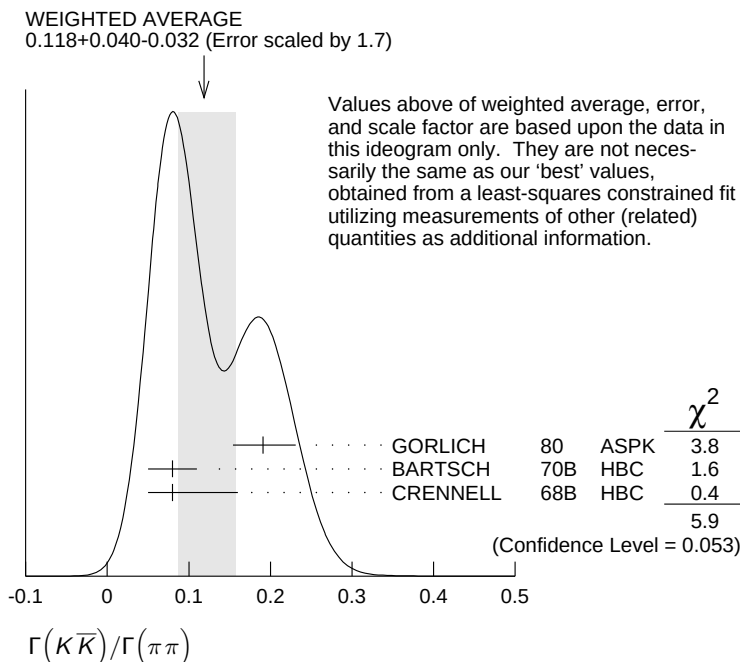
NODE=M015R2
NODE=M015R2

$\Gamma(\pi\pi)/\Gamma(4\pi)$					Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.332$\pm$0.026 OUR FIT	Error includes scale factor of 1.1.				
0.30 $\pm$0.10	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow p 4\pi$

NODE=M015R3
NODE=M015R3

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$					Γ_6/Γ_4
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.067$\pm$0.011 OUR FIT	Error includes scale factor of 1.2.				
0.118$^{+0.040}_{-0.032}$ OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.				
0.191 $^{+0.040}_{-0.037}$	GORLICH	80	ASPK	0	17,18 $\pi^- p$ polarized
0.08 $\pm$ 0.03	BARTSCH	70B	HBC	+	8 $\pi^+ p$
0.08 $^{+0.08}_{-0.03}$	CRENNELL	68B	HBC		6.0 $\pi^- p$

NODE=M015R4
NODE=M015R4

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_5/Γ_4
0.16±0.05 OUR FIT					
0.16±0.05	³⁰ BARTSCH	70B	HBC	+	8 $\pi^+ p$

³⁰ Increased by us to correspond to $B(\rho_3(1690) \rightarrow \pi\pi)=0.24$.

NODE=M015R5
NODE=M015R5

NODE=M015R5;LINKAGE=A

 $[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	$(\Gamma_9+\Gamma_{10}+\Gamma_{11})/\Gamma_2$
0.94±0.09 OUR AVERAGE					
0.96±0.21	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p4\pi$
0.88±0.15	BALLAM	71B	HBC	-	16 $\pi^- p$
1 ±0.15	BARTSCH	70B	HBC	+	8 $\pi^+ p$
consistent with 1	CASO	68	HBC	-	11 $\pi^- p$

NODE=M015R6
NODE=M015R6

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

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_{11}/Γ_2
0.12±0.11		BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p4\pi$
0.56	66	KLIGER	74	HBC	-	4.5 $\pi^- p \rightarrow p4\pi$
0.13±0.09		³¹ THOMPSON	74	HBC	+	13 $\pi^+ p$
0.7 ±0.15		BARTSCH	70B	HBC	+	8 $\pi^+ p$

³¹ $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R7
NODE=M015R7

NODE=M015R7;LINKAGE=T

 $\Gamma(\rho\rho)/[\Gamma(\pi\pi\rho) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	$\Gamma_{11}/(\Gamma_9+\Gamma_{10}+\Gamma_{11})$
0.48±0.16	CASO	68	HBC	-	11 $\pi^- p$

NODE=M015R8
NODE=M015R8

 $\Gamma(a_2(1320)\pi)/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_{10}/Γ_2
0.66±0.08	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p4\pi$
0.36±0.14	³² THOMPSON	74	HBC	+	13 $\pi^+ p$
not seen	CASON	73	HBC	-	8,18.5 $\pi^- p$
0.6 ±0.15	BARTSCH	70B	HBC	+	8 $\pi^+ p$
0.6	BALTAY	68	HBC	+	7,8.5 $\pi^+ p$

³² $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R9
NODE=M015R9

NODE=M015R9;LINKAGE=T

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

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	Γ_3/Γ_2
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

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_{12}/Γ_2
• • • 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

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_{14}/Γ_2
• • • 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

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_{13}/Γ_2
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.02	THOMPSON	74	HBC	+	13 $\pi^+ p$

NODE=M015R13
NODE=M015R13

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_6/Γ
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

$$\Gamma(\omega\pi)/[\Gamma(\omega\pi) + \Gamma(\rho\rho)]$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	$\Gamma_3/(\Gamma_3+\Gamma_{11})$
• • • 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

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ
seen	FUKUI	88	SPEC	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M015R17
NODE=M015R17

$$\Gamma(a_2(1320)\pi)/\Gamma(\rho(770)\eta)$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{10}/Γ_8
5.5±2.0	AMELIN	00	VES	37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M015R18
NODE=M015R18

$\rho_3(1690)$ REFERENCES

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+)
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)

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REFID=47432
REFID=44371
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REFID=21273
REFID=21272
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REFID=21651
REFID=20642
REFID=20355
REFID=20110

GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)
KLIGER	74	SJNP 19 428	G.K. Kliger <i>et al.</i>	(ITEP)
		Translated from YAF 19 839.		
OREN	74	NP B71 189	Y. Oren <i>et al.</i>	(ANL, OXF)
THOMPSON	74	NP B69 220	G. Thompson <i>et al.</i>	(PURD)
CASON	73	PR D7 1971	N.M. Cason <i>et al.</i>	(NDAM)
BOWEN	72	PRL 29 890	D.R. Bowen <i>et al.</i>	(NEAS, STON)
HOLMES	72	PR D6 3336	R. Holmes <i>et al.</i>	(ROCH)
BALLAM	71B	PR D3 2606	J. Ballam <i>et al.</i>	(SLAC)
MATTHEWS	71C	NP B33 1	J.A.J. Matthews <i>et al.</i>	(TNTO, WISC) JP
ARMENISE	70	LNC 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
BARNHAM	70	PRL 24 1083	K.W.J. Barnham <i>et al.</i>	(BIRM)
BARTSCH	70B	NP B22 109	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN)
CASO	70	LNC 3 707	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)
ANDERSON	69	PRL 22 1390	E.W. Anderson <i>et al.</i>	(BNL, CMU)
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+) I
BALTAY	68	PRL 20 887	C. Baltay <i>et al.</i>	(COLU, ROCH, RUTG, YALE) I
CASO	68	NC 54A 983	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)
CRENNELL	68B	PL 28B 136	D.J. Crennell <i>et al.</i>	(BNL)
JOHNSTON	68	PRL 20 1414	T.F. Johnston <i>et al.</i>	(TNTO, WISC) IJP
FOCACCI	66	PRL 17 890	M.N. Focacci <i>et al.</i>	(CERN)
GOLDBERG	65	PL 17 354	M. Goldberg <i>et al.</i>	(CERN, EPOL, ORSAY+)

REFID=20113
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NODE=M065

 $\rho(1700)$

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

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M065

 $\rho(1700)$ MASS

NODE=M065205

 $\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)

DOCUMENT ID

1720±20 OUR ESTIMATE

NODE=M065M0

NODE=M065M0

→ NOT CHECKED ←

 $\eta\rho^0$ 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. • • •

1728 ±17 ±89	5.4M	2,3	FUJIKAWA	08	BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1780 ⁺³⁷ ₋₂₉		4	ABELE	97	CBAR	$\bar{p}n \rightarrow \pi^- \pi^0 \pi^0$
1719 ±15		4	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		5	ERKAL	85	RVUE	20-70 $\gamma p \rightarrow \gamma\pi$
1550 ±70			ABE	84B	HYBR	20 $\gamma p \rightarrow \pi^+\pi^-p$
1590 ±20		6	ASTON	80	OMEG	20-70 $\gamma p \rightarrow p2\pi$
1600 ±10		7	ATIYA	79B	SPEC	50 $\gamma C \rightarrow C2\pi$
1598 ⁺²⁴ ₋₂₂			BECKER	79	ASPK	17 π^-p polarized
1659 ±25		5	LANG	79	RVUE	
1575		5	MARTIN	78C	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
1610 ±30		5	FROGGATT	77	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
1590 ±20		8	HYAMS	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$

² $|F_\pi(0)|^2$ fixed to 1.

³ From the GOUNARIS 68 parametrization of the pion form factor.

⁴ T-matrix pole.

⁵ From phase shift analysis of HYAMS 73 data.

⁶ Simple relativistic Breit-Wigner fit with constant width.

⁷ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.

⁸ Included in BECKER 79 analysis.

NODE=M065M1;LINKAGE=FU

NODE=M065M1;LINKAGE=GO

NODE=M065M;LINKAGE=QQ

NODE=M065M;LINKAGE=P

NODE=M065M;LINKAGE=M

NODE=M065M;LINKAGE=R

NODE=M065M;LINKAGE=H

$\pi\omega$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1550 to 1620	⁹ ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1580 to 1710	¹⁰ ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1710±90	ACHASOV	97 RVUE	$e^+e^- \rightarrow \omega\pi^0$

⁹Taking 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.

¹⁰Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

NODE=M065M8
NODE=M065M8

OCCUR=2

NODE=M065M;LINKAGE=I1

NODE=M065M;LINKAGE=I2

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1740.8±22.2	27k	¹¹ ABELE	99D CBAR	±	$0.0 \bar{p}p \rightarrow K^+K^-\pi^0$
1582 ±36	1600	CLELAND	82B SPEC	±	$50 \pi p \rightarrow K_S^0 K^\pm p$

¹¹K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

NODE=M065M2
NODE=M065M2

NODE=M065M2;LINKAGE=AN

 $2(\pi^+\pi^-)$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1851 ⁺ ₂₄		ACHASOV	97 RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1570±20		¹² CORDIER	82 DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1520±30		¹³ ASTON	81E OMEG	$20-70 \gamma p \rightarrow p4\pi$
1654±25		¹⁴ DIBIANCA	81 DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
1666±39		¹² BACCI	80 FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1780	34	KILLIAN	80 SPEC	$11 e^-p \rightarrow 2(\pi^+\pi^-)$
1500		¹⁵ ATIYA	79B SPEC	$50 \gamma C \rightarrow C4\pi^\pm$
1570±60	65	¹⁶ ALEXANDER	75 HBC	$7.5 \gamma p \rightarrow p4\pi$
1550±60		¹³ 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	$9.3 \gamma p \rightarrow p4\pi$

¹²Simple relativistic Breit-Wigner fit with model dependent width.

¹³Simple relativistic Breit-Wigner fit with constant width.

¹⁴One peak fit result.

¹⁵Parameters roughly estimated, not from a fit.

¹⁶Skew mass distribution compensated by Ross-Stodolsky factor.

NODE=M065M4
NODE=M065M4

OCCUR=2

NODE=M065M;LINKAGE=A
NODE=M065M4;LINKAGE=M
NODE=M065M;LINKAGE=O
NODE=M065M;LINKAGE=C
NODE=M065M;LINKAGE=D

 $\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1660±30	ATKINSON	85B OMEG	$20-70 \gamma p$

NODE=M065M5
NODE=M065M5

 $3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1730±34	¹⁷ FRABETTI	04 E687	$\gamma p \rightarrow 3\pi^+3\pi^-\rho$
1783±15	CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

¹⁷From a fit with two resonances with the JACOB 72 continuum.

NODE=M065M7
NODE=M065M7

NODE=M065M;LINKAGE=PI

 $\rho(1700)$ WIDTH

NODE=M065210

 $\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)	DOCUMENT ID
250±100 OUR ESTIMATE	

NODE=M065W0
NODE=M065W0

→ NOT CHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.			

NODE=M065W6
NODE=M065W6

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

150±30	ANTONELLI	88 DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
282±44	¹⁸ FUKUI	88 SPEC	$8.95 \pi^-p \rightarrow \eta\pi^+\pi^-n$

¹⁸Assuming $\rho^+f_0(1370)$ 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.

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

164 $\pm$ 21 $^{+89}_{-26}$	5.4M	19,20 FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
275 $\pm$ 45		21 ABELE	97 CBAR	$\bar{p}n \rightarrow \pi^- \pi^0 \pi^0$
310 $\pm$ 40		21 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		22 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		23 ASTON	80 OMEG	20-70 $\gamma p \rightarrow p 2\pi$
283 $\pm$ 14		24 ATIYA	79B SPEC	50 $\gamma C \rightarrow C 2\pi$
175 $^{+98}_{-53}$		BECKER	79 ASPK	17 $\pi^- p$ polarized
232 $\pm$ 34		22 LANG	79 RVUE	
340		22 MARTIN	78C RVUE	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
300 $\pm$ 100		22 FROGGATT	77 RVUE	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
180 $\pm$ 50		25 HYAMS	73 ASPK	17 $\pi^- p \rightarrow \pi^+ \pi^- n$

¹⁹ $|F_\pi(0)|^2$ fixed to 1.

²⁰ From the GOUNARIS 68 parametrization of the pion form factor.

²¹ T-matrix pole.

²² From phase shift analysis of HYAMS 73 data.

²³ Simple relativistic Breit-Wigner fit with constant width.

²⁴ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.

²⁵ Included in BECKER 79 analysis.

NODE=M065W1
NODE=M065W1

NODE=M065W1;LINKAGE=FU
NODE=M065W1;LINKAGE=GO
NODE=M065W;LINKAGE=QQ
NODE=M065W;LINKAGE=P
NODE=M065W;LINKAGE=M
NODE=M065W;LINKAGE=R

NODE=M065W;LINKAGE=H

NODE=M065W2
NODE=M065W2

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

187.2 $\pm$ 26.7	27k	26 ABELE	99D CBAR	$\pm$	0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
265 $\pm$ 120	1600	CLELAND	82B SPEC	$\pm$	50 $\pi p \rightarrow K_S^0 K^\pm p$

²⁶ K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

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 $\pm$ 40		27 CORDIER	82 DM1	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
400 $\pm$ 50		28 ASTON	81E OMEG	20-70 $\gamma p \rightarrow p 4\pi$
400 $\pm$ 146		29 DIBIANCA	81 DBC	$\pi^+ d \rightarrow p p 2(\pi^+ \pi^-)$
700 $\pm$ 160		27 BACCI	80 FRAG	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
100	34	KILLIAN	80 SPEC	11 $e^- p \rightarrow 2(\pi^+ \pi^-)$
600		30 ATIYA	79B SPEC	50 $\gamma C \rightarrow C 4\pi^\pm$
340 $\pm$ 160	65	31 ALEXANDER	75 HBC	7.5 $\gamma p \rightarrow p 4\pi$
360 $\pm$ 100		28 CONVERSI	74 OSPK	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
400 $\pm$ 120	160	32 SCHACHT	74 STRC	5.5-9 $\gamma p \rightarrow p 4\pi$
850 $\pm$ 200	340	32 SCHACHT	74 STRC	9-18 $\gamma p \rightarrow p 4\pi$
650 $\pm$ 100	400	BINGHAM	72B HBC	9.3 $\gamma p \rightarrow p 4\pi$

²⁷ Simple relativistic Breit-Wigner fit with model-dependent width.

²⁸ Simple relativistic Breit-Wigner fit with constant width.

²⁹ One peak fit result.

³⁰ Parameters roughly estimated, not from a fit.

³¹ Skew mass distribution compensated by Ross-Stodolsky factor.

³² Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M065W4
NODE=M065W4

OCCUR=2

NODE=M065W;LINKAGE=A
NODE=M065W4;LINKAGE=M
NODE=M065W;LINKAGE=O
NODE=M065W;LINKAGE=C
NODE=M065W;LINKAGE=D
NODE=M065W;LINKAGE=E

 $\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

300 $\pm$ 50	ATKINSON	85B OMEG	20-70 γp

NODE=M065W5
NODE=M065W5

$\omega\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
350 to 580	³³ ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
490 to 1040	³⁴ ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

³³ 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.

³⁴ Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$.

 $3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
315 ± 100	³⁵ FRABETTI	04	E687 $\gamma p \rightarrow 3\pi^+ 3\pi^- p$
285 ± 20	CLEGG	90	RVUE $e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

³⁵ 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

 $\rho(1700) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the cross-section into channel i in e^+e^- annihilation.

 $\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{17}/\Gamma$

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 $e^+e^- \rightarrow 2(\pi^+\pi^-)$

 $\Gamma(\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{11}\Gamma_{17}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13	³⁶ DIEKMAN	88	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
$0.029^{+0.016}_{-0.012}$	KURDADZE	83	OLYA $0.64\text{--}1.4 e^+e^- \rightarrow \pi^+\pi^-$

³⁶ Using total width = 220 MeV.

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;→ NOT CHECKED ←

DESIG=12;OUR EST;→ NOT CHECKED ←

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=7

DESIG=9;OUR EST;→ NOT CHECKED ←

DESIG=15;OUR EST;→ NOT CHECKED ←

DESIG=16;OUR EST;→ NOT CHECKED ←

DESIG=17;OUR EST;→ NOT CHECKED ←

DESIG=18;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=13;OUR EST;→ NOT CHECKED ←

DESIG=10;OUR EST;→ NOT CHECKED ←

DESIG=11;OUR EST;→ NOT CHECKED ←

DESIG=14;OUR EST;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

DESIG=8;OUR EST;→ NOT CHECKED ←

DESIG=6;OUR EST;→ NOT CHECKED ←

NODE=M065225

NODE=M065225

NODE=M065G2
NODE=M065G2

NODE=M065G4
NODE=M065G4

NODE=M065G4;LINKAGE=B

$$\Gamma(K\bar{K}^*(892)+c.c.) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_{17}/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.305 ± 0.071	³⁷ BIZOT	80	DM1 e^+e^-
³⁷ Model dependent.			

NODE=M065G10
NODE=M065G10

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	³⁸ BIZOT	80	DM1 e^+e^-
³⁸ Model dependent.			

NODE=M065G5
NODE=M065G5

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	³⁹ BIZOT	80	DM1 e^+e^-
³⁹ Model dependent.			

NODE=M065G12
NODE=M065G12

NODE=M065G12;LINKAGE=M

$\rho(1700)$ BRANCHING RATIOS

$$\Gamma(\rho\pi\pi)/\Gamma(4\pi) \quad \Gamma_3/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.28 ± 0.06	⁴⁰ ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$
⁴⁰ $\omega\pi$ not included.			

NODE=M065R19
NODE=M065R19

NODE=M065R;LINKAGE=BL

$$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-)) \quad \Gamma_4/\Gamma_2$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1.0		DELCOURT	81B	DM1 $e^+e^- \rightarrow 2(\pi^+\pi^-)$
0.7 ± 0.1	500	SCHACHT	74	STRC $5.5-18 \gamma p \rightarrow p4\pi$
0.80		⁴¹ BINGHAM	72B	HBC $9.3 \gamma p \rightarrow p4\pi$
⁴¹ The $\pi\pi$ system is in S -wave.				

NODE=M065R1
NODE=M065R1

NODE=M065R1;LINKAGE=S

$$\Gamma(\rho^0\pi^0\pi^0)/\Gamma(\rho^\pm\pi^\mp\pi^0) \quad \Gamma_5/\Gamma_6$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.10	ATKINSON	85B	OMEG	$20-70 \gamma p$
< 0.15	ATKINSON	82	OMEG 0	$20-70 \gamma p \rightarrow p4\pi$

NODE=M065R6
NODE=M065R6

$$\Gamma(a_1(1260)\pi)/\Gamma(4\pi) \quad \Gamma_7/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.16 ± 0.05	⁴² ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$
⁴² $\omega\pi$ not included.			

NODE=M065R15
NODE=M065R15

NODE=M065R15;LINKAGE=BL

$$\Gamma(h_1(1170)\pi)/\Gamma(4\pi) \quad \Gamma_8/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.17 ± 0.06	⁴³ ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$
⁴³ $\omega\pi$ not included.			

NODE=M065R16
NODE=M065R16

NODE=M065R16;LINKAGE=BL

$$\Gamma(\pi(1300)\pi)/\Gamma(4\pi) \quad \Gamma_9/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.30 ± 0.10	⁴⁴ ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$
⁴⁴ $\omega\pi$ not included.			

NODE=M065R17
NODE=M065R17

NODE=M065R17;LINKAGE=BL

$\Gamma(\rho\rho)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.09 ± 0.03	⁴⁵ ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
⁴⁵ $\omega \pi$ not included.			

 Γ_{10}/Γ_1

NODE=M065R18
 NODE=M065R18

NODE=M065R18;LINKAGE=BL

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.287^{+0.043}_{-0.042}$	BECKER	79	ASPK $17 \pi^- p$ polarized
0.15 to 0.30	⁴⁶ MARTIN	78C	RVUE $17 \pi^- p \rightarrow \pi^+\pi^- n$
<0.20	⁴⁷ COSTA...	77B	RVUE $e^+e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	⁴⁶ FROGGATT	77	RVUE $17 \pi^- p \rightarrow \pi^+\pi^- n$
<0.15	⁴⁸ EISENBERG	73	HBC $5 \pi^+ p \rightarrow \Delta^{++} 2\pi$
0.25 ± 0.05	⁴⁹ HYAMS	73	ASPK $17 \pi^- p \rightarrow \pi^+\pi^- n$
⁴⁶ From phase shift analysis of HYAMS 73 data.			
⁴⁷ Estimate using unitarity, time reversal invariance, Breit-Wigner.			
⁴⁸ Estimated using one-pion-exchange model.			
⁴⁹ Included in BECKER 79 analysis.			

 Γ_{11}/Γ

NODE=M065R5
 NODE=M065R5

NODE=M065R5;LINKAGE=P
 NODE=M065R5;LINKAGE=C
 NODE=M065R5;LINKAGE=E
 NODE=M065R5;LINKAGE=H

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13 ± 0.05	ASTON	80	OMEG $20-70 \gamma p \rightarrow p 2\pi$
<0.14	⁵⁰ DAVIER	73	STRC $6-18 \gamma p \rightarrow p 4\pi$
<0.2	⁵¹ BINGHAM	72B	HBC $9.3 \gamma p \rightarrow p 2\pi$
⁵⁰ Upper limit is estimate.			
⁵¹ 2σ upper limit.			

 Γ_{11}/Γ_2

NODE=M065R3
 NODE=M065R3

NODE=M065R3;LINKAGE=E
 NODE=M065R3;LINKAGE=S

 $\Gamma(\pi\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.16 ± 0.04	^{52,53} ABELE	01B	CBAR $0.0 \bar{p} n \rightarrow 5\pi$
⁵² Using ABELE 97.			
⁵³ $\omega \pi$ not included.			

 Γ_{12}/Γ_1

NODE=M065R20
 NODE=M065R20

NODE=M065R;LINKAGE=LK
 NODE=M065R20;LINKAGE=BL

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

 Γ_{13}/Γ

NODE=M065R21
 NODE=M065R21

 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma(2(\pi^+\pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.15 ± 0.03	⁵⁴ DELCOURT	81B	DM1 $e^+e^- \rightarrow \bar{K} K \pi$
⁵⁴ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.			

 Γ_{13}/Γ_2

NODE=M065R9
 NODE=M065R9

NODE=M065R9;LINKAGE=D

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
possibly seen		AKHMETSHIN	00D	CMD2 $e^+e^- \rightarrow \eta \pi^+ \pi^-$
<0.04		DONNACHIE	87B	RVUE
<0.02	58	ATKINSON	86B	OMEG $20-70 \gamma p$

 Γ_{14}/Γ

NODE=M065R12
 NODE=M065R12

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.123 ± 0.027	DELCOURT	82	DM1 $e^+e^- \rightarrow \pi^+ \pi^- \text{MM}$
~ 0.1	ASTON	80	OMEG $20-70 \gamma p$

 Γ_{14}/Γ_2

NODE=M065R8
 NODE=M065R8

$$\Gamma(\pi^+\pi^- \text{ neutrals})/\Gamma(2(\pi^+\pi^-)) \quad (\Gamma_5+\Gamma_6+0.714\Gamma_{14})/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.6±0.4	⁵⁵ BALLAM	74	HBC 9.3 γp

⁵⁵ Upper limit. Background not subtracted.

NODE=M065R7
NODE=M065R7

NODE=M065R7;LINKAGE=U

$$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

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

$$\Gamma(K\bar{K})/\Gamma(2(\pi^+\pi^-)) \quad \Gamma_{16}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.015±0.010		⁵⁶ DELCOURT	81B	DM1	$e^+e^- \rightarrow \bar{K}K$
<0.04	95	BINGHAM	72B	HBC	0 9.3 γp

⁵⁶ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

NODE=M065R4
NODE=M065R4

NODE=M065R4;LINKAGE=D

$$\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892)+\text{c.c.}) \quad \Gamma_{16}/\Gamma_{13}$$

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

$$\Gamma(\pi^0\omega)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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

FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
FRABETTI	04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	00I	PL B486 29	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)
DUBNICKA	89	JPG 15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
ATKINSON	86B	ZPHY C30 531	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ATKINSON	85B	ZPHY C26 499	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ERKAL	85	ZPHY C29 485	C. Erkal, M.G. Olsson	(WISC)
ABE	84B	PRL 53 751	K. Abe <i>et al.</i>	
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)
Translated from ZETFP 37 613.				
ATKINSON	82	PL 108B 55	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
CORDIER	82	PL 109B 129	A. Cordier <i>et al.</i>	(LALO)
DELCOURT	82	PL 113B 93	B. Delcourt <i>et al.</i>	(LALO)
ASTON	81E	NP B189 15	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)
Also		PL 109B 129	A. Cordier <i>et al.</i>	(LALO)
DIBIANCA	81	PR D23 595	F.A. di Bianca <i>et al.</i>	(CASE, CMU)
ASTON	80	PL 92B 215	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
BACCI	80	PL 95B 139	C. Bacci <i>et al.</i>	(ROMA, FRAS)
BIZOT	80	Madison Conf. 546	J.C. Bizot <i>et al.</i>	(LALO, MONP)
KILLIAN	80	PR D21 3005	T.J. Killian <i>et al.</i>	(CORN)
ATIYA	79B	PRL 43 1691	M.S. Atiya <i>et al.</i>	(COLU, ILL, FNAL)
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parada	(GRAZ)
MARTIN	78C	ANP 114 1	A.D. Martin, M.R. Pennington	(CERN)
COSTA...	77B	PL 71B 345	B. Costa de Beauregard, B. Pire, T.N. Truong	(EPOL)
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)
ALEXANDER	75	PL 57B 487	G. Alexander <i>et al.</i>	(TELA)
BALLAM	74	NP B76 375	J. Ballam <i>et al.</i>	(SLAC, LBL, MPIM)
CONVERSI	74	PL 52B 493	M. Conversi <i>et al.</i>	(ROMA, FRAS)
SCHACHT	74	NP B81 205	P. Schacht <i>et al.</i>	(MPIM)
DAVIER	73	NP B58 31	M. Davier <i>et al.</i>	(SLAC)
EISENBERG	73	PL 43B 149	Y. Eisenberg <i>et al.</i>	(REHO)
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
BINGHAM	72B	PL 41B 635	H.H. Bingham <i>et al.</i>	(LBL, UCB, SLAC) IGJP
JACOB	72	PR D5 1847	M. Jacob, R. Slansky	
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

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REFID=21426
REFID=49668
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

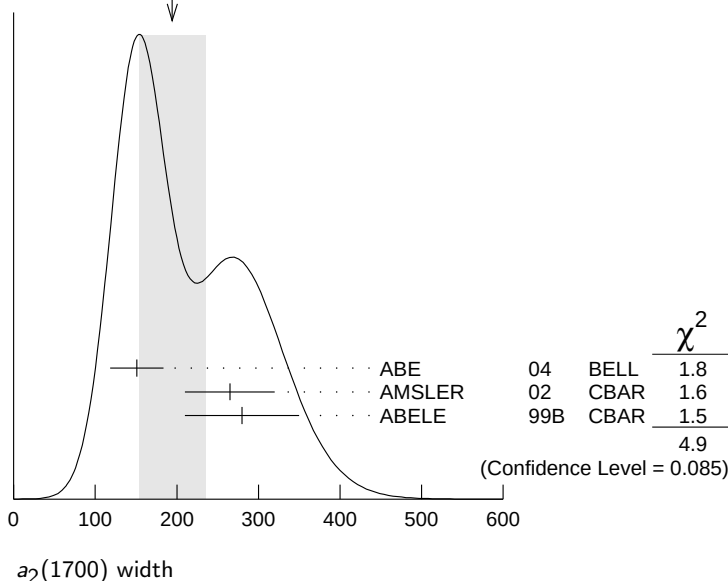
NODE=M162W

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;→ NOT CHECKED ←
DESIG=1
DESIG=2
DESIG=3
DESIG=5;OUR EST;→ NOT CHECKED ←
DESIG=6;OUR EVAL;→ NOT CHECKED ←
DESIG=7;OUR EVAL;→ NOT CHECKED ←

$a_2(1700)$ 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	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
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=M162G2

NODE=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>
LU	05	PRL 94 032002	M. Lu <i>et al.</i>
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>
AMSLER	02	EPJ C23 29	C. AMSler <i>et al.</i>
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>
ABELE	99B	EPJ C8 67	A. Abele <i>et al.</i>
GRYGOREV	99	PAN 62 470	V.K. Grygorev <i>et al.</i>
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>

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

 $f_0(1710)$

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

See our mini-review in the 2004 edition of this *Review*, Physics Letters **B592** 1 (2004). See also the mini-review on scalar mesons under $f_0(500)$ (see the index for the page number).

NODE=M068

 $f_0(1710)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1720 ± 6	OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.		
$1701 \pm 5 \begin{smallmatrix} +9 \\ -2 \end{smallmatrix}$	4k	¹ CHEKANOV	08 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
$1765 \begin{smallmatrix} +4 \\ -3 \end{smallmatrix} \pm 13$		ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1760 \pm 15 \begin{smallmatrix} +15 \\ -10 \end{smallmatrix}$		² ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1738 ± 30		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
$1740 \pm 4 \begin{smallmatrix} +10 \\ -25 \end{smallmatrix}$		³ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
$1740 \begin{smallmatrix} +30 \\ -25 \end{smallmatrix}$		³ BAI	00A BES	$J/\psi \rightarrow \gamma (\pi^+ \pi^- \pi^+ \pi^-)$
1698 ± 18		⁴ BARBERIS	00E	$450 p p \rightarrow p_f \eta \eta p_S$
$1710 \pm 12 \pm 11$		⁵ BARBERIS	99D OMEG	$450 p p \rightarrow K^+ K^-, \pi^+ \pi^-$
1710 ± 25		⁶ FRENCH	99	$300 p p \rightarrow p_f (K^+ K^-) p_S$
1707 ± 10		⁷ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
1698 ± 15		⁷ AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1720 \pm 10 \pm 10$		⁸ BALTRUSAIT.	87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$
1742 ± 15		⁷ WILLIAMS	84 MPSF	$200 \pi^- N \rightarrow 2 K_S^0 X$
1670 ± 50		BLOOM	83 CBAL	$J/\psi \rightarrow \gamma 2\eta$

NODE=M068M

NODE=M068M

• • • 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	$J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=2
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	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$	OCCUR=2
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 $pp \rightarrow ppK_S^0 K_S^0$	OCCUR=2
1700±15		⁸ BOLONKIN	88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	
1720±60		³ BOLONKIN	88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	OCCUR=2
1638±10		²¹ FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	
1690± 4		²² FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	OCCUR=2
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 $\pi^- p \rightarrow n2K_S^0$	

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.

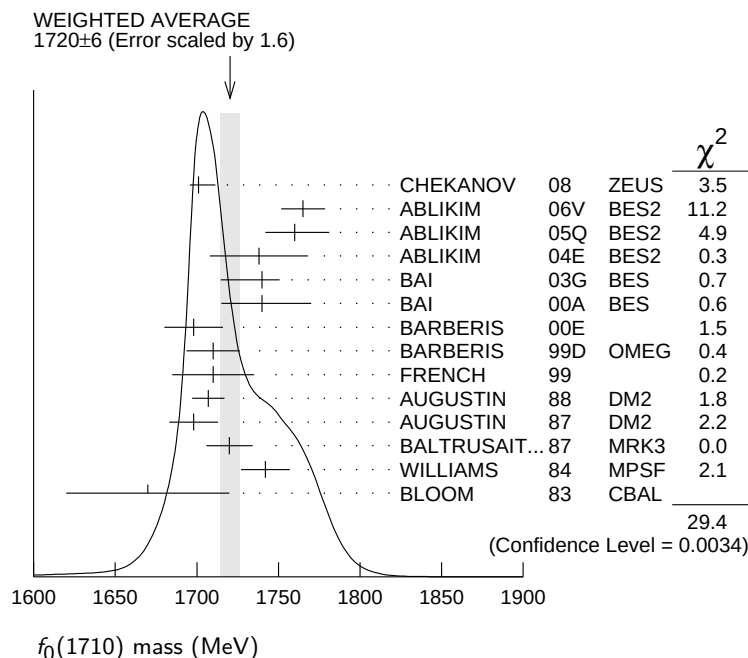
²⁷ Superseded by LONGACRE 86.

NODE=M068M;LINKAGE=A9

NODE=M068M;LINKAGE=B2

NODE=M068M;LINKAGE=E

NODE=M068M;LINKAGE=B1



$f_0(1710)$ WIDTH

NODE=M068W

NODE=M068W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
135 ± 8	OUR AVERAGE	Error includes scale factor of 1.1.		
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	$^{+15}_{-10}$	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		AMSLER 06	CBAR	1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$
188 ± 13	80k	^{29,37} UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
250 ± 30		VLADIMIRSK... 06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
270 ± 60		³⁸ ABLIKIM 05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
260 ± 50		²⁹ BINON 05	GAMS	33 $\pi^- p \rightarrow \eta \eta n$
38 ± 20	74	³⁷ CHEKANOV 04	ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
144 ± 30		^{39,40} ANISOVICH 03	RVUE	
320 ± 50		^{40,41} ANISOVICH 03	RVUE	
102 ± 26		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
267 ± 44	3651	^{30,42} NICHITIU 02	OBLX	
220 ± 40		^{43,44} ANISOVICH 99B	SPEC	0.6–1.2 $p \bar{p} \rightarrow \eta \eta \pi^0$
100 ± 25		³⁰ BARBERIS 99	OMEG	450 $p p \rightarrow p_s p_f K^+ K^-$

OCCUR=2

160 ± 30	30 BARBERIS	99B OMEG	450 $pp \rightarrow p_S p_f \pi^+ \pi^-$	
250 ± 140	45 ANISOVICH	98B RVUE	Compilation	
30 ± 7	46 BARKOV	98	$\pi^- p \rightarrow K_S^0 K_S^0 n$	
103 ± 18	35 BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$	
85 ± 24	30 BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$	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	$pp \rightarrow pp \pi^+ \pi^- \pi^+ \pi^-$	
< 80 90% CL	48 ALDE	92D GAM2	$38 \pi^- p \rightarrow \eta \eta N^*$	
181 ± 30	49 ARMSTRONG	89D OMEG	$300 pp \rightarrow pp K^+ K^-$	
104 ± 30	49 ARMSTRONG	89D OMEG	$300 pp \rightarrow pp K_S^0 K_S^0$	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.

NODE=M068W;LINKAGE=HE

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=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

NODE=M068215;NODE=M068

$f_0(1710)$ DECAY MODES

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;→ NOT CHECKED ←
DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=5;OUR EST;→ NOT CHECKED ←
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
<110	95	⁵⁶ BEHREND	89C	CELL $\gamma\gamma \rightarrow K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<480	95	ALBRECHT	90G	ARG $\gamma\gamma \rightarrow K^+ K^-$
<280	95	⁵⁶ ALTHOFF	85B	TASS $\gamma\gamma \rightarrow K \bar{K} \pi$
⁵⁶ Assuming helicity 2.				

NODE=M068G2
NODE=M068G2

NODE=M068G2;LINKAGE=F

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_4 / \Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.82	95	⁵⁷ BARATE	00E	ALEP $\gamma\gamma \rightarrow \pi^+ \pi^-$
⁵⁷ Assuming spin 0.				

NODE=M068G3
NODE=M068G3

NODE=M068G;LINKAGE=Z

 $f_0(1710) \text{ BRANCHING RATIOS}$

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	COMMENT
• • • 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	95	⁶⁰ ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$
$5.8^{+9.1}_{-5.5}$		⁶¹ ANISOVICH	02D	SPEC Combined fit
$0.2 \pm 0.024 \pm 0.036$		BARBERIS	99D	OMEG 450 $p p \rightarrow K^+ K^-, \pi^+ \pi^-$
0.39 ± 0.14		ARMSTRONG	91	OMEG 300 $p p \rightarrow p p \pi \pi, p p K \bar{K}$

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 $p p \rightarrow p_f \eta \eta p_s$
• • • 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 $300 \pi^- p \rightarrow \pi^- p \eta \eta$

NODE=M068R7
NODE=M068R7 $\Gamma(\omega\omega) / \Gamma_{\text{total}}$ Γ_5 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	180	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma \omega \omega$

NODE=M068R3
NODE=M068R3⁵⁸ From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2.

NODE=M068R;LINKAGE=L

⁵⁹ Fit with constrained inelasticity.⁶⁰ Using data from ABLIKIM 04A.NODE=M068R;LINKAGE=M
NODE=M068R;LINKAGE=AB
NODE=M068R;LINKAGE=CH⁶¹ From a combined K-matrix analysis of Crystal Barrel ($0. p \bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta \eta n, \eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.⁶² Combining results of GAM4 with those of ARMSTRONG 89D.

NODE=M068R;LINKAGE=A

f₀(1710) REFERENCES

NODE=M068

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
1756 ± 9 OUR AVERAGE				
1744 ± 10 ± 15	1045	¹ ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
1760 ± 11	320	² BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M114M

¹ From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.

² Estimated by us from various fits.

NODE=M114M;LINKAGE=MA
NODE=M114M;LINKAGE=A

 $\eta(1760)$ WIDTH

NODE=M114W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
96 ± 70 OUR AVERAGE Error includes scale factor of 5.1.				
244 ⁺²⁴ ₋₂₁ ± 25	1045	³ ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
60 ± 16	320	⁴ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M114W

³ From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.

⁴ Estimated by us from various fits.

NODE=M114W;LINKAGE=MA
NODE=M114W;LINKAGE=B

 $\eta(1760)$ REFERENCES

NODE=M114

ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40012
BALTRUSAITIS...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAITIS...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095

NODE=M075

 $\pi(1800)$

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

See also minireview under non- $q\bar{q}$ candidates in PDG 06, Journal of Physics, G **33** 1 (2006).

NODE=M075

 $\pi(1800)$ MASS

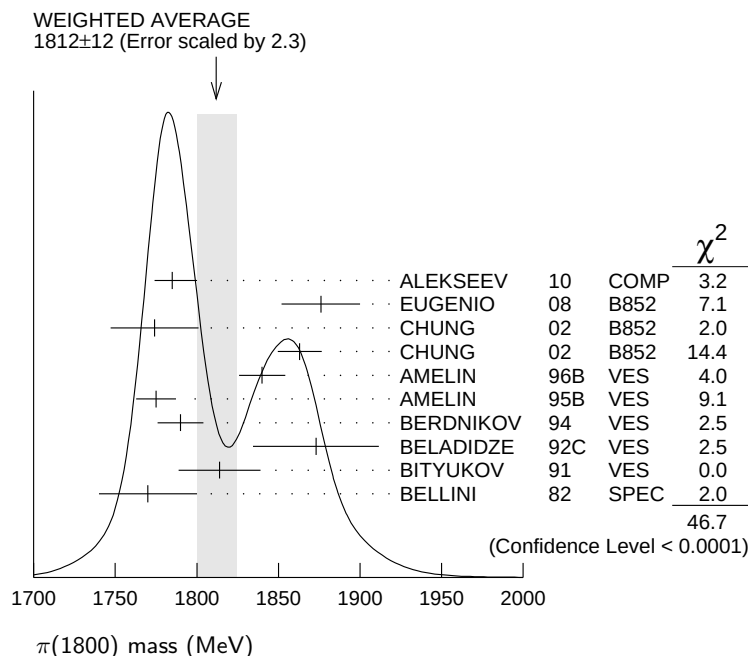
NODE=M075M

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

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.



$\pi(1800)$ 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	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

⁶ From a single-pole fit.

⁷ In the $f_0(980)\pi$ wave.

⁸ In the $f_0(500)\pi$ wave.

⁹ From a fit to $J^{PC} = 0^{-+} f_0(980)\pi, f_0(1370)\pi$ waves.

¹⁰ From a fit to $J^{PC} = 0^{-+} K_0^*(1430)K^-$ and $f_0(980)\pi^-$ waves.

$\pi(1800)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi^+ \pi^- \pi^-$	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=M075M;LINKAGE=SP
 NODE=M075M;LINKAGE=C1
 NODE=M075M;LINKAGE=C2
 NODE=M075M;LINKAGE=AX
 NODE=M075M;LINKAGE=A

NODE=M075W

NODE=M075W

OCCUR=2

NODE=M075W;LINKAGE=SP
 NODE=M075W;LINKAGE=C1
 NODE=M075W;LINKAGE=C2
 NODE=M075W;LINKAGE=AX
 NODE=M075W;LINKAGE=A

NODE=M075215;NODE=M075

DESIG=10;OUR EST;→ NOT CHECKED ←
 DESIG=11;OUR EST;→ NOT CHECKED ←
 DESIG=3;OUR EST;→ NOT CHECKED ←
 DESIG=1
 DESIG=12
 DESIG=2
 DESIG=7;OUR EST;→ NOT CHECKED ←

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;→ NOT CHECKED ←
DESIG=13
DESIG=14
DESIG=15
DESIG=6;OUR EST;→ NOT CHECKED ←
DESIG=8;OUR EST;→ NOT CHECKED ←
DESIG=4
DESIG=9

$\pi(1800)$ BRANCHING RATIOS

NODE=M075220

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(500)\pi^-)$ Γ_3/Γ_2

NODE=M075R11
NODE=M075R11

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
$0.44 \pm 0.08 \pm 0.38$	¹¹ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(1370)\pi^-)$ Γ_3/Γ_4

NODE=M075R5
NODE=M075R5

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	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ

NODE=M075R1
NODE=M075R1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	BELLINI	82	SPEC	$40 \pi^- A \rightarrow 3\pi A$

$\Gamma(f_0(1500)\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

NODE=M075R12
NODE=M075R12

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

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

NODE=M075R2
NODE=M075R2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	BELLINI	82	SPEC	$40 \pi^- A \rightarrow 3\pi A$

$\Gamma(\rho\pi^-)/\Gamma(f_0(980)\pi^-)$ Γ_6/Γ_3

NODE=M075R6
NODE=M075R6

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	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

$\Gamma(\eta\eta\pi^-)/\Gamma(\pi^+\pi^-\pi^-)$ Γ_7/Γ_1

NODE=M075R8
NODE=M075R8

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	$37 \pi^- A \rightarrow \eta\eta\pi^- A$

$\Gamma(a_2(1320)\eta)/\Gamma_{\text{total}}$ Γ_9/Γ

NODE=M075R13
NODE=M075R13

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$

$\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ

NODE=M075R14
NODE=M075R14

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

NODE=M075R15
NODE=M075R15

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$

$\Gamma(f_0(1500)\pi^-)/\Gamma(a_0(980)\eta)$ Γ_{12}/Γ_8

NODE=M075R7
NODE=M075R7

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	$0.6-1.94 p\bar{p} \rightarrow \eta\eta\pi^0\pi^0$
0.08 ± 0.03	1200	^{12,14} AMELIN	96B	VES	$37 \pi^- A \rightarrow \eta\eta\pi^- A$

$\Gamma(\eta\eta'(958)\pi^-)/\Gamma(\eta\eta\pi^-)$ 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	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01B	PL B500 222	A.V. Anisovich <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
AMELIN	96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL) IGJPC
		Translated from YAF 59 1021.		
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. 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 -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	$8 \pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$

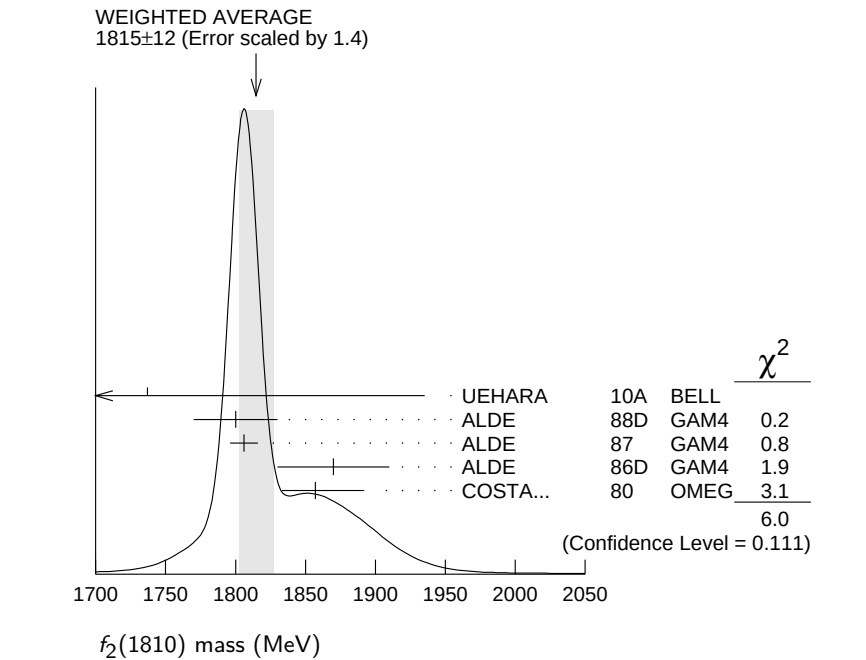
¹ Breit-Wigner mass.² Seen in only one solution.³ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.⁵ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2\pi^0$. 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 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

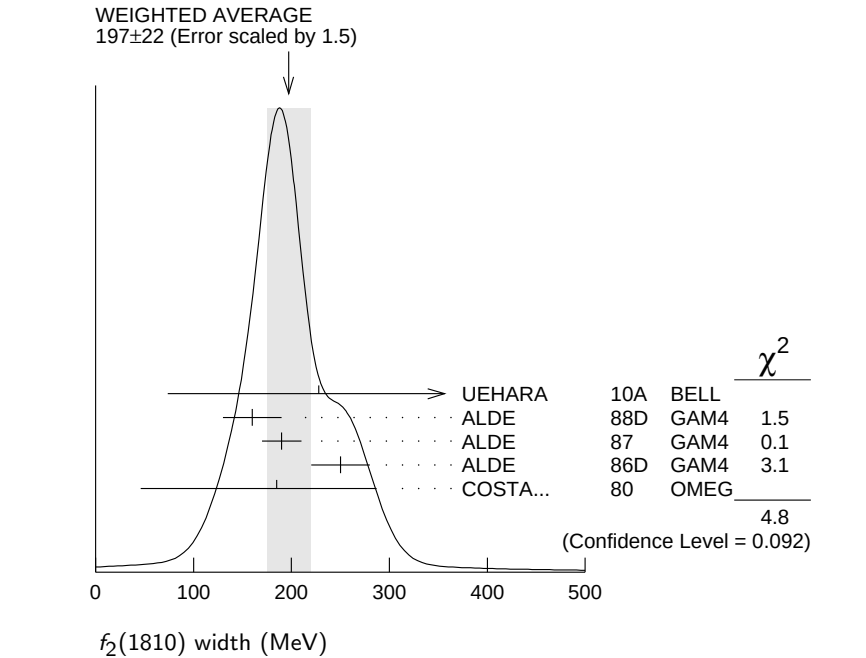
⁶ Breit-Wigner width.
⁷ Seen in only one solution.
⁸ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
⁹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
¹⁰ From an amplitude analysis of 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;→ NOT CHECKED ←
DESIG=1
DESIG=5;OUR EST;→ NOT CHECKED ←

$f_2(1810)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_5/\Gamma$
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.

NODE=M038R2;LINKAGE=L

¹³ Included in LONGACRE 86 global analysis.

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)
		Translated from DANS 353 323.		
ALDE	88D	SJNP 47 810	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
		Translated from YAF 47 1273.		
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
COSTA...	80	NP B175 402	G. Costa de Beauregard <i>et al.</i>	(BARI, BONN+)

NODE=M038

REFID=53641
 REFID=52166
 REFID=48580
 REFID=45386

REFID=44652

REFID=40221
 REFID=20765
 REFID=20768
 REFID=20746
 REFID=20737

 $X(1835)$

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

OMITTED FROM SUMMARY TABLE

Could be a superposition of several states.

NODE=M085

NODE=M085

 $X(1835)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1835.7^{+5.0}_{-3.2}$ OUR AVERAGE				
[$1835.7^{+4.0}_{-3.1}$ MeV OUR 2011 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. • • •				
$1877.3 \pm 6.3^{+3.4}_{-7.4}$		² ABLIKIM	11J	BES3 $J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
$1837^{+10}_{-12} \pm 9_{-7}$	231	^{3,4} ALEXANDER	10	CLEO $J/\psi \rightarrow \gamma p \bar{p}$
1831 ± 7		^{4,5} ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma p \bar{p}$
$1859^{+3}_{-10} \pm 5_{-25}$		⁴ BAI	03F	BES2 $J/\psi \rightarrow \gamma p \bar{p}$

NODE=M085M

NODE=M085M

NEW

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 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

³ 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

⁴ 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 $\bar{B}^0 \rightarrow p\bar{p} D^0$, and WEI 08 in $B^+ \rightarrow p\bar{p} \pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow p\bar{p} \gamma$.

NODE=M085M;LINKAGE=HF

⁵From the fit including final state interaction effects in isospin 0 S-wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085M;LINKAGE=AB

X(1835) WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
99 ± 50	OUR AVERAGE	Error includes scale factor of 2.8.			
190 ± 9 ⁺³⁸ ₋₃₆		4265	⁶ 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. • • •					
57 ± 12 ⁺¹⁹ ₋₄			⁷ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
0 ⁺⁴⁴ ₋₀		231	^{8,9} ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma p \bar{p}$
< 153	90		^{9,10} ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma p \bar{p}$
< 30			⁹ BAI	03F BES2	$J/\psi \rightarrow \gamma p \bar{p}$

NODE=M085W

NODE=M085W

OCCUR=2

NODE=M085W;LINKAGE=AI

NODE=M085W;LINKAGE=BL

NODE=M085W;LINKAGE=AE

NODE=M085W;LINKAGE=HF

NODE=M085W;LINKAGE=AB

⁶From 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 $J/\psi \rightarrow \pi^0 \pi^+ \pi^- \eta'$.

⁷The 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 $\eta_2(1870)$.

⁸From 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.

⁹Evidence for a threshold enhancement in the $p \bar{p}$ mass spectrum was also reported by ABE 02K, AUBERT,B 05L, and WANG 05A in $B^+ \rightarrow p \bar{p} K^+$, WANG 05A in $B^0 \rightarrow p \bar{p} K_S^0$, ABE 02W in $\bar{B}^0 \rightarrow p \bar{p} D^0$, and WEI 08 in $B^+ \rightarrow p \bar{p} \pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow p \bar{p} \gamma$.

¹⁰From the fit including final state interaction effects in isospin 0 S-wave according to SIBIRTSEV 05A. Systematic errors not estimated.

X(1835) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $p \bar{p}$	seen
Γ_2 $\pi^+ \pi^- \eta'$	seen

NODE=M085215;NODE=M085

DESIG=1;OUR EVAL;→ NOT CHECKED ←

DESIG=2;OUR EVAL;→ NOT CHECKED ←

X(1835) BRANCHING RATIOS

$\Gamma(p \bar{p})/\Gamma(\pi^+ \pi^- \eta')$	Γ_1/Γ_2
VALUE	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.333	ABLIKIM 05R BES2 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M085220

NODE=M085R01

NODE=M085R01

X(1835) REFERENCES

ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BES III Collab.)
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
WEI	08	PL B659 80	J.-T. Wei <i>et al.</i>	(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 051101R	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=53684

REFID=53931

REFID=53525

REFID=52086

REFID=50993

REFID=50985

REFID=50827

REFID=51038

REFID=50651

REFID=49473

REFID=48690

REFID=48980

NODE=M054

$\phi_3(1850)$

$I^G(J^{PC}) = 0^-(3^{--})$

$\phi_3(1850)$ 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;→ NOT CHECKED ←
DESIG=2;OUR EST;→ NOT CHECKED ←

$\phi_3(1850)$ 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

DESIG=1

DESIG=4

DESIG=8

DESIG=2

DESIG=9

NODE=M101225;NODE=M101

 $\eta_2(1870)$ 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

$\rho(1900)$

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

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. **$\rho(1900) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$**

VALUE (units 10^{-8})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4.2 \pm 1.2 \pm 0.8$	54	⁷ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$

⁷ From the fit with two resonances. **$\rho(1900)$ 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 NN	not seen

 $\rho(1900)$ BRANCHING RATIOS

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	AGNELLO	02 OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^- \pi^0$
seen	FRABETTI	01 E687	$\gamma p \rightarrow 3\pi^+ 3\pi^- p$
seen	ANTONELLI	96 SPEC	$e^+ e^- \rightarrow \text{hadrons}$

 $\rho(1900)$ REFERENCES

AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)
FRABETTI	04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AGNELLO	02	PL B527 39	M. Agnello <i>et al.</i>	(OBELIX Collab.)
FRABETTI	01	PL B514 240	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ANTONELLI	96	PL B365 427	A. Antonelli <i>et al.</i>	(FENICE Collab.)
JACOB	72	PR D5 1847	M. Jacob, R. Slansky	

NODE=M170

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;→ NOT CHECKED ←

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=6

DESIG=7

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=3;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

NODE=M170230

NODE=M170R1

NODE=M170R1

NODE=M170

REFID=52242

REFID=51047

REFID=49614

REFID=48576

REFID=48350

REFID=44633

REFID=49668

$f_2(1910)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

We list here three different peaks with close masses and widths seen in the mass distributions of $\omega\omega$, $\eta\eta'$, and K^+K^- final states. ALDE 91B argues that they are of different nature.

NODE=M142

NODE=M142

 $f_2(1910)$ MASS

NODE=M142205

NODE=M142MX

 $f_2(1910)$ $\omega\omega$ MODE

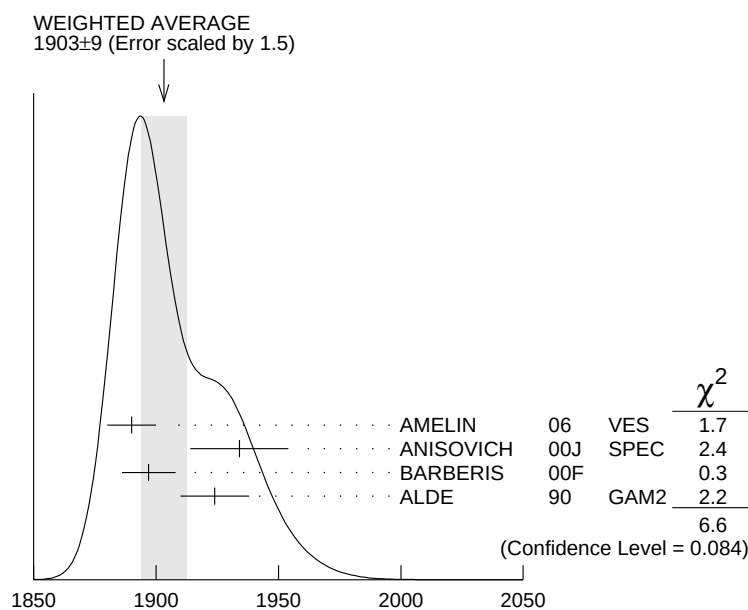
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1903 ± 9 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
1890 ± 10	¹ AMELIN	06 VES	36 $\pi^- p \rightarrow \omega\omega n$
1934 ± 20	ANISOVICH	00J SPEC	
1897 ± 11	BARBERIS	00F	450 $pp \rightarrow p_f \omega\omega p_s$
1924 ± 14	ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega\omega n$

NODE=M142M2

NODE=M142M2

¹Supersedes 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 ± 16	² BARBERIS	00A	450 $pp \rightarrow p_f \eta\eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1911 ± 10	ALDE	91B GAM2	38 $\pi^- p \rightarrow \eta\eta' n$

²Also compatible with $J^{PC}=1^-+$.

NODE=M142M3

NODE=M142M3

NODE=M142M3;LINKAGE=KS

 $f_2(1910)$ K^+K^- MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1941 ± 18	AMSLER	06 CBAR	1.64 $\bar{p}p \rightarrow K^+K^-\pi^0$

NODE=M142M4

NODE=M142M4

 $f_2(1910)$ WIDTH

NODE=M142210

NODE=M142WX

 $f_2(1910)$ $\omega\omega$ MODE

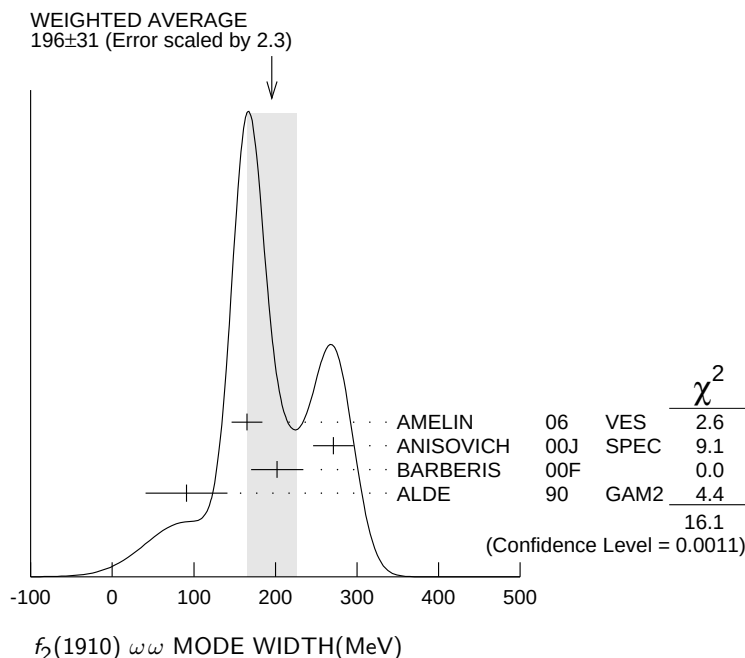
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
196 ± 31 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.		
165 ± 19	³ AMELIN	06 VES	36 $\pi^- p \rightarrow \omega\omega n$
271 ± 25	ANISOVICH	00J SPEC	
202 ± 32	BARBERIS	00F	450 $pp \rightarrow p_f \omega\omega p_s$
91 ± 50	ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega\omega n$

NODE=M142W2

NODE=M142W2

³Supersedes BELADIDZE 92B.

NODE=M142W2;LINKAGE=AM

 **$f_2(1910) \eta\eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
141±41	⁴ BARBERIS	00A	450 $p p \rightarrow p_f \eta \eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
90±35	ALDE	91B	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$
⁴ Also compatible with $J^{PC}=1^-+$.			

NODE=M142W3
NODE=M142W3 **$f_2(1910) K^+ K^-$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
120±40	AMSLER	06	CBAR 1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$

NODE=M142W4
NODE=M142W4 **$f_2(1910)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi^0 \pi^0$	
$\Gamma_2 K^+ K^-$	seen
$\Gamma_3 K_S^0 K_S^0$	
$\Gamma_4 \eta \eta$	seen
$\Gamma_5 \omega \omega$	seen
$\Gamma_6 \eta \eta'$	seen
$\Gamma_7 \eta' \eta'$	
$\Gamma_8 \rho \rho$	seen
$\Gamma_9 a_2(1320) \pi$	seen
$\Gamma_{10} f_2(1270) \eta$	seen

NODE=M142215;NODE=M142

DESIG=6

DESIG=11

DESIG=8

DESIG=3;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

DESIG=9

DESIG=10;OUR EST;→ NOT CHECKED ←

DESIG=12;OUR EST;→ NOT CHECKED ←

DESIG=13;OUR EST;→ NOT CHECKED ←

 $f_2(1910)$ BRANCHING RATIOS **$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$**

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	AMSLER	06	CBAR 1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$	

NODE=M142225

NODE=M142R11
NODE=M142R11 **$\Gamma(\pi^0 \pi^0)/\Gamma(\eta \eta')$**

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_6
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.1	ALDE	89	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$	

NODE=M142R4
NODE=M142R4

$\Gamma(K_S^0 K_S^0)/\Gamma(\eta\eta')$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.066	90	BALOSHIN	86	SPEC $40\pi p \rightarrow K_S^0 K_S^0 n$

Γ_3/Γ_6

NODE=M142R7
NODE=M142R7

$\Gamma(\eta\eta)/\Gamma(\eta\eta')$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.05	90	ALDE	91B	GAM2 $38\pi^- p \rightarrow \eta\eta' n$

Γ_4/Γ_6

NODE=M142R6
NODE=M142R6

$\Gamma(\omega\omega)/\Gamma(\eta\eta')$

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.6 ± 0.6	BARBERIS 00F	$450 p p \rightarrow p_f \omega \omega p_S$

Γ_5/Γ_6

NODE=M142R10
NODE=M142R10

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
probably not seen	BARBERIS 00A		$450 p p \rightarrow p_f \eta' \eta' p_S$
possibly seen	BELADIDZE 92D	VES	$37\pi^- p \rightarrow \eta' \eta' n$

Γ_7/Γ

NODE=M142R8
NODE=M142R8

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

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.6 ± 0.4	BARBERIS 00F	$450 p p \rightarrow p_f \omega \omega p_S$

Γ_8/Γ_5

NODE=M142R9
NODE=M142R9

$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.09 ± 0.05	⁵ ANISOVICH 11	SPEC	$0.9-1.94 p \bar{p}$

Γ_{10}/Γ_9

NODE=M142R12
NODE=M142R12

⁵ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M142R12;LINKAGE=AN

$f_2(1910)$ REFERENCES

ANISOVICH 11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
AMELIN 06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
Translated from YAF 69 715.			
AMSLER 06	PL B639 165	C. Amsler <i>et al.</i>	(CBAR Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
ANISOVICH 00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS 00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT 96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE 92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)
BELADIDZE 92D	ZPHY C57 13	G.M. Beladidze <i>et al.</i>	(VES Collab.)
ALDE 91B	SJNP 54 455	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
Translated from YAF 54 751.			
Also	PL B276 375	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
ALDE 90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE 89	PL B216 447	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
Also	SJNP 48 1035	D.M. Alde <i>et al.</i>	(BELG, SERP, LANL, LAPP)
Translated from YAF 48 1724.			
BALOSHIN 86	SJNP 43 959	O.N. Baloshin <i>et al.</i>	(ITEP)
Translated from YAF 43 1487.			

NODE=M142

REFID=53631
REFID=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 $f_4(2050)$.

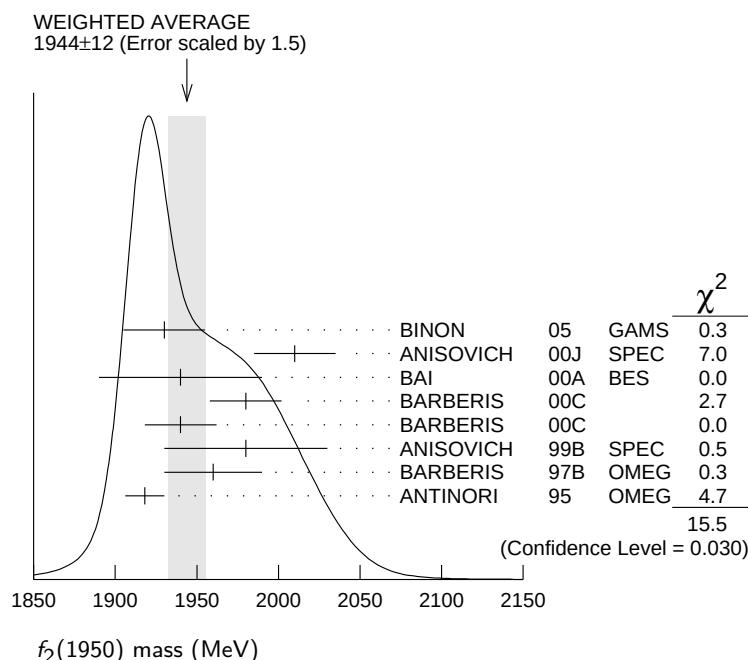
⁵ T-matrix pole.

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;→ NOT CHECKED ←
 DESIG=10;OUR EST;→ NOT CHECKED ←
 DESIG=7;OUR EST;→ NOT CHECKED ←
 DESIG=3
 DESIG=4
 DESIG=5
 DESIG=6;OUR EST;→ NOT CHECKED ←
 DESIG=8;OUR EST;→ NOT CHECKED ←
 DESIG=9;OUR EST;→ NOT CHECKED ←
 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=M135220

NODE=M135R3
 NODE=M135R3

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

VALUE	CL%	DOCUMENT ID	COMMENT

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

$<5.0 \times 10^{-3}$	90	BARBERIS	00E 450 $p\bar{p} \rightarrow p_f \eta \eta p_S$

 Γ_9/Γ_5

NODE=M135R5
NODE=M135R5

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.14±0.05	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$

 Γ_9/Γ_3

NODE=M135R6
NODE=M135R6

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen	111	ALEXANDER	10	CLEO $\psi(2S) \rightarrow \gamma p \bar{p}$

 Γ_{12}/Γ

NODE=M135R07
NODE=M135R07

 $f_2(1950)$ REFERENCES

ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ANISOVICH	99B	PL B449 154	A.V. Anisovich <i>et al.</i>	
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ASTON	91	NPBPS B21 5	D. Aston <i>et al.</i>	(LASS Collab.)

NODE=M135

REFID=53525
REFID=52761
REFID=50780

REFID=49650
REFID=48580
REFID=47950
REFID=47426
REFID=47958
REFID=47959
REFID=47961
REFID=46886
REFID=45758
REFID=45212
REFID=44437
REFID=45210
REFID=41746

 $\rho_3(1990)$

$$I^G(J^{PC}) = 1^+(3^--)$$

OMITTED FROM SUMMARY TABLE

NODE=M167

 $\rho_3(1990)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1982 ± 14	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
~ 2007	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167M

NODE=M167M

NODE=M167M;LINKAGE=AY

 $\rho_3(1990)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

188 ± 24	² ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
~ 287	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$

² From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167W

NODE=M167W

NODE=M167W;LINKAGE=AY

 $\rho_3(1990)$ REFERENCES

ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M167

REFID=48828
REFID=48327
REFID=48349
REFID=47950
REFID=44103

$f_2(2010)$

$I^G(J^{PC}) = 0^+(2^{++})$

NODE=M106

$f_2(2010)$ MASS

NODE=M106M

NODE=M106M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2011^{+62}_{-76}	¹ ETKIN	88 MPS	$22 \pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2005 ± 12	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1980 ± 20	² BOLONKIN	88 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
2050^{+90}_{-50}	ETKIN	85 MPS	$22 \pi^- p \rightarrow 2 \phi n$
2120^{+20}_{-120}	LINDENBAUM	84 RVUE	
2160 ± 50	ETKIN	82 MPS	$22 \pi^- p \rightarrow 2 \phi n$
¹ Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 98^{+1}_{-3} , 0^{+1}_{-0} , and 2^{+2}_{-1} , respectively.			
² Statistically very weak, only 1.4 s.d.			

NODE=M106M;LINKAGE=C

NODE=M106M;LINKAGE=E

$f_2(2010)$ WIDTH

NODE=M106W

NODE=M106W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
202^{+67}_{-62}	³ ETKIN	88 MPS	$22 \pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
209 ± 32	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
145 ± 50	⁴ BOLONKIN	88 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
200^{+160}_{-50}	ETKIN	85 MPS	$22 \pi^- p \rightarrow 2 \phi n$
300^{+150}_{-50}	LINDENBAUM	84 RVUE	
310 ± 70	ETKIN	82 MPS	$22 \pi^- p \rightarrow 2 \phi n$
³ Includes data of ETKIN 85.			
⁴ Statistically very weak, only 1.4 s.d.			

NODE=M106W;LINKAGE=C

NODE=M106W;LINKAGE=E

$f_2(2010)$ DECAY MODES

NODE=M106215;NODE=M106

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi \phi$	seen
$\Gamma_2 \quad K \bar{K}$	seen

DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=2

$f_2(2010)$ BRANCHING RATIOS

NODE=M106230

NODE=M106R01
NODE=M106R01

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
VALUE				
seen	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$	

$f_2(2010)$ REFERENCES

NODE=M106

REFID=51191

REFID=40580
REFID=40285
REFID=21871
REFID=21869
REFID=21866
REFID=21867

VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
BOLONKIN 88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)
ETKIN 88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
ETKIN 85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM 84	CNPP 13 285	S.J. Lindenbaum	(CUNY)
ETKIN 82	PRL 49 1620	A. Etkin <i>et al.</i>	(BNL, CUNY)
Also	Brighton Conf. 351	S.J. Lindenbaum	(BNL, CUNY)

$f_0(2020)$

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

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;→ NOT CHECKED ←

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=3;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=5

NODE=M156220

NODE=M156R1

NODE=M156R1

NODE=M156R01

NODE=M156R01

NODE=M156

REFID=51063

REFID=47950

REFID=47959

REFID=47962

REFID=46605

REFID=46914

REFID=45758

 $f_0(2020)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1992±16		^{1,2} BARBERIS	00C	450 $p p \rightarrow p_f 4\pi p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2037±8	80k	³ UMAN	06 E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
2040±38		ANISOVICH	00J SPEC	
2010±60		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
2020±35		BARBERIS	97B OMEG	450 $p p \rightarrow p p 2(\pi^+ \pi^-)$

¹ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.² T-matrix pole.³ Statistical error only. **$f_0(2020)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
442±60		^{4,5} BARBERIS	00C	450 $p p \rightarrow p_f 4\pi p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
296±17	80k	⁶ UMAN	06 E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
405±40		ANISOVICH	00J SPEC	
240±100		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
410±50		BARBERIS	97B OMEG	450 $p p \rightarrow p p 2(\pi^+ \pi^-)$

⁴ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.⁵ T-matrix pole.⁶ Statistical error only. **$f_0(2020)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho \pi \pi$	seen
Γ_2 $\pi^0 \pi^0$	seen
Γ_3 $\rho \rho$	seen
Γ_4 $\omega \omega$	seen
Γ_5 $\eta \eta$	seen

 $f_0(2020)$ BRANCHING RATIOS

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$				Γ_3/Γ_4
VALUE	DOCUMENT ID	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 3	BARBERIS	00F 450 $p p \rightarrow p_f \omega \omega p_s$		

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
seen	UMAN	06	E835	5.2 $\bar{p} p \rightarrow \eta\eta\pi^0$	

 $f_0(2020)$ REFERENCES

UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446		
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)

$a_4(2040)$

$$I^G(J^{PC}) = 1^-(4^{++})$$

NODE=M017

 $a_4(2040)$ MASS

NODE=M017M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1996^{+10}_{-9} OUR AVERAGE		Error includes scale factor of 1.1.			
$1885 \pm 13^{+50}_{-2}$	420k	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$1985 \pm 10 \pm 13$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$1996 \pm 25 \pm 43$		CHUNG	02	B852	$18.3 \pi^- p \rightarrow 3\pi p$
2005^{+25}_{-45}		¹ ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
$2000 \pm 40^{+60}_{-20}$		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$
$1944 \pm 8 \pm 50$		² AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
2010 ± 20		³ DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
2040 ± 30		⁴ CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$
2030 ± 50		⁵ CORDEN	78C	OMEG 0	$15 \pi^- p \rightarrow 3\pi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2004 ± 6	80k	⁶ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
1903 ± 10		⁷ BALDI	78	SPEC $-$	$10 \pi^- p \rightarrow p K_S^0 K^-$

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.² May be a different state.³ From a simultaneous fit to the G_+ and G_0 wave intensities.⁴ From an amplitude analysis.⁵ $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.⁶ Statistical error only.⁷ From a fit to the Y_8^0 moment. Limited by phase space.

NODE=M017M;LINKAGE=AN
 NODE=M017M;LINKAGE=DM
 NODE=M017M;LINKAGE=A
 NODE=M017M;LINKAGE=C
 NODE=M017M;LINKAGE=M
 NODE=M017M;LINKAGE=ST
 NODE=M017M;LINKAGE=Y

 $a_4(2040)$ WIDTH

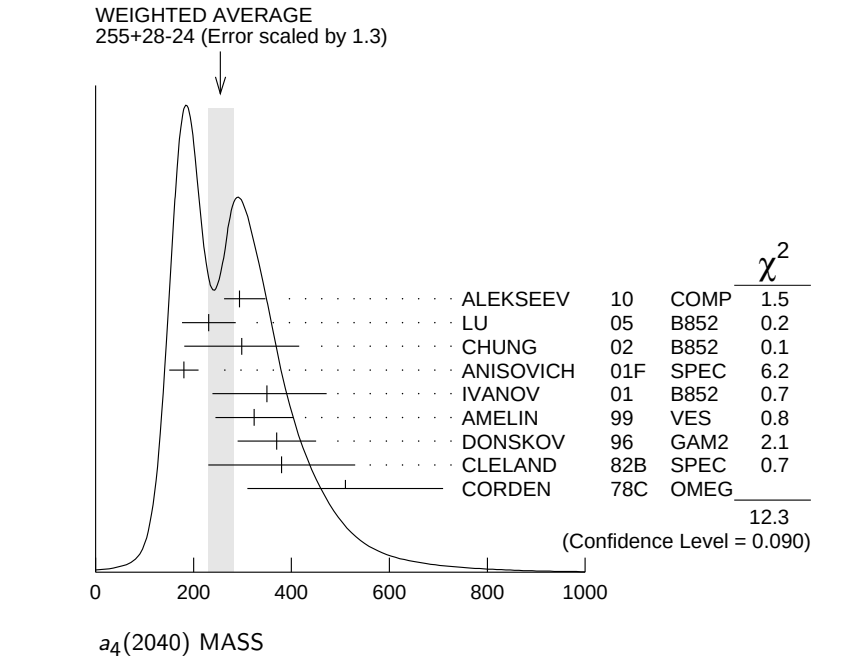
NODE=M017W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
255^{+28}_{-24} OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
$294 \pm 25^{+46}_{-19}$	420k	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$231 \pm 30 \pm 46$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$298 \pm 81 \pm 85$		CHUNG	02	B852	$18.3 \pi^- p \rightarrow 3\pi p$
180 ± 30		⁸ ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
$350 \pm 100^{+70}_{-50}$		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$
$324 \pm 26 \pm 75$		⁹ AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
370 ± 80		¹⁰ DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
380 ± 150		¹¹ CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$
510 ± 200		¹² CORDEN	78C	OMEG 0	$15 \pi^- p \rightarrow 3\pi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
401 ± 16	80k	¹³ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
166 ± 43		¹⁴ BALDI	78	SPEC $-$	$10 \pi^- p \rightarrow p K_S^0 K^-$

⁸ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.⁹ May be a different state.¹⁰ From a simultaneous fit to the G_+ and G_0 wave intensities.¹¹ From an amplitude analysis.¹² $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.¹³ Statistical error only.¹⁴ From a fit to the Y_8^0 moment. Limited by phase space.

NODE=M017W

NODE=M017W;LINKAGE=AN
 NODE=M017W;LINKAGE=DM
 NODE=M017W;LINKAGE=A
 NODE=M017W;LINKAGE=C
 NODE=M017W;LINKAGE=M
 NODE=M017W;LINKAGE=ST
 NODE=M017W;LINKAGE=Y



$a_4(2040)$ 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;→ NOT CHECKED ←
DESIG=6;OUR EST;→ NOT CHECKED ←
DESIG=7;OUR EST;→ NOT CHECKED ←
DESIG=8
DESIG=3
DESIG=4;OUR EST;→ NOT CHECKED ←

$a_4(2040)$ 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	$18\pi^-p \rightarrow \omega\pi^-\pi^0 p$

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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

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REFID=46902
REFID=45207

REFID=21281
REFID=21783
REFID=20859

NODE=M016

 $f_4(2050)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

 $f_4(2050)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2018±11 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
1960±15		AMELIN	06	VES $36 \pi^- p \rightarrow \omega \omega n$
2005±10		¹ BINON	05	GAMS $33 \pi^- p \rightarrow \eta \eta n$
1998±15		ALDE	98	GAM4 $100 \pi^- p \rightarrow \pi^0 \pi^0 n$
2060±20		ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega \omega n$
2038±30		AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
2086±15		BALTRUSAIT..	87	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
2000±60		ALDE	86D	GAM4 $100 \pi^- p \rightarrow n 2 \eta$
2020±20	40k	² BINON	84B	GAM2 $38 \pi^- p \rightarrow n 2 \pi^0$
2015±28		³ CASON	82	STRC $8 \pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
2031 ⁺²⁵ ₋₃₆		ETKIN	82B	MPS $23 \pi^- p \rightarrow n 2 K_S^0$
2020±30	700	APEL	75	NICE $40 \pi^- p \rightarrow n 2 \pi^0$
2050±25		BLUM	75	ASPK $18.4 \pi^- p \rightarrow n K^+ K^-$

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

1966±25	⁴ ANISOVICH	09	RVUE	0.0 $\bar{p} p, \pi N$
1885 ⁺¹⁴⁺²¹⁸ ₋₁₃₋₂₅	⁵ UEHARA	09	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2018± 6	ANISOVICH	00J	SPEC	2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 2000	⁶ MARTIN	98	RVUE	$N \bar{N} \rightarrow \pi \pi$
~ 2010	⁷ MARTIN	97	RVUE	$\bar{N} N \rightarrow \pi \pi$
~ 2040	⁸ OAKDEN	94	RVUE	0.36–1.55 $\bar{p} p \rightarrow \pi \pi$
~ 1990	⁹ OAKDEN	94	RVUE	0.36–1.55 $\bar{p} p \rightarrow \pi \pi$
1978± 5	¹⁰ ALPER	80	CNTR	62 $\pi^- p \rightarrow K^+ K^- n$
2040±10	¹⁰ ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$
1935±13	¹⁰ CORDEN	79	OMEG	12–15 $\pi^- p \rightarrow n 2 \pi$
1988± 7	EVANGELIS...	79B	OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
1922±14	¹¹ ANTIPOV	77	CIBS	25 $\pi^- p \rightarrow p 3 \pi$

¹ From the first PWA solution.

² From a partial-wave analysis of the data.

³ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.

⁴ K matrix pole.

⁵ Taking into account the $f_2(1950)$. Helicity-2 production favored.

⁶ Energy-dependent analysis.

⁷ Single energy analysis.

⁸ From solution A of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

⁹ From solution B of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis assuming one-pion exchange.

¹¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M016M

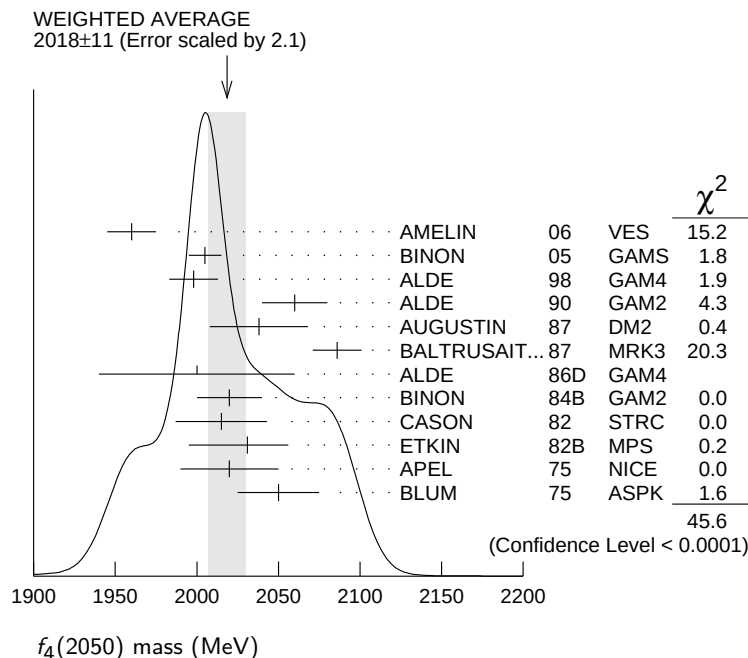
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NODE=M016M;LINKAGE=N
NODE=M016M;LINKAGE=NN
NODE=M016M;LINKAGE=KM
NODE=M016M;LINKAGE=UE
NODE=M016M;LINKAGE=RB
NODE=M016M;LINKAGE=BR
NODE=M016M;LINKAGE=B

NODE=M016M;LINKAGE=BB

NODE=M016M;LINKAGE=M
NODE=M016M;LINKAGE=T



$f_4(2050)$ WIDTH

NODE=M016W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
237± 18 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
290± 20		AMELIN	06	VES 36 $\pi^- p \rightarrow \omega \omega n$
340± 80		12 BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
395± 40		ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
170± 60		ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega \omega n$
304± 60		AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
210± 63		BALTRUSAIT..	87	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
400±100		ALDE	86D	GAM4 100 $\pi^- p \rightarrow n 2 \eta$
240± 40	40k	13 BINON	84B	GAM2 38 $\pi^- p \rightarrow n 2 \pi^0$
190± 14		DENNEY	83	LASS 10 $\pi^+ n / \pi^+ p$
186 ⁺¹⁰³ ₋₅₈		14 CASON	82	STRC 8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
305 ⁺³⁶ ₋₁₁₉		ETKIN	82B	MPS 23 $\pi^- p \rightarrow n 2 K_S^0$
180± 60	700	APEL	75	NICE 40 $\pi^- p \rightarrow n 2 \pi^0$
225 ⁺¹²⁰ ₋₇₀		BLUM	75	ASPK 18.4 $\pi^- p \rightarrow n K^+ K^-$

NODE=M016W

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

260± 40		15 ANISOVICH	09	RVUE 0.0 $\bar{p} p, \pi N$
453± 20 ⁺³¹ ₋₁₂₉		16 UEHARA	09	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
182± 7		ANISOVICH	00J	SPEC 2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 170		17 MARTIN	98	RVUE $N \bar{N} \rightarrow \pi \pi$
~ 200		18 MARTIN	97	RVUE $\bar{N} N \rightarrow \pi \pi$
~ 60		19 OAKDEN	94	RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
~ 80		20 OAKDEN	94	RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
243± 16		21 ALPER	80	CNTR 62 $\pi^- p \rightarrow K^+ K^- n$
140± 15		21 ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p \bar{p} n$
263± 57		21 CORDEN	79	OMEG 12-15 $\pi^- p \rightarrow n 2 \pi$
100± 28		EVANGELIS...	79B	OMEG 10 $\pi^- p \rightarrow K^+ K^- n$
107± 56		22 ANTIPOV	77	CIBS 25 $\pi^- p \rightarrow p 3 \pi$

OCCUR=2

12 From the first PWA solution.

13 From a partial-wave analysis of the data.

14 From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.

15 K matrix pole.

16 Taking into account the $f_2(1950)$. Helicity-2 production favored.

17 Energy-dependent analysis.

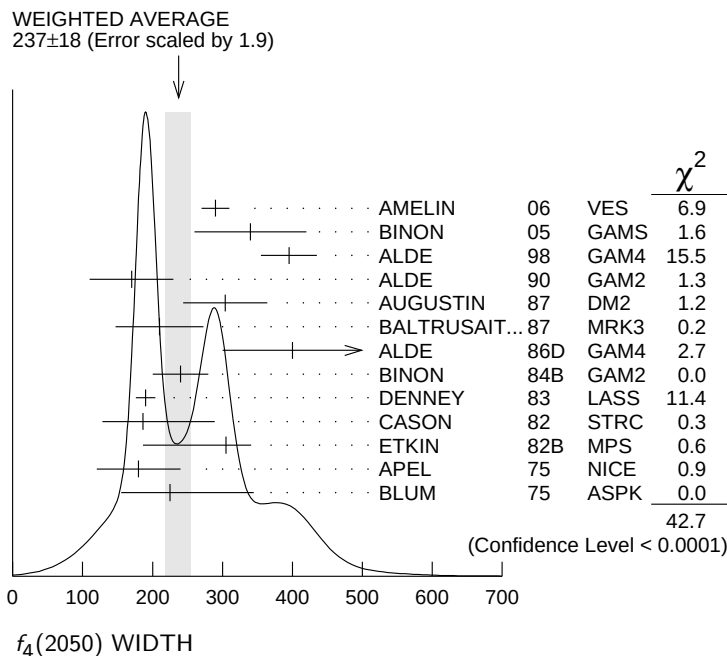
18 Single energy analysis.

NODE=M016W;LINKAGE=BI
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 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

COMMENT

23 $\pi^- p \rightarrow n2K_S^0$ Γ_3/Γ_2

NODE=M016R2

NODE=M016R2

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ VALUE (units 10⁻³)**2.1±0.8**

DOCUMENT ID

ALDE

TECN

86D

GAM4

COMMENT

100 $\pi^- p \rightarrow n4\gamma$ Γ_4/Γ

NODE=M016R3

NODE=M016R3

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

VALUE

<0.012

DOCUMENT ID

ALDE

TECN

87

GAM4

COMMENT

100 $\pi^- p \rightarrow 4\pi^0 n$ Γ_5/Γ

NODE=M016R4

NODE=M016R4

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE

seen

DOCUMENT ID

AMELIN

TECN

00

VES

COMMENT

37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$ Γ_7/Γ

NODE=M016R6

NODE=M016R6

f₄(2050) REFERENCES

NODE=M016

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
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+) JP
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+) JP
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP

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REFID=21651

$\pi_2(2100)$

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

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M020

NODE=M020

NODE=M020M

NODE=M020M

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NODE=M020W

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NODE=M020W;LINKAGE=L

NODE=M020215;NODE=M020

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=3;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

NODE=M020220

NODE=M020R1

NODE=M020R1

NODE=M020R2

NODE=M020R2

NODE=M020R3

NODE=M020R3

NODE=M020R4

NODE=M020R4

NODE=M020R;LINKAGE=L

NODE=M020

REFID=44433

REFID=20872

 $\pi_2(2100)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2090± 29 OUR AVERAGE			
2090± 30	¹ AMELIN	95B VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
2100± 150	² DAUM	81B CNTR	63,94 $\pi^- p \rightarrow 3\pi X$
¹ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
² From a two-resonance fit to four 2^-0^+ waves.			

 $\pi_2(2100)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
625± 50 OUR AVERAGE	Error includes scale factor of 1.2.		
520± 100	³ AMELIN	95B VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
651± 50	⁴ DAUM	81B CNTR	63,94 $\pi^- p \rightarrow 3\pi X$
³ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
⁴ From a two-resonance fit to four 2^-0^+ waves.			

 $\pi_2(2100)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 3π	seen
Γ_2 $\rho\pi$	seen
Γ_3 $f_2(1270)\pi$	seen
Γ_4 $(\pi\pi)_S\pi$	seen

 $\pi_2(2100)$ BRANCHING RATIOS

$\Gamma(\rho\pi)/\Gamma(3\pi)$				Γ_2/Γ_1
<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=AK
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 ¹UMAN 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	
seen	³ ANISOVICH	99B SPEC	1.35–1.94 $\bar{p}p \rightarrow \eta\eta\pi^0$
2104±20	⁴ ARMSTRONG	93C E760	$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$

² Spin not determined.³ $J^{PC} = 0^{++}$.⁴ 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 ⁵ADOMEIT 96 CBAR 0 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$ ⁵ 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	⁶ OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2120	⁷ OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2170	⁸ MARTIN	80B RVUE	
~ 2150	⁸ MARTIN	80C RVUE	
~ 2150	⁹ DULUDE	78B OSPK	1–2 $\bar{p}p \rightarrow \pi^0 \pi^0$

⁶ 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.⁷ From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$.⁸ $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.⁹ $I^G(J^P) = 0^+(2^+)$ 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	¹⁰ EVANGELIS...	97 SPEC	0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
~ 2190	¹⁰ CUTTS	78B CNTR	0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155±15	^{10,11} COUPLAND	77 CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193±2	^{10,12} ALSPECTOR	73 CNTR	$\bar{p}p$ S channel

¹⁰ Isospins 0 and 1 not separated.¹¹ From a fit to the total elastic cross section.¹² Referred to as T or $\bar{T}$ region by ALSPECTOR 73.

$K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2200 ± 13	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
2150 ± 20	ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
2130 ± 35	BARBERIS	99 OMEG	$450 p p \rightarrow p_s p_f K^+ K^-$

NODE=M042M5
NODE=M042M5

 $f_2(2150)$ WIDTH

NODE=M042210

 $f_2(2150)$ WIDTH, COMBINED MODES (MeV)

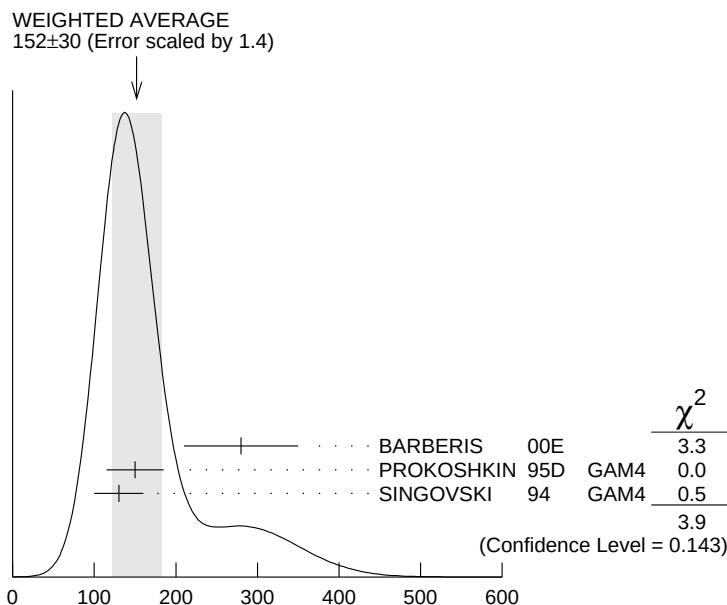
152 $\pm$ 30 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.4. See the ideogram below.

NODE=M042W
NODE=M042W

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

182 ± 11	80k	¹³ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
¹³ Statistical error only.					

NODE=M042W;LINKAGE=ST

 **$f_2(2150)$ WIDTH, COMBINED MODES (MeV)** **$\eta\eta$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

NODE=M042W3
NODE=M042W3

152 $\pm$ 30 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

280 ± 70	BARBERIS	00E	$450 p p \rightarrow p_f \eta \eta p_s$
150 ± 35	PROKOSHKIN 95D	GAM4	$300 \pi^- N \rightarrow \pi^- N 2\eta,$ $450 p p \rightarrow p p 2\eta$
130 ± 30	SINGOVSKI 94	GAM4	$450 p p \rightarrow p p 2\eta$

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

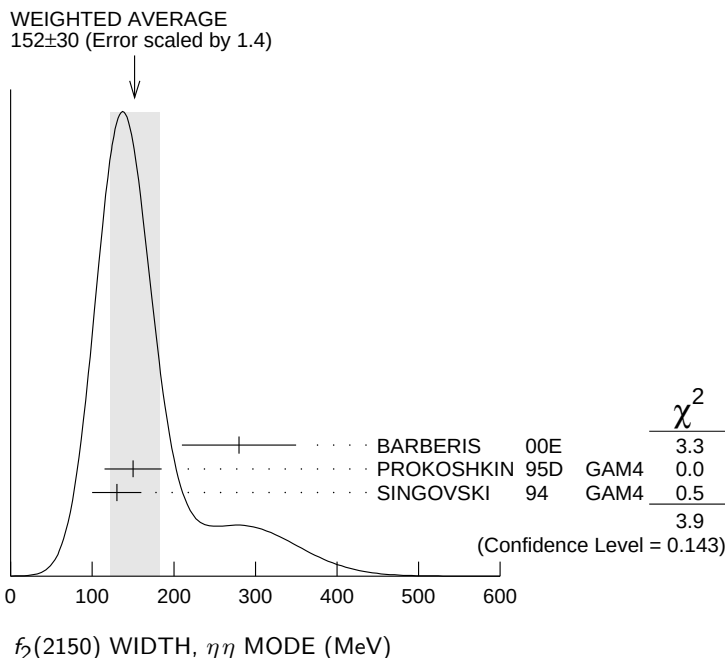
310 ± 50	¹⁴ ABELE	99B	CBAR
seen	¹⁵ ANISOVICH	99B	SPEC
203 ± 10	¹⁶ ARMSTRONG	93C	E760

¹⁴ Spin not determined.

¹⁵ $J^{PC} = 0^{++}$

¹⁶ No J^{PC} determination.

NODE=M042W3;LINKAGE=K3
NODE=M042W3;LINKAGE=J1
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 17 ADOMEIT 96 CBAR 0 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
 17 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 18 OAKDEN 94 RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
 ~ 250 19 MARTIN 80B RVUE
 ~ 250 19 MARTIN 80C RVUE
 ~ 250 20 DULUDE 78B OSPK 1–2 $\bar{p}p \rightarrow \pi^0\pi^0$

18 See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

19 $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

20 $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.

NODE=M042W1
 NODE=M042W1
 → NOT CHECKED ←

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 21 EVANGELIS... 97 SPEC 0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
 135±75 22,23 COUPLAND 77 CNTR 0 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
 98±8 23 ALSPECTOR 73 CNTR $\bar{p}p$ S channel

21 Isospin 0 and 2 not separated.

22 From a fit to the total elastic cross section.

23 Isospins 0 and 1 not separated.

NODE=M042W2
 NODE=M042W2

NODE=M042W2;LINKAGE=F
 NODE=M042W2;LINKAGE=E
 NODE=M042W2;LINKAGE=I

$K\bar{K}$ MODE

VALUE (MeV) DOCUMENT ID TECN COMMENT

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

91±62 VLADIMIRSK...06 SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
 150±30 ABLIKIM 04E BES2 $J/\psi \rightarrow \omega K^+ K^-$
 270±50 BARBERIS 99 OMEG 450 $pp \rightarrow p_S p_f K^+ K^-$

NODE=M042W5
 NODE=M042W5

$f_2(2150)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	
Γ_2 $\eta\eta$	seen
Γ_3 $K\bar{K}$	seen
Γ_4 $f_2(1270)\eta$	seen
Γ_5 $a_2(1320)\pi$	seen
Γ_6 $\rho\bar{\rho}$	seen

NODE=M042215;NODE=M042

DESIG=1

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=3;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

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 $p p \rightarrow p_f \eta \eta p_s$

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

<0.1 95 ²⁴ PROKOSHKIN 95D GAM4 300 $\pi^- N \rightarrow \pi^- N 2\eta$,
450 $p p \rightarrow p p 2\eta$

²⁴ Using data from ARMSTRONG 89D.

NODE=M042R1

NODE=M042R1

NODE=M042R1;LINKAGE=A

$\Gamma(\pi\pi)/\Gamma(\eta\eta)$	Γ_1/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.33 95 ²⁵ PROKOSHKIN 95D GAM4 300 $\pi^- N \rightarrow \pi^- N 2\eta$,
450 $p p \rightarrow p p 2\eta$

²⁵ 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 ²⁶ ADOMEIT 96 CBAR 1.94 $\bar{p} p \rightarrow \eta 3\pi^0$

²⁶ 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. Vladimirsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ABELE 99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH 99B	PL B449 154	A.V. Anisovich <i>et al.</i>	
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

REFID=50174

REFID=47945

REFID=47961

REFID=46904

REFID=46886

REFID=46921

REFID=45687

REFID=45685

REFID=45202

REFID=45212

REFID=44647

REFID=44103

REFID=45210

REFID=44648

REFID=43587

REFID=41010

REFID=21838

REFID=21837

REFID=21733

REFID=21850

REFID=21830

REFID=21813

$\rho(2150)$

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

OMITTED FROM SUMMARY TABLE

This entry was previously called $T_1(2190)$. See our mini-review under the $\rho(1700)$.

NODE=M032

NODE=M032

 $\rho(2150)$ MASS

NODE=M032205

 e^+e^- PRODUCEDNODE=M032M3
NODE=M032M3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2149±17 OUR AVERAGE Includes data from the datablock that follows this one.			
2150±40±50	AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
2153±37	BIAGINI	91 RVUE	$e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$
2110±50	¹ CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1990±80	AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$

OCCUR=2

 $\bar{p}p \rightarrow \pi\pi$ NODE=M032M1
NODE=M032M1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 2191	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2070	² OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2170	³ MARTIN	80B RVUE	
~ 2100	³ MARTIN	80C RVUE	

S-CHANNEL $\bar{N}N$ NODE=M032M2
NODE=M032M2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2110±35	⁴ ANISOVICH	02 SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	⁵ CUTTS	78B CNTR	0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155±15	^{5,6} COUPLAND	77 CNTR	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193± 2	^{5,7} ALSPECTOR	73 CNTR	$\bar{p}p$ S channel
2190±10	⁸ ABRAMS	70 CNTR	S channel $\bar{p}N$

 $\pi^-p \rightarrow \omega\pi^0n$ NODE=M032M4
NODE=M032M4

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.			

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 Includes ATKINSON 85.			
² See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.			
³ $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.			
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 T or $\bar{T}$ region by ALSPECTOR 73.			
⁸ 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=M032M3;LINKAGE=A
NODE=M032M1;LINKAGE=CCNODE=M032M;LINKAGE=P
NODE=M032M;LINKAGE=AYNODE=M032M;LINKAGE=I
NODE=M032M;LINKAGE=E
NODE=M032M;LINKAGE=M
NODE=M032M;LINKAGE=B **$\rho(2150)$ WIDTH**

NODE=M032210

 e^+e^- PRODUCEDNODE=M032W3
NODE=M032W3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
359± 40 OUR AVERAGE Includes data from the datablock that follows this one.			
350± 40±50	AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
389± 79	BIAGINI	91 RVUE	$e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$
410±100	⁹ CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-), 2(\pi^+\pi^-\pi^0)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310±140	AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$

OCCUR=2

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 296	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 40	¹⁰ OAKDEN	94	RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	¹¹ MARTIN	80B	RVUE
~ 200	¹¹ 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	¹² ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
135±75	^{13,14} COUPLAND	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98± 8	¹⁴ ALSPECTOR	73	CNTR $\bar{p}p$ S channel
~ 85	¹⁵ 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

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

NODE=M032W4
NODE=M032W4

- 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 $\pi^- p \rightarrow \omega\pi^0 n$
- ⁹Includes ATKINSON 85.
- ¹⁰See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- ¹¹ $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.
- ¹²From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.
- ¹³From a fit to the total elastic cross section.
- ¹⁴Isospins 0 and 1 not separated.
- ¹⁵Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M032W3;LINKAGE=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

NODE=M032215;NODE=M032

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\pi^+\pi^-$	seen
Γ_3 K^+K^-	seen
Γ_4 $3(\pi^+\pi^-)$	seen
Γ_5 $2(\pi^+\pi^-\pi^0)$	seen
Γ_6 $\eta'\pi^+\pi^-$	seen
Γ_7 $f_1(1285)\pi^+\pi^-$	seen
Γ_8 $\omega\pi^0$	seen
Γ_9 $\omega\pi^0\eta$	seen
Γ_{10} $p\bar{p}$	

DESIG=1
DESIG=2;OUR EVAL;→ NOT CHECKED ←
DESIG=3;OUR EVAL;→ NOT CHECKED ←
DESIG=4;OUR EVAL;→ NOT CHECKED ←
DESIG=5;OUR EVAL;→ NOT CHECKED ←
DESIG=6;OUR EVAL;→ NOT CHECKED ←
DESIG=7;OUR EVAL;→ NOT CHECKED ←
DESIG=8;OUR EVAL;→ NOT CHECKED ←
DESIG=9;OUR EVAL;→ NOT CHECKED ←
DESIG=10

 $\rho(2150) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M032230

$$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_1/\Gamma$$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
3.1±0.6±0.5	¹⁶ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$

NODE=M032G01
NODE=M032G01

¹⁶Calculated by us from the reported value of cross section at the peak.

NODE=M032G01;LINKAGE=AU

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

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

NODE=M032G02
NODE=M032G02

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

4.9±1.9	¹⁷ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$

¹⁷Calculated by us from the reported value of cross section at the peak.

NODE=M032G02;LINKAGE=AU

$\rho(2150)$ REFERENCES

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)

NODE=M032

REFID=52049
REFID=48828
REFID=48327
REFID=48349
REFID=47950
REFID=45212
REFID=44371
REFID=44103
REFID=45210
REFID=41859
REFID=41894
REFID=41355
REFID=22000
REFID=21838
REFID=21837
REFID=21733
REFID=21830
REFID=21824
REFID=21813
REFID=21807
REFID=21805

NODE=M103

$\phi(2170)$

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

Observed by AUBERT,BE 06D in the initial-state radiation process
 $e^+ e^- \rightarrow \phi f_0(980) \gamma$.

NODE=M103

$\phi(2170)$ MASS

NODE=M103M

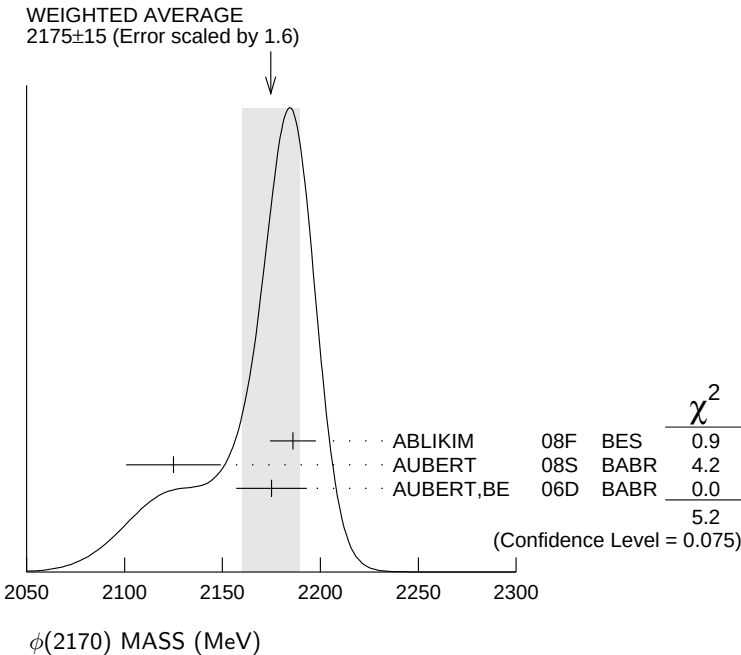
NODE=M103M

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

- ¹ From the $\phi f_0(980)$ component.
² From a fit with two incoherent Breit-Wigners.
³ From the $K^+ K^- f_0(980)$ component.



$\phi(2170)$ WIDTH

NODE=M103W

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±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

OCCUR=2

NODE=M103W;LINKAGE=AB
 NODE=M103W;LINKAGE=SH
 NODE=M103W;LINKAGE=AU

 $\phi(2170)$ DECAY MODES

NODE=M103215;NODE=M103

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

DESIG=1;OUR EVAL;→ NOT CHECKED ←
 DESIG=5
 DESIG=9
 DESIG=2;OUR EVAL;→ NOT CHECKED ←
 DESIG=3
 DESIG=6
 DESIG=4
 DESIG=7
 DESIG=8
 DESIG=10

 $\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M103230

$\Gamma(\phi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_2 \Gamma_1 / \Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.7±0.7±1.3	483	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \eta \gamma$	

NODE=M103G2
 NODE=M103G2

$\Gamma(\phi f_0(980)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_4 \Gamma_1 / \Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2.5±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=M103G1
 NODE=M103G1

NODE=M103G1;LINKAGE=AB

 $\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M103220

$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_3 / \Gamma \times \Gamma_1 / \Gamma$
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=M103G01
 NODE=M103G01

NODE=M103G01;LINKAGE=SH

 $\phi(2170)$ BRANCHING RATIOS

NODE=M103225

$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}}$				Γ_6 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$	
$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}}$				Γ_8 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$	
$\Gamma(K^{*0} K^\pm \pi^\mp) / \Gamma_{\text{total}}$				Γ_9 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	AUBERT	07AK BABR	$10.6 \text{ GeV } e^+ e^-$	

NODE=M103R01
 NODE=M103R01

NODE=M103R02
 NODE=M103R02

NODE=M103R03
 NODE=M103R03

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$

NODE=M103R04
 NODE=M103R04

 $\phi(2170)$ REFERENCES

ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)
SHEN	09	PR D80 031101R	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 091103R	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M103

REFID=53349
 REFID=53000
 REFID=52154
 REFID=52242
 REFID=51908
 REFID=51511

 $f_0(2200)$

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

OMITTED FROM SUMMARY TABLE

Seen in $K_S^0 K_S^0$ (AUGUSTIN 88), $K^+ K^-$ (ABLIKIM 05Q) and $\eta\eta$ (BINON 05) system. Not seen in $\Upsilon(1S)$ radiative decays (BARU 89).

NODE=M112

NODE=M112

 $f_0(2200)$ MASS

VALUE (MeV)	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	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M112M

NODE=M112M

• • • 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	$\bar{p} p \rightarrow \pi \pi$

OCCUR=2

¹ First solution, PWA is ambiguous.

² Cannot determine spin to be 0.

NODE=M112M;LINKAGE=BI
 NODE=M112M;LINKAGE=A

 $f_0(2200)$ WIDTH

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	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M112W

NODE=M112W

• • • 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	$\bar{p} p \rightarrow \pi \pi$

OCCUR=2

³ First solution, PWA is ambiguous.

⁴ Cannot determine spin to be 0.

NODE=M112W;LINKAGE=BI
 NODE=M112W;LINKAGE=A

 $f_0(2200)$ REFERENCES

ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)

NODE=M112

REFID=50958
 REFID=50780

REFID=44103
 REFID=40917
 REFID=40574

$f_J(2220)$

$$J^G(J^{PC}) = 0^+(2^{++} \text{ or } 4^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation. See our mini-review in the 2004 edition of this Review, PDG 04.

NODE=M082

NODE=M082

 $f_J(2220)$ MASS

NODE=M082M

NODE=M082M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2231.1 ± 3.5 OUR AVERAGE				
2235 ± 4 ± 6	74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
2230 $^{+6}_{-7}$ ± 16	46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
2232 $^{+8}_{-7}$ ± 15	23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
2235 ± 4 ± 5	32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
2209 $^{+17}_{-15}$ ± 10		ASTON	88F LASS	$11 K^-p \rightarrow K^+K^- \Lambda$
2230 ± 20		BOLONKIN	88 SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n$
2220 ± 10	41	¹ ALDE	86B GA24	$38-100 \pi p \rightarrow n\eta\eta'$
2230 ± 6 ± 14	93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+K^-$
2232 ± 7 ± 7	23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2223.9 ± 2.5		² VLADIMIRSK...08	SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n + m\pi^0$
2246 ± 36		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

¹ALDE 86B uses data from both the GAMS-2000 and GAMS-4000 detectors.² $J^{PC} = 2^{++}$. Systematic uncertainties not evaluatedNODE=M082M;LINKAGE=A
NODE=M082M;LINKAGE=VL **$f_J(2220)$ WIDTH**

NODE=M082W

NODE=M082W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
23 $^{+8}_{-7}$ OUR AVERAGE					
19 $^{+13}_{-11}$ ± 12		74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
20 $^{+20}_{-15}$ ± 17		46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
20 $^{+25}_{-16}$ ± 14		23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
15 $^{+12}_{-9}$ ± 9		32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
60 $^{+107}_{-57}$			ASTON	88F LASS	$11 K^-p \rightarrow K^+K^- \Lambda$
80 ± 30			BOLONKIN	88 SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n$
26 $^{+20}_{-16}$ ± 17		93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+K^-$
18 $^{+23}_{-15}$ ± 10		23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.6 ± 2.5			³ VLADIMIRSK...08	SPEC	$40 \pi^-p \rightarrow K_S^0 K_S^0 n + m\pi^0$
<80	90		ALDE	87C GAM2	$38 \pi^-p \rightarrow \eta'\eta n$

³ $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated

NODE=M082W;LINKAGE=VL

 $f_J(2220)$ DECAY MODES

NODE=M082215;NODE=M082

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	seen
$\Gamma_2 \pi^+\pi^-$	seen
$\Gamma_3 K\bar{K}$	seen
$\Gamma_4 p\bar{p}$	
$\Gamma_5 \gamma\gamma$	not seen
$\Gamma_6 \eta\eta'(958)$	seen
$\Gamma_7 \phi\phi$	not seen
$\Gamma_8 \eta\eta$	not seen

DESIG=5;OUR EST;→ NOT CHECKED ←
DESIG=6;OUR EST;→ NOT CHECKED ←
DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=4
DESIG=2;OUR EST;→ NOT CHECKED ←
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=7;OUR EST;→ NOT CHECKED ←
DESIG=8;OUR EST;→ NOT CHECKED ←

$f_J(2220) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M082220

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_5 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4	95	⁴ ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183-209 \text{ GeV}$

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

< 5.6	95	⁴ GODANG	97 CLE2	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 86	95	⁴ ALBRECHT	90G ARG	$\gamma\gamma \rightarrow K^+ K^-$
<1000	95	⁵ ALTHOFF	85B TASS	$\gamma\gamma, K \bar{K} \pi$

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

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	95	ALAM	98C CLE2	$\gamma\gamma \rightarrow \pi^+ \pi^-$

⁴ Assuming $J^P = 2^+$.⁵ True for $J^P = 0^+$ and $J^P = 2^+$.NODE=M082G3
NODE=M082G3NODE=M082G1;LINKAGE=D
NODE=M082G1;LINKAGE=C $f_J(2220) \Gamma(i) \Gamma(p\bar{p}) / \Gamma^2(\text{total})$

NODE=M082223

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\pi\pi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_1 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<18	95	⁶ AMSLER	01 CBAR	$1.4-1.5 \text{ } p\bar{p} \rightarrow \pi^0 \pi^0$

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

<(11-42)	99	⁷ HASAN	96 SPEC	$1.35-1.55 \text{ } p\bar{p} \rightarrow \pi^+ \pi^-$

NODE=M082GG1
NODE=M082GG1 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\phi\phi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_7 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6	95	⁸ EVANGELIS...	98 SPEC	$1.1-2.0 \text{ } p\bar{p} \rightarrow \phi\phi$

NODE=M082GG2
NODE=M082GG2 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\eta\eta) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_8 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<4	95	⁶ AMSLER	01 CBAR	$1.4-1.5 \text{ } p\bar{p} \rightarrow \eta\eta$

⁶ For $J^P = 2^+$ in the mass range 2222-2240 MeV and the total width between 10 and 20 MeV.⁷ For $J^P = 2^+$ and $J^P = 4^+$ in the mass range 2220-2245 MeV and the total width of 15 MeV.⁸ For $J^P = 2^+$, the mass of 2235 MeV and the total width of 15 MeV.NODE=M082GG3
NODE=M082GG3

NODE=M082GG;LINKAGE=A

NODE=M082GG;LINKAGE=B

NODE=M082GG;LINKAGE=C

 $f_J(2220) \text{ BRANCHING RATIOS}$

NODE=M082225

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}}$ Γ_4 / Γ

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

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

not seen		⁹ AUBERT	07AV BABR	$B \rightarrow p\bar{p} K^*$
not seen		WANG	05A BELL	$B^+ \rightarrow \bar{p} p K^+$
<3.0	95	¹⁰ EVANGELIS...	97 SPEC	$1.96-2.40 \text{ } p\bar{p} \rightarrow K_S^0 K_S^0$
<1.1	99.7	¹¹ BARNES	93 SPEC	$1.3-1.57 \text{ } p\bar{p} \rightarrow K_S^0 K_S^0$
<2.6	99.7	¹¹ BARDIN	87 CNTR	$1.3-1.5 \text{ } p\bar{p} \rightarrow K^+ K^-$
<3.6	99.7	¹¹ SCULLI	87 CNTR	$1.29-1.55 \text{ } p\bar{p} \rightarrow K^+ K^-$

⁹ Assuming $\Gamma < 30 \text{ MeV}$.¹⁰ Assuming $\Gamma \sim 20 \text{ MeV}$, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.¹¹ Assuming $\Gamma = 30-35 \text{ MeV}$, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.NODE=M082R1
NODE=M082R1

NODE=M082R1;LINKAGE=AU

NODE=M082R1;LINKAGE=C

NODE=M082R1;LINKAGE=B

 $\Gamma(\pi\pi) / \Gamma(K\bar{K})$ Γ_1 / Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
1.0±0.5	BAI	96B BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma 2\pi, K\bar{K}$

NODE=M082R2
NODE=M082R2 $\Gamma(p\bar{p}) / \Gamma(K\bar{K})$ Γ_4 / Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.17±0.09	BAI	96B BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}, K\bar{K}$

NODE=M082R3
NODE=M082R3

f_J(2220) REFERENCES

VLADIMIRSK... 08	PAN 71 2129	V.V. Vladimirsky <i>et al.</i>	(ITEP)
AUBERT 07AV	Translated from YAF 71 2166.	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG 05A	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
REFID=46365
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REFID=40585
REFID=40580
REFID=47474

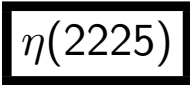
REFID=40235
REFID=40023
REFID=21864
REFID=21865
REFID=21349

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

NODE=M044205

 $\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$ NODE=M044M1
NODE=M044M1

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2232	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2090	¹ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2250	² MARTIN	80B	RVUE	
~ 2300	² MARTIN	80C	RVUE	
~ 2140	³ CARTER	78B	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow K^- K^+$
~ 2150	⁴ CARTER	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \pi\pi$

¹ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

² $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

³ $I = 0, 1. J^P = 3^-$ from Barrelet-zero analysis.

⁴ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044M1;LINKAGE=CC

NODE=M044M1;LINKAGE=P
NODE=M044M1;LINKAGE=K
NODE=M044M1;LINKAGE=J**S-CHANNEL $\bar{N}N$** NODE=M044M2
NODE=M044M2

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2260 ± 20	⁵ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	⁶ CUTTS	78B	CNTR	0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{6,7} COUPLAND	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{6,8} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
2190 ± 10	⁹ ABRAMS	70	CNTR	S channel $\bar{p}N$

⁵ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁶ Isospins 0 and 1 not separated.

⁷ From a fit to the total elastic cross section.

⁸ Referred to as T or T region by ALSPECTOR 73.

⁹ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M044M;LINKAGE=AY

NODE=M044M2;LINKAGE=I
NODE=M044M2;LINKAGE=E
NODE=M044M2;LINKAGE=M
NODE=M044M2;LINKAGE=B **$\pi^- p \rightarrow \eta\pi\pi$** NODE=M044M3
NODE=M044M3

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2290 ± 20 ± 30	AMELIN	00	VES	37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

 $\rho_3(2250)$ WIDTH

NODE=M044210

 $\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$ NODE=M044W1
NODE=M044W1

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 220	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 60	¹⁰ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	¹¹ MARTIN	80B	RVUE	
~ 200	¹¹ MARTIN	80C	RVUE	
~ 150	¹² CARTER	78B	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow K^- K^+$
~ 200	¹³ CARTER	77	CNTR 0	0.7–2.4 $\bar{p}p \rightarrow \pi\pi$

¹⁰ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

¹¹ $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

¹² $I = 0, 1. J^P = 3^-$ from Barrelet-zero analysis.

¹³ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044W1;LINKAGE=CC

NODE=M044W1;LINKAGE=P
NODE=M044W1;LINKAGE=K
NODE=M044W1;LINKAGE=J

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
160±25	¹⁴ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
135±75	^{15,16} COUPLAND	77	CNTR	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98±8	¹⁶ ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
~ 85	¹⁷ ABRAMS	70	CNTR	S channel $\bar{p}N$

- ¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.
¹⁵ From a fit to the total elastic cross section.
¹⁶ Isospins 0 and 1 not separated.
¹⁷ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M044W2
 NODE=M044W2

NODE=M044W;LINKAGE=AY

NODE=M044W2;LINKAGE=E
 NODE=M044W2;LINKAGE=I
 NODE=M044W2;LINKAGE=B

 $\pi^- p \rightarrow \eta\pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
230±50±80	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M044W3
 NODE=M044W3

 $\rho_3(2250)$ REFERENCES

ANISOVICH 02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH 01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH 01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
AMELIN 00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH 00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
KLOET 96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
HASAN 94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN 94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
MARTIN 80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN 80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER 78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS 78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
CARTER 77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND 77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
PEASLEE 75	PL 57B 189	D.C. Peaslee <i>et al.</i>	(CANB, BARI, BROW+)
ALSPECTOR 73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS 70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
COOPER 68	PRL 20 1059	W.A. Cooper <i>et al.</i>	(ANL)

NODE=M044

REFID=48828
 REFID=48327
 REFID=48349
 REFID=47432
 REFID=47950
 REFID=45212
 REFID=44103
 REFID=45210
 REFID=21838
 REFID=45210
 REFID=21837
 REFID=21964
 REFID=21733
 REFID=21963
 REFID=21830
 REFID=21824
 REFID=21813
 REFID=21807
 REFID=21805

NODE=M107

$f_2(2300)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

 $f_2(2300)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2297±28	¹ ETKIN	88	MPS 22 $\pi^- p \rightarrow \phi\phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2270±12	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2327±9±6	ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^- K^+ K^-$
2231±10	BOOTH	86	OMEG 85 $\pi^- Be \rightarrow 2\phi Be$
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 $\pi^- p \rightarrow \phi\phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
90±29	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
275±36±20	ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^- K^+ K^-$
133±50	BOOTH	86	OMEG 85 $\pi^- Be \rightarrow 2\phi Be$
200±50	LINDENBAUM	84	RVUE
220±70	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$

- ² Includes data of ETKIN 85.

NODE=M107W

NODE=M107W

NODE=M107W;LINKAGE=C

$f_2(2300)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi\phi$	seen
$\Gamma_2 \quad K\bar{K}$	seen
$\Gamma_3 \quad \gamma\gamma$	seen

NODE=M107215;NODE=M107

DESIG=1;OUR EST;→ NOT CHECKED ←
 DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=3;OUR EST;→ NOT CHECKED ←

 $f_2(2300) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M107225

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_3/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M107G1
 NODE=M107G1

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

$44 \pm 6 \pm 12$ ³ ABE 04 BELL $10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$

³ Assuming spin 2.

NODE=M107G1;LINKAGE=AB

 $f_2(2300)$ REFERENCES

VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
ABE 04	EPJ C32 323	K. Abe <i>et al.</i>	(Belle Collab.)
ETKIN 88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
BOOTH 86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)
ETKIN 85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM 84	CNPP 13 285	S.J. Lindenbaum	(CUNY)
ETKIN 82	PRL 49 1620	A. Etkin <i>et al.</i>	(BNL, CUNY)

NODE=M107

REFID=51191

REFID=49650
 REFID=40285
 REFID=21870
 REFID=21871
 REFID=21869
 REFID=21866

NODE=M041

 $f_4(2300)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_0(2350)$. Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $\rho_5(2350)$.

NODE=M041

 $f_4(2300)$ MASS

NODE=M041205

NODE=M041M

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

~ 2314	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 2300	¹ MARTIN	80B	RVUE
~ 2300	¹ MARTIN	80C	RVUE
~ 2340	² CARTER	78B	CNTR $0.7-2.4 \bar{p}p \rightarrow K^- K^+$
~ 2330	DULUDE	78B	OSPK $1-2 \bar{p}p \rightarrow \pi^0 \pi^0$
~ 2310	³ CARTER	77	CNTR $0.7-2.4 \bar{p}p \rightarrow \pi\pi$

¹ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

² $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.

³ $I(J^P) = 0(4^+)$ from amplitude analysis.

NODE=M041M1;LINKAGE=P
 NODE=M041M1;LINKAGE=K
 NODE=M041M1;LINKAGE=J

S-CHANNEL $\bar{p}p$ or $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

2283 ± 17	⁴ ANISOVICH	00J	SPEC
~ 2380	⁵ CUTTS	78B	CNTR $0.97-3 \bar{p}p \rightarrow \bar{N}N$
2345 ± 15	^{5,6} COUPLAND	77	CNTR $0.7-2.4 \bar{p}p \rightarrow \bar{p}p$
2359 ± 2	^{5,7} ALSPECTOR	73	CNTR $\bar{p}p$ S channel
2375 ± 10	ABRAMS	70	CNTR S channel $\bar{N}N$

⁴ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p}p \rightarrow \eta \pi^0 \pi^0$, $\pi^0 \pi^0$, $\eta \eta$, $\eta \eta'$, $\pi^+ \pi^-$.

⁵ Isospins 0 and 1 not separated.

⁶ From a fit to the total elastic cross section.

⁷ Referred to as U or U region by ALSPECTOR 73.

NODE=M041M2
 NODE=M041M2

NODE=M041M2;LINKAGE=AN

NODE=M041M2;LINKAGE=I
 NODE=M041M2;LINKAGE=E
 NODE=M041M2;LINKAGE=M

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2330 \pm 20 \pm 40$	AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M041M3
 NODE=M041M3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
2320±60 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2332 ± 15	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

NODE=M041M4
 NODE=M041M4
 → NOT CHECKED ←

 $f_4(2300)$ WIDTH **$\bar{p} p \rightarrow \pi \pi$ or $\bar{K} K$**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 278	HASAN	94	RVUE $\bar{p} p \rightarrow \pi \pi$
~ 200	⁸ MARTIN	80C	RVUE
~ 150	⁹ CARTER	78B	CNTR 0.7–2.4 $\bar{p} p \rightarrow K^- K^+$
~ 210	¹⁰ CARTER	77	CNTR 0.7–2.4 $\bar{p} p \rightarrow \pi \pi$
⁸ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.			
⁹ $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.			
¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis.			

NODE=M041210

NODE=M041W1
 NODE=M041W1

NODE=M041W1;LINKAGE=P
 NODE=M041W1;LINKAGE=K
 NODE=M041W1;LINKAGE=J

S-CHANNEL $\bar{p} p$ or $\bar{N} N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310 ± 25	¹¹ ANISOVICH	00J	SPEC
135^{+150}_{-65}	^{12,13} COUPLAND	77	CNTR 0.7–2.4 $\bar{p} p \rightarrow \bar{p} p$
165^{+18}_{-8}	¹³ ALSPECTOR	73	CNTR $\bar{p} p$ S channel
~ 190	ABRAMS	70	CNTR S channel $\bar{N} N$
¹¹ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p} p \rightarrow \eta \pi^0 \pi^0$, $\pi^0 \pi^0$, $\eta \eta$, $\eta \eta'$, $\pi^+ \pi^-$.			
¹² From a fit to the total elastic cross section.			
¹³ Isospins 0 and 1 not separated.			

NODE=M041W2
 NODE=M041W2

NODE=M041W2;LINKAGE=AN

NODE=M041W2;LINKAGE=E
 NODE=M041W2;LINKAGE=I

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$235 \pm 50 \pm 40$	AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M041W3
 NODE=M041W3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
250±80 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
260 ± 57	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

NODE=M041W4
 NODE=M041W4
 → NOT CHECKED ←

 $f_4(2300)$ 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;→ NOT CHECKED ←
 DESIG=2;OUR EST;→ NOT CHECKED ←
 DESIG=3;OUR EST;→ NOT CHECKED ←
 DESIG=4;OUR EST;→ NOT CHECKED ←
 DESIG=5;OUR EST;→ NOT CHECKED ←
 DESIG=6;OUR EST;→ NOT CHECKED ←

 $f_4(2300)$ BRANCHING RATIOS **$\Gamma(\rho\rho)/\Gamma(\omega\omega)$**

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.8 ± 0.5	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

 Γ_1/Γ_2

NODE=M041220

NODE=M041R1
 NODE=M041R1

$f_4(2300)$ REFERENCES

AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE	78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M041

REFID=47432
REFID=47950
REFID=47962
REFID=46903
REFID=46926
REFID=44103
REFID=21838
REFID=21837
REFID=21964
REFID=21733
REFID=21850
REFID=21963
REFID=21830
REFID=21813
REFID=21807

$f_0(2330)$

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

OMITTED FROM SUMMARY TABLE

NODE=M169

$f_0(2330)$ MASS

NODE=M169M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2314±25	¹ BUGG	04A	RVUE
2337±14	ANISOVICH	00J	SPEC 2.0 $\bar{p}p \rightarrow \pi\pi, \eta\eta$
~ 2321	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
¹ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.			

NODE=M169M

NODE=M169M;LINKAGE=BU

$f_0(2330)$ WIDTH

NODE=M169W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
144±20	² BUGG	04A	RVUE
217±33	ANISOVICH	00J	SPEC 2.0 $\bar{p}p \rightarrow \pi\pi, \eta\eta$
~ 223	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
² Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.			

NODE=M169W

NODE=M169W;LINKAGE=BU

$f_0(2330)$ REFERENCES

NODE=M169

BUGG	04A	EPJ C36 161	D.V. Bugg	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

REFID=50158
REFID=47950
REFID=47965
REFID=44103

$f_2(2340)$

$I^G(J^{PC}) = 0^+(2^{++})$

NODE=M108

$f_2(2340)$ MASS

NODE=M108M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2339±55		¹ ETKIN 88	MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2350±7	80k	² UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
2392±10		BOOTH 86	OMEG	85 $\pi^- Be \rightarrow 2 \phi Be$
2360±20		LINDENBAUM 84	RVUE	
¹ Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 37 ± 19 , 4^{+12}_{-4} , and 59^{+21}_{-19} , respectively.				
² Statistical error only.				

NODE=M108M

NODE=M108M;LINKAGE=C

NODE=M108M;LINKAGE=ST

$f_2(2340)$ WIDTH

NODE=M108W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
319 ⁺ 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;→ NOT CHECKED ←
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 $\bar{p}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
260 ± 75	13 ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow$ $\omega\pi^0, \omega\eta\pi^0,$ $\pi^+\pi^-$
235 ⁺⁶⁵ ₋₄₀	ANISOVICH	00J	SPEC	
135 ⁺¹⁵⁰ ₋₆₅	14,15 COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow$ $\bar{p}p$
165 ⁺¹⁸ ₋₈	15 ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
< 60	16 OH	70B	HDBC -0	$\bar{p}(pn), K^*K2\pi$
~ 140	ABRAMS	67C	CNTR	S channel $\bar{p}N$

NODE=M033W2
 NODE=M033W2

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

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
245 ± 20	ALPER	80	CNTR 0	62 $\pi^- p \rightarrow$ $K^+ K^- n$
¹⁰ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$. ¹¹ $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis. ¹² $I(J^P) = 1(5^-)$ from amplitude analysis. ¹³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02. ¹⁴ From a fit to the total elastic cross section. ¹⁵ Isospins 0 and 1 not separated. ¹⁶ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.				

NODE=M033W4
 NODE=M033W4

OCCUR=2

NODE=M033W1;LINKAGE=P
 NODE=M033W1;LINKAGE=K
 NODE=M033W1;LINKAGE=J
 NODE=M033W2;LINKAGE=AY
 NODE=M033W2;LINKAGE=E
 NODE=M033W2;LINKAGE=I
 NODE=M033W2;LINKAGE=N

 $\rho_5(2350)$ REFERENCES

ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
OH	73	NP B51 57	B.Y. Oh <i>et al.</i>	(MSU)
CHAPMAN	71B	PR D4 1275	J.W. Chapman <i>et al.</i>	(MICH)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
OH	70B	PRL 24 1257	B.Y. Oh <i>et al.</i>	(MSU)
ABRAMS	67C	PRL 18 1209	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M033

REFID=48828
 REFID=48327
 REFID=48349
 REFID=47950
 REFID=44371
 REFID=44103
 REFID=21665
 REFID=21838
 REFID=21837
 REFID=21964
 REFID=21733
 REFID=21963
 REFID=21830
 REFID=21813
 REFID=21931
 REFID=21926
 REFID=21807
 REFID=21925
 REFID=21804

$a_6(2450)$

$I^G(J^{PC}) = 1^-(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$a_6(2450)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2450±130	¹ CLELAND	82B	SPEC	± 50 $\pi p \rightarrow K_S^0 K^\pm p$

¹ From an amplitude analysis.

$a_6(2450)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
400±250	² CLELAND	82B	SPEC	± 50 $\pi p \rightarrow K_S^0 K^\pm p$

² From an amplitude analysis.

$a_6(2450)$ DECAY MODES

Mode
$\Gamma_1 \quad K \bar{K}$

$a_6(2450)$ REFERENCES

CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)

$f_6(2510)$

$I^G(J^{PC}) = 0^+(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$f_6(2510)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2469±29 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
2485±40	¹ ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$
2420±30	ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
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

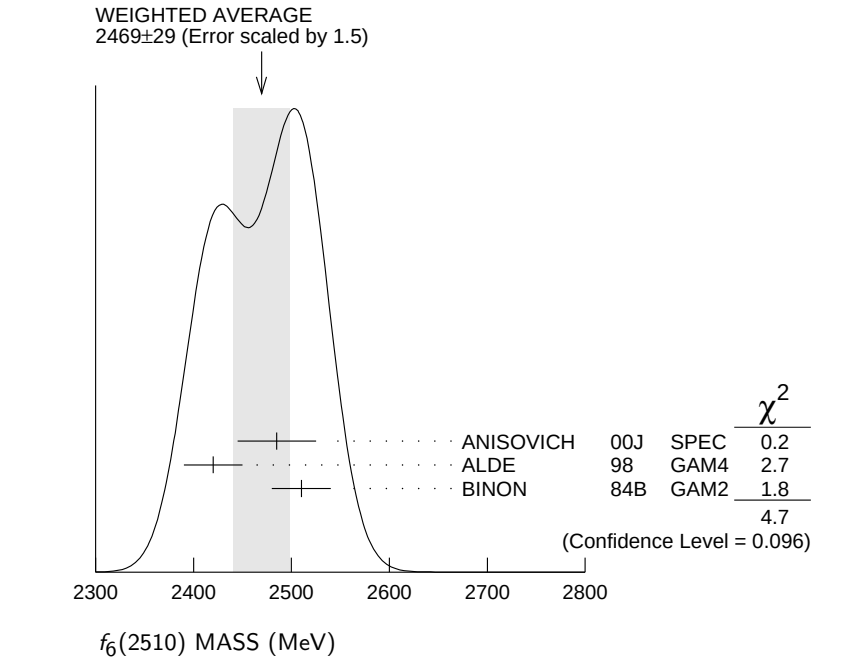
NODE=M089

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 $\pi^- p \rightarrow n 2\pi^0$

² From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.

NODE=M089W

NODE=M089W

NODE=M089W;LINKAGE=AN

$f_6(2510)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	(6.0±1.0) %

NODE=M089215;NODE=M089

DESIG=1

$f_6(2510)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.06±0.01	³ BINON	83C GAM2	38 $\pi^- p \rightarrow n 4\gamma$		

³ Assuming one pion exchange and using data of BOLOTOV 74.

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

$$B(X(1750) \rightarrow \bar{K}^*(892)^0 K^0 \rightarrow K^\pm \pi^\mp K_S^0) / B(X(1750) \rightarrow K^+ K^-)$$

VALUE	CL%	DOCUMENT ID	TECN
<0.065	90	LINK 02k	FOCS

NODE=M300B5
NODE=M300B5

$$B(X(1750) \rightarrow \bar{K}^*(892)^\pm K^\mp \rightarrow K^\pm \pi^\mp K_S^0) / B(X(1750) \rightarrow K^+ K^-)$$

VALUE	CL%	DOCUMENT ID	TECN
<0.183	90	LINK 02k	FOCS

NODE=M300B6
NODE=M300B6

f₂(1750) $I^G(J^{PC}) = 0^+(2^{++})$					
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(KK̄)**

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=M300JA4⁸ 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

X(1812) $I^G(J^{PC}) = ?^?(?^{?}+)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1812 $^{+19}_{-26}$ ± 18	105 ± 20 ± 28	¹⁰ ABLIKIM	06J BES2	$J/\psi \rightarrow \gamma \omega \phi$	

NODE=M300K29
NODE=M300K29

¹⁰ Favors $J^{PC} = 0^{++}$. Not seen by LIU 09 in $B^{\pm} \rightarrow K^{\pm} \omega \phi$.

NODE=M300K29;LINKAGE=AB

X(1850 - 3100) $I^G(J^{PC}) = ?^?(1^{--})$					
$\Gamma(e^+e^-) \cdot B(X \rightarrow \text{hadrons})$ (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<120	90	¹¹ ANASHIN	11	KEDR	$e^+e^- \rightarrow \text{hadrons}$
¹¹ This limit is center-of-mass energy dependent. We quote the most stringent one.					

NODE=M300K28
NODE=M300K28

NODE=M300K28;LINKAGE=AN

X(1855) $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1856.6 ± 5	20 ± 5	BRIDGES	86D	SPEC	$0. \bar{p} d \rightarrow \pi \pi N$

NODE=M300J31
NODE=M300J31

X(1870) $I^G(J^{PC}) = ?^?(2^{??})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1870 ± 40	250 ± 30	ALDE	86D	GAM4	$100 \pi^- p \rightarrow 2\eta X$

NODE=M300J45
NODE=M300J45

$a_3(1875)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$1874 \pm 43 \pm 96$	$385 \pm 121 \pm 114$	CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M300J95
NODE=M300J95

$B(a_3(1875) \rightarrow f_2(1270)\pi)/B(a_3(1875) \rightarrow \rho\pi)$					
VALUE	DOCUMENT ID	TECN	COMMENT		
0.8 ± 0.2	¹² CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	
¹² Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.					

NODE=M300B7
NODE=M300B7

NODE=M300B;LINKAGE=C1

$B(a_3(1875) \rightarrow \rho_3(1690)\pi)/B(a_3(1875) \rightarrow \rho\pi)$					
VALUE	DOCUMENT ID	TECN	COMMENT		
0.9 ± 0.3	¹³ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	
¹³ Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.					

NODE=M300B8
NODE=M300B8

NODE=M300B8;LINKAGE=C1

$a_1(1930)$ $I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1930^{+30}_{-70}	155 ± 45	ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J92
NODE=M300J92

X(1935) $I^G(J^{PC}) = 1^+(1^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1935 ± 20	215 ± 30	EVANGELIS...	79	OMEG	$10,16 \pi^- p \rightarrow \bar{p} p n$

NODE=M300J33
NODE=M300J33

$\rho_2(1940)$ $I^G(J^{PC}) = 1^+(2^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1940 ± 40	155 ± 40	¹⁴ ANISOVICH	02	SPEC	$0.6-1.9 \bar{p} \bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$

NODE=M300J85
NODE=M300J85

¹⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J85;LINKAGE=AY

$\omega_3(1945)$ $I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1945 ± 20	115 ± 22	¹⁵ ANISOVICH	02B	SPEC	$0.6-1.9 \bar{p} \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$
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
NODE=M300J81

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
NODE=M300J2

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

²⁶From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J78;LINKAGE=AZ

$b_3(2030)$		$I^G(J^{PC}) = 1^+(3^{+-})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2032±12	117 ± 11	²⁷ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J69
NODE=M300J69

²⁷ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J69;LINKAGE=AY

$a_2(2030)$ $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2030 ± 20	205 ± 30	²⁸ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K23
NODE=M300K23

²⁸ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K23;LINKAGE=AN

$a_3(2030)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2031 ± 12	150 ± 18	²⁹ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K20
NODE=M300K20

²⁹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K20;LINKAGE=AN

$\eta_2(2030)$ $I^G(J^{PC}) = 0^+(2^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2030 ± 5 ± 15	205 ± 10 ± 15	ANISOVICH	00E	SPEC	

NODE=M300J8
NODE=M300J8

$B(a_2\pi)_{L=0}/B(a_2\pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.05 ± 0.03	³⁰ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B1
NODE=M300B1

³⁰ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B1;LINKAGE=AN

$B(a_0\pi)/B(a_2\pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.10 ± 0.08	³¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B2
NODE=M300B2

³¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B2;LINKAGE=AN

$B(f_2\eta)/B(a_2\pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.13 ± 0.06	³² ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B3
NODE=M300B3

³² Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B3;LINKAGE=AN

$f_3(2050)$ $I^G(J^{PC}) = 0^+(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2048 ± 8	213 ± 34	ANISOVICH	00J	SPEC	2.0 $p\bar{p} \rightarrow \eta\pi^0\pi^0$

NODE=M300J7
NODE=M300J7

$f_0(2060)$ $I^G(J^{PC}) = 0^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
~ 2050	~ 120	³³ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2060	~ 50	³³ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$

NODE=M300J59
NODE=M300J59

³³ See SEMENOV 99 and KLOET 96.

OCCUR=2

NODE=M300J;LINKAGE=A

$\pi(2070)$ $I^G(J^{PC}) = 1^-(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2070 ± 35	310^{+100}_{-50}	ANISOVICH	01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J91
NODE=M300J91

$X(2075)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2075 ± 12 ± 5	90 ± 35 ± 9	³⁴ ABLIKIM	04J	BES2	$J/\psi \rightarrow K^- p\bar{\Lambda}$

NODE=M300J01
NODE=M300J01

³⁴ From a fit in the region $M_{p\bar{\Lambda}} - M_p - M_{\Lambda} < 150$ MeV. *S*-wave in the $p\bar{\Lambda}$ system preferred.

A similar near-threshold enhancement in the $p\bar{\Lambda}$ system is observed in $B^+ \rightarrow p\bar{\Lambda}\bar{D}^0$ by CHEN 11F.

NODE=M300J01;LINKAGE=AB

$X(2080)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2080 ± 10	110 ± 20	KREYMER	80	STRC	13 $\pi^- d \rightarrow p\bar{p}n(n_s)$

NODE=M300J35
NODE=M300J35

X(2080) $I^G(J^{PC}) = ?^?(3^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2080 ± 10	190 ± 15	ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J37
NODE=M300J37

a₁(2095) $I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2096 ± 17 ± 121	451 ± 41 ± 81	69k	KUHN	04	B852 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300J04
NODE=M300J04

B(a₁(2095) → f₁(1285)π) / B(a₁(2095) → a₁(1260))					
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
3.18 ± 0.64	69k	KUHN	04	B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300B03
NODE=M300B03

η(2100) $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2103 ± 50	187 ± 75	586	³⁵ BISELLO	89B	DM2 $J/\psi \rightarrow 4\pi\gamma$
³⁵ ASTON 81B sees no peak, has 850 events in Ajinenko+Barth bins. ARESTOV 80 sees no peak.					

NODE=M300J48
NODE=M300J48

NODE=M300J;LINKAGE=A1

X(2100) $I^G(J^{PC}) = ?^?(0^{??})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2100 ± 40	250 ± 40	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J49
NODE=M300J49

X(2110) $I^G(J^{PC}) = 1^+(3^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2110 ± 10	330 ± 20	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p} p n$

NODE=M300J36
NODE=M300J36

f₂(2140) $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2141 ± 12	49 ± 28	389	GREEN	86	MPSF 400 $pA \rightarrow 4KX$

NODE=M300J50
NODE=M300J50

X(2150) $I^G(J^{PC}) = ?^?(2^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2150 ± 10	260 ± 10	ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J38
NODE=M300J38

a₂(2175) $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2175 ± 40	310 ⁺⁹⁰ ₋₄₅	ANISOVICH	01F	SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J88
NODE=M300J88

η(2190) $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2190 ± 50	850 ± 100	BUGG	99	BES	

NODE=M300J13
NODE=M300J13

ω₂(2195) $I^G(J^{PC}) = 0^-(2^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2195 ± 30	225 ± 40	³⁶ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
³⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J82
NODE=M300J82

NODE=M300J82;LINKAGE=AZ

ω(2205) $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2205 ± 30	350 ± 90	³⁷ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J80
NODE=M300J80

³⁷ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J80;LINKAGE=AZ

X(2210) $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2210 ⁺⁷⁹ ₋₂₁	203 ⁺⁴³⁷ ₋₈₇	EVANGELIS...	79B	OMEG	10 $\pi^- p \rightarrow K^+ K^- n$

NODE=M300J39
NODE=M300J39

X(2210) $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2207 ± 22	130	CASO	70	HBC	11.2 $\pi^- p$

NODE=M300J51
NODE=M300J51

h₁(2215) $I^G(J^{PC}) = 0^-(1^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2215 ± 40	325 ± 55	³⁸ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

³⁸ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J27
NODE=M300J27

NODE=M300J27;LINKAGE=AZ

ρ₂(2225) $I^G(J^{PC}) = 1^+(2^- -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2225 ± 35	335 ⁺¹⁰⁰ ₋₅₀	³⁹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J70
NODE=M300J70

³⁹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J70;LINKAGE=AY

ρ₄(2230) $I^G(J^{PC}) = 1^+(4^- -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2230 ± 25	210 ± 30	⁴⁰ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J74
NODE=M300J74

⁴⁰ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J74;LINKAGE=AY

b₁(2240) $I^G(J^{PC}) = 1^+(1^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2240 ± 35	320 ± 85	⁴¹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J87
NODE=M300J87

⁴¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J87;LINKAGE=AY

f₂(2240) $I^G(J^{PC}) = 0^+(2^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2240 ± 15	241 ± 30	⁴² ANISOVICH	00J	SPEC	1.92–2.41 $p\bar{p}$

NODE=M300K26
NODE=M300K26

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

~ 2226 ~ 226 HASAN 94 RVUE $p\bar{p} \rightarrow \pi\pi$

⁴² From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.

NODE=M300K26;LINKAGE=AN

b₃(2245) $I^G(J^{PC}) = 1^+(3^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN		
2245 ± 50	320 ± 70	⁴³ BUGG	04C	RVUE	

NODE=M300K10
NODE=M300K10

⁴³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300K10;LINKAGE=AY

η₂(2250) $I^G(J^{PC}) = 0^+(2^- +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN		
2248 ± 20	280 ± 20	ANISOVICH	00I	SPEC	
2267 ± 14	290 ± 50	ANISOVICH	00J	SPEC	

NODE=M300J17
NODE=M300J17

$\pi_4(2250) \quad I^G(J^{PC}) = 1^-(4^-+)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2250 ± 15	215 ± 25	ANISOVICH	01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J73
NODE=M300J73

$\omega_4(2250) \quad I^G(J^{PC}) = 0^-(4^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2250 ± 30	150 ± 50	⁴⁴ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
⁴⁴ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J84
NODE=M300J84

NODE=M300J84;LINKAGE=AZ

$\omega_5(2250) \quad I^G(J^{PC}) = 0^-(5^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2250 ± 70	320 ± 95	⁴⁵ BUGG	04	RVUE	
⁴⁵ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300K11
NODE=M300K11

NODE=M300;LINKAGE=AZ

$\omega_3(2255) \quad I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2255 ± 15	175 ± 30	⁴⁶ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
⁴⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J66
NODE=M300J66

NODE=M300J66;LINKAGE=AZ

$a_4(2255)$		$I^G(J^{PC}) = 1^-(4^{++})$				
<u>MASS (MeV)</u>	<u>WIDTH (MeV)</u>	<u>DOCUMENT ID</u>		<u>TECN</u>	<u>COMMENT</u>	
2237± 5 OUR AVERAGE						
2237± 5	291 ± 12	UMAN	06	E835	5.2	$\bar{p}p \rightarrow \eta\eta\pi^0$
2255±40	330 ⁺¹¹⁰ ₋₅₀	⁴⁷ ANISOVICH	01F	SPEC	1.96–2.41	$\bar{p}p$
⁴⁷ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F						

NODE=M300K21
NODE=M300K21

NODE=M300K21;LINKAGE=AN

$a_2(2255) \quad I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2255 ± 20	230 ± 15	⁴⁸ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$
⁴⁸ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.					

NODE=M300K22
NODE=M300K22

NODE=M300K22;LINKAGE=AN

$X(2260) \quad I^G(J^{PC}) = 0^+(4^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2260 ± 20	400 ± 100	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p}pn$

NODE=M300J40
NODE=M300J40

$\rho(2270) \quad I^G(J^{PC}) = 1^+(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2265 ± 40	325 ± 80	⁴⁹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
2280 ± 50	440 ± 110	ATKINSON	85	OMEG	20–70 $\gamma p \rightarrow p\omega\pi^+\pi^-\pi^0$
⁴⁹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.					

NODE=M300J86
NODE=M300J86

NODE=M300J86;LINKAGE=AY

$a_1(2270) \quad I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2270 ⁺⁵⁵ ₋₄₀	305 ⁺⁷⁰ ₋₄₀	ANISOVICH	01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J72
NODE=M300J72

$h_3(2275) \quad I^G(J^{PC}) = 0^-(3^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 25	190 ± 45	⁵⁰ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J28
NODE=M300J28

⁵⁰ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J28;LINKAGE=AZ

$a_3(2275)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 35	350 ⁺¹⁰⁰ ₋₅₀	⁵¹ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K19
NODE=M300K19

⁵¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K19;LINKAGE=AN

$\pi_2(2285)$ $I^G(J^{PC}) = 1^-(2^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2285 ± 20 ± 25	250 ± 20 ± 25	⁵² ANISOVICH	11	SPEC	0.9–1.94 $p\bar{p}$

NODE=M300K25
NODE=M300K25

⁵² Reanalysis of ADOEIT 96 and ANISOVICH 00E.

NODE=M300K25;LINKAGE=AN

$\omega_3(2285)$ $I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2278 ± 28	224 ± 50	⁵³ BUGG	04A	RVUE	
2285 ± 60	230 ± 40	⁵⁴ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J83
NODE=M300J83

⁵³ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J83;LINKAGE=BU

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.

NODE=M300K27;LINKAGE=AN

$f_3(2300)$ $I^G(J^{PC}) = 0^+(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2334 ± 25	200 ± 20	⁵⁷ BUGG	04A	RVUE	

NODE=M300J19
NODE=M300J19

⁵⁷ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J19;LINKAGE=BU

$f_1(2310)$ $I^G(J^{PC}) = 0^+(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2310 ± 60	255 ± 70	ANISOVICH	00J	SPEC	

NODE=M300J23
NODE=M300J23

$\eta(2320)$ $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2320 ± 15	230 ± 35	⁵⁸ ANISOVICH	00M	SPEC	

NODE=M300J18
NODE=M300J18

⁵⁸ From the combined analysis of $\bar{p}p \rightarrow \eta\eta\eta$ from ANISOVICH 00M and $\bar{p}p \rightarrow \eta\pi^0\pi^0$ from ANISOVICH 00J.

NODE=M300;LINKAGE=B

$\eta_4(2330)$ $I^G(J^{PC}) = 0^+(4^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2328 ± 38	240 ± 90	ANISOVICH	00J	SPEC	2.0 $p\bar{p} \rightarrow \eta\pi^0\pi^0$

NODE=M300J22
NODE=M300J22

$\omega(2330)$ $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2330 ± 30	435 ± 75	ATKINSON	88	OMEG	25–50 $\gamma p \rightarrow \rho^\pm \rho^0 \pi^\mp$

NODE=M300J53
NODE=M300J53

$X(2340)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2340 ± 20	180 ± 60	126	⁵⁹ BALTAY	75	HBC 15 $\pi^+ p \rightarrow p5\pi$

NODE=M300J54
NODE=M300J54

⁵⁹ Dominant decay into $\rho^0 \rho^0 \pi^+$. BALTAY 78 finds confirmation in $2\pi^+ \pi^- 2\pi^0$ events which contain $\rho^+ \rho^0 \pi^0$ and $2\rho^+ \pi^-$.

NODE=M300J;LINKAGE=B1

$\pi(2360)$ $I^G(J^{PC}) = 1^-(0^-+)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2360 ± 25	300 $^{+100}_{-50}$	ANISOVICH	01F SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$	

NODE=M300J90
NODE=M300J90

$X(2360)$ $I^G(J^{PC}) = ?^?(4^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2360 ± 10	430 ± 30	ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J42
NODE=M300J42

$X(2440)$ $I^G(J^{PC}) = ?^?(5^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2440 ± 10	310 ± 20	ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J43
NODE=M300J43

$X(2632)$ $I^G(J^{PC}) = ?^?(??)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2635.2 ± 3.3		⁶⁰ EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^+ \eta$	
2631.6 ± 2.1	< 17	⁶¹ EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^0 K^+$	

NODE=M300J03
NODE=M300J03

OCCUR=2

⁶⁰ From a mass difference to D_s^+ of 666.9 ± 3.3 MeV.

⁶¹ From a mass difference to D_s^0 of 767.0 ± 2.0 MeV.

NODE=M300J03;LINKAGE=EV
NODE=M300J03;LINKAGE=ED

$B(X(2632) \rightarrow D_s^0 K^+)/B(X(2632) \rightarrow D_s^+ \eta)$					
VALUE	DOCUMENT ID	TECN			
0.14 ± 0.06	⁶² EVDOKIMOV	04 SELX			

NODE=M300B01
NODE=M300B01

⁶² Possible interpretation of this decay pattern is discussed by YASUI 07.

NODE=M300B01;LINKAGE=YA

$X(2680)$ $I^G(J^{PC}) = ?^?(??)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2676 ± 27	150	CASO	70 HBC	11.2 $\pi^- p \rightarrow \rho^- \pi^+ \pi^- p$	

NODE=M300J55
NODE=M300J55

$X(2710)$ $I^G(J^{PC}) = ?^?(6^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2710 ± 20	170 ± 40	ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J44
NODE=M300J44

$X(2750)$ $I^G(J^{PC}) = ?^?(7^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2747 ± 32	195 ± 75	DENNEY	83 LASS	10 $\pi^+ p \rightarrow K^+ K^- \pi^+ p$	

NODE=M300J56
NODE=M300J56

$f_6(3100)$ $I^G(J^{PC}) = 0^+(6^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3100 ± 100	700 ± 130	BINON	05 GAMS	33 $\pi^- p \rightarrow \eta\eta n$	

NODE=M300J06
NODE=M300J06

$X(3250)$ $I^G(J^{PC}) = ?^?(??)$ 3-Body Decays					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3250 ± 8 ± 20	45 ± 18	ALEEV	93 BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+$	
3265 ± 7 ± 20	40 ± 18	ALEEV	93 BIS2	$X(3250) \rightarrow \bar{\Lambda} p K^-$	

NODE=M300J57
NODE=M300J57

OCCUR=2

X(3250)	$I^G(J^{PC}) = \text{?}^{\text{?}}(\text{?}^{\text{?}})$	4-Body Decays			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3245 ± 8 ± 20	25 ± 11	ALEEV	93	BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+ \pi^\pm$
3250 ± 9 ± 20	50 ± 20	ALEEV	93	BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^- \pi^\mp$
3270 ± 8 ± 20	25 ± 11	ALEEV	93	BIS2	$X(3250) \rightarrow K_S^0 \bar{p} K^\pm$

NODE=M300J58
NODE=M300J58

OCCUR=2
OCCUR=3

X(3350)	$I^G(J^{PC}) = \text{?}^{\text{?}}(\text{?}^{\text{?}})$				
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

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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 031102R	B. AUBERT <i>et al.</i>	(BABAR Collab.)
ABRAAMYAN	09	PR C80 034001	Kh.U. Abraamyan <i>et al.</i>	
LIU	09	PR D79 071102R	C. Liu <i>et al.</i>	(BELLE Collab.)
VLADIMIRSK...	08	PAN 71 2129	V.V. Vladimirovsky <i>et al.</i>	(ITEP)
VLADIMIRSK...	07	Translated from YAF 71 2166	V. Vladimirovsky <i>et al.</i>	
YASUI	07	PAN 70 1706	S. Yasui, M. Oka	
ABLIKIM	06J	PR D76 034009	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	06S	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)
GABYSHEV	06A	PRL 97 142002	N. Gabyshev <i>et al.</i>	(BELLE Collab.)
SCHEGELSKY	06	PRL 97 242001	V.A. Schegelsky <i>et al.</i>	
SCHEGELSKY	06A	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
UMAN	06	EPJ A27 207	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK...	06	PR D73 052009	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
BINON	05	PAN 69 493	F. Binon <i>et al.</i>	
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ABLIKIM	04J	Translated from YAF 68 998	M. Ablikim <i>et al.</i>	(BES Collab.)
BUGG	04	PRL 94 032002	D.V. Bugg	
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ANISOVICH	02	PAN 66 700	A.V. Anisovich <i>et al.</i>	
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CHUNG	02	PL B542 8	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
LINK	02K	PL B542 19	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ANISOVICH	01C	PR D65 072001	A.V. Anisovich <i>et al.</i>	
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ANISOVICH	00B	PL B517 261	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00D	PL B517 273	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00E	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00F	PL B476 15	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00G	PL B477 19	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00H	PL B491 40	A.V. Anisovich <i>et al.</i>	
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KLOET	96	ZPHY C71 227	W.M. Kloet, F. Myhrer	(RUTG, NORD)
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ARMSTRONG	93D	PAN 56 1358	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
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CONDO	91	ZPHY C50 1	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)
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DAFTARI	87	ZPHY C38 535	I.K. Daftari <i>et al.</i>	(SYRA)
ALDE	86D	PRL 58 859	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
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GREEN	86	PL B180 313	D.R. Green <i>et al.</i>	(FNAL, ARIZ, FSU+)
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DENNEY	83	ZPHY C29 333	D.L. Denney <i>et al.</i>	(IOWA, MICH)
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ARESTOV	80	NP B189 205	Y.I. Arestov <i>et al.</i>	(SERP)
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KREYMER	80	ZPHY C3 285	A.E. Kreymer <i>et al.</i>	(IND, PURD, SLAC+)
ROZANSKA	80	PR D22 36	M. Rozanska <i>et al.</i>	(MPIM, CERN)
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BALTAY	78	NP B154 381	C. Baltay <i>et al.</i>	(COLU, BING)
ANTIPOV	77	PR D17 52	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
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BALTAY	75	PRL 39 591	C. Baltay <i>et al.</i>	(COLU, BING)
KALELKHAR	75	PRL 35 891	M.S. Kalelkar	(COLU)
CASO	70	Thesis Neviss 207	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)

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REFID=21564
REFID=20590

STRANGE MESONS

($S = \pm 1$, $C = B = 0$)

$K^+ = u\bar{s}$, $K^0 = d\bar{s}$, $\bar{K}^0 = \bar{d}s$, $K^- = \bar{u}s$, similarly for K^{*} 's

$K_0^*(800)$

or κ

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation. See the mini-review on scalar mesons under $f_0(500)$ (see the index for the page number).

$K_0^*(800)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
682 ± 29 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below. [676 ± 40 MeV OUR 2011 AVERAGE Scale factor = 2.9]		
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 $\pm 1.8 \pm 22.8$	141k	¹⁰ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
856 ± 17 ± 13	54k	¹¹ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
750 $^{+30}_{-55}$		¹² BUGG	06 RVUE	
855 ± 15	0.6k	¹³ CAWLFIELD	06A CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
694 ± 53		^{3,14} ZHOU	06 RVUE	$K p \rightarrow K^- \pi^+ n$
753 ± 52		¹⁵ PELAEZ	04A RVUE	$K \pi \rightarrow K \pi$
594 ± 79		¹⁴ ZHENG	04 RVUE	$K^- p \rightarrow K^- \pi^+ n$
722 ± 60		¹⁶ BUGG	03 RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
905 $^{+65}_{-30}$		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.

NODE=MXXX020

NODE=MXXX020

NODE=M174

NODE=M174

NODE=M174M

NODE=M174M

NEW

NODE=M174M;LINKAGE=LI

NODE=M174M;LINKAGE=BL

NODE=M174M;LINKAGE=SM

NODE=M174M;LINKAGE=AB

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NODE=M174M;LINKAGE=A

NODE=M174M;LINKAGE=AU

NODE=M174M;LINKAGE=BG

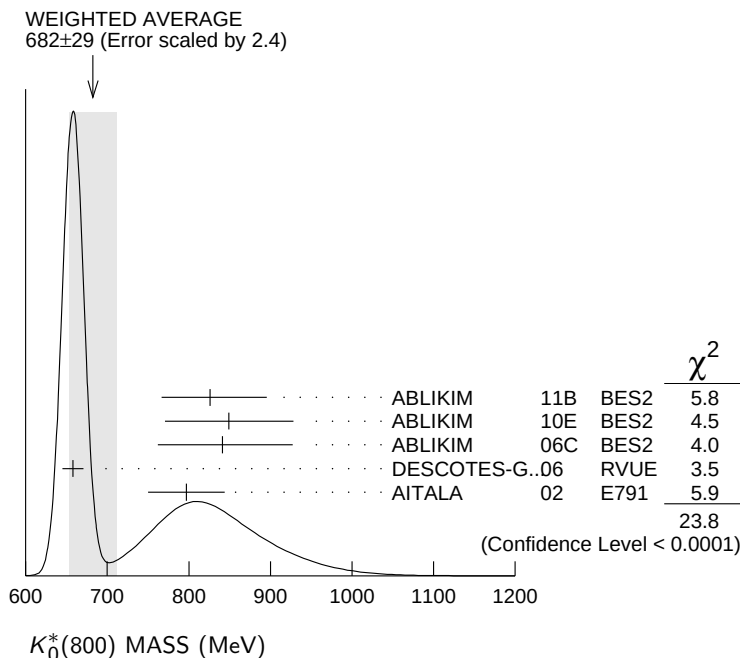
NODE=M174M;LINKAGE=TM

NODE=M174M;LINKAGE=BW

NODE=M174M;LINKAGE=BU

- 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.

NODE=M174M;LINKAGE=CA

NODE=M174M;LINKAGE=ZH
NODE=M174M;LINKAGE=PENODE=M174M;LINKAGE=A1
NODE=M174M;LINKAGE=IS **$K_0^*(800)$ WIDTH**

NODE=M174W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
547 ± 24 OUR AVERAGE Error includes scale factor of 1.1. [548 ± 24 MeV OUR 2011 AVERAGE Scale factor = 1.1]

NODE=M174W
NEW

449 ± 156	$^{+144}_{-81}$	1338	18	ABLIKIM	11B	BES2	$J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
512 ± 80	$^{+92}_{-44}$	1421	19,20	ABLIKIM	10E	BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
618 ± 90	$^{+96}_{-144}$	25k	19,21	ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
557 ± 24			22	DESCOTES-G..06		RVUE	$\pi K \rightarrow \pi K$
410 ± 43 ± 87		15k	23,24	AITALA	02	E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •							
658 ± 10 ± 44			25	BUGG	10	RVUE	S -matrix pole
638.8 ± 4.4 ± 40.4		141k	26	BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
464 ± 28 ± 22		54k	27	LINK	07B	FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
684 ± 120			28	BUGG	06	RVUE	
251 ± 48		0.6k	29	CAWLFIELD	06A	CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
606 ± 59			19,30	ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
470 ± 66			31	PELAEZ	04A	RVUE	$K \pi \rightarrow K \pi$
724 ± 332			30	ZHENG	04	RVUE	$K^- p \rightarrow K^- \pi^+ n$
772 ± 100			32	BUGG	03	RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
545 $^{+235}_{-110}$			33	ISHIDA	97B	RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

- 18 The Breit-Wigner parameters from a fit with seven intermediate resonances. The S -matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.

NODE=M174W;LINKAGE=LI

- 19 S -matrix pole.

NODE=M174W;LINKAGE=AB
NODE=M174W;LINKAGE=BL

- 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.

NODE=M174W;LINKAGE=EP

- 22 S -matrix pole. Using Roy-Steiner equations (ROY 71) as well as unitarity, analyticity and crossing symmetry constraints.

NODE=M174W;LINKAGE=DE

- 23 Not seen by KOPP 01 using 7070 events of $D^0 \rightarrow K^- \pi^+ \pi^0$. LINK 02E and LINK 05I show clear evidence for a constant non-resonant scalar amplitude rather than $K_0^*(800)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.
- 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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NODE=M174W;LINKAGE=BW

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NODE=M174W;LINKAGE=ZH

NODE=M174W;LINKAGE=PE

NODE=M174W;LINKAGE=A1

NODE=M174W;LINKAGE=IS

$K_0^*(800)$ REFERENCES

ABLIKIM	11B	PL B698 183	M. Ablikim <i>et al.</i>	(BES II Collab.)
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)
BUGG	10	PR D81 014002	D.V. Bugg	(LOQM)
LINK	09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT	07T	PR D76 011102R	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 031108R	C. Cawfield <i>et al.</i>	(CLEO Collab.)
DESCOTES-G...	06	EPJ C48 553	S. Descotes-Genon, B. Moussallam	
GUO	06	NP A773 78	F.K. Guo <i>et al.</i>	
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	
LINK	05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	
ZHENG	04	NP A733 235	H.Q. Zheng <i>et al.</i>	
BUGG	03	PL B572 1	D.V. Bugg	
AITALA	02	PRL 89 121801	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
LINK	02E	PL B535 43	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
KOPP	01	PR D63 092001	S. Kopp <i>et al.</i>	(CLEO Collab.)
ISHIDA	97B	PTP 98 621	S. Ishida <i>et al.</i>	
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
LINGLIN	73	NP B55 408	D. Linglin	(CERN)
ROY	71	PL 36B 353	S.M. Roy	

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$K^*(892)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M018

 $K^*(892)$ MASS

NODE=M018205

CHARGED ONLY, HADROPRODUCEDNODE=M018M1
NODE=M018M1

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	DELFOSSÉ 81	SPEC	+	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
886.0 ±2.3	187	DELFOSSÉ 81	SPEC	—	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
894.2 ±2.0	765	² CLARK 73	HBC	—	3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
894.3 ±1.5	1150	^{2,3} CLARK 73	HBC	—	3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.0 ±2.6	341	² SCHWEING...68	HBC	—	5.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYSNODE=M018MCT
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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	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$

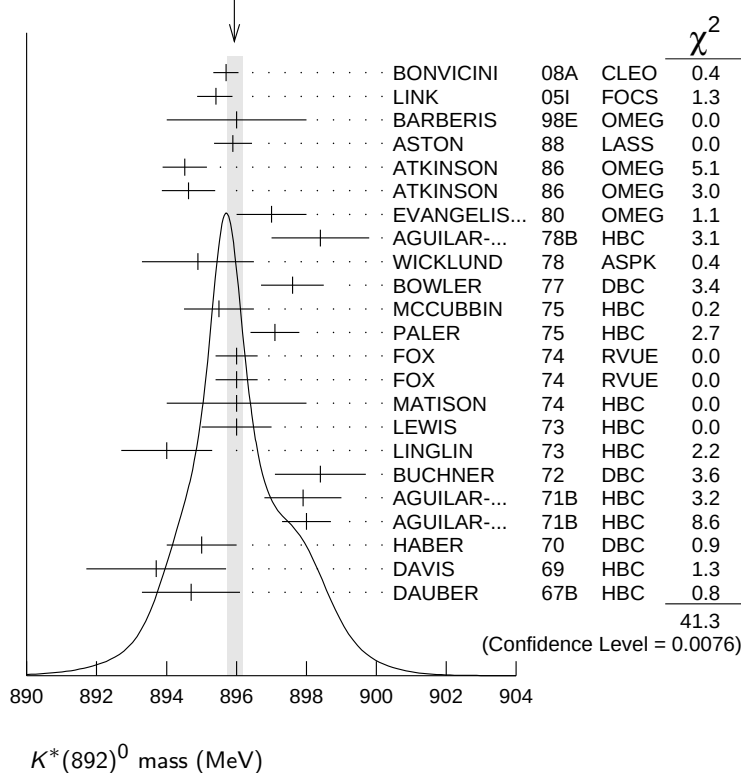
NEUTRAL ONLYNODE=M018M2
NODE=M018M2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.94±0.22 OUR AVERAGE				
Error includes scale factor of 1.4. See the ideogram below.				
895.7 ±0.2 ±0.3	141k	¹³ BONVICINI 08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
895.41±0.32 ^{+0.35} _{-0.43}	18k	¹⁴ 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		¹⁵ MATISON	74	HBC	$12 K^+ p \rightarrow K^+ \pi^- \Delta$	
896 ±1	3186	LEWIS	73	HBC	$2.1\text{--}2.7 K^+ p \rightarrow K \pi \pi p$	
894.0 ±1.3		¹⁵ LINGLIN	73	HBC	$2\text{--}13 K^+ p \rightarrow K^+ \pi^- \pi^+ p$	
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	¹⁶ MITCHELL	09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$	
896.2 ±0.3	20k	⁸ AUBERT	07AK	BABR	$10.6 e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$	
900.7 ±1.1	5900	BARTH	83	HBC	$70 K^+ p \rightarrow K^+ \pi^- X$	

WEIGHTED AVERAGE
895.94±0.22 (Error scaled by 1.4)



¹ Inclusive reaction. Complicated background and phase-space effects.

² Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.

³ Number of events in peak reevaluated by us.

⁴ K-matrix pole.

⁵ From a partial wave amplitude analysis.

⁶ From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.

⁷ From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{f3} decays in ANTONELLI 10.

⁸ Systematic uncertainties not estimated.

⁹ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

¹⁰ Reanalysis of EPIFANOV 07 using resonance chiral theory.

¹¹ Calculated by us from the shift by 4.7 ± 0.9 MeV (statistical uncertainty only) reported in BONVICINI 02 with respect to the world average value from PDG 00.

¹² With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

¹³ From the isobar model with a complex pole for the κ .

¹⁴ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

¹⁵ From pole extrapolation.

¹⁶ This value comes from a fit with χ^2 of 178/117.

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NODE=M018M2;LINKAGE=BO

NODE=M018W2;LINKAGE=LI

NODE=M018M;LINKAGE=C

NODE=M018M2;LINKAGE=MI

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M018209

$$m_{K^*(892)^0} = m_{K^*(892)^\pm}$$

NODE=M018D

NODE=M018D

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
6.7±1.2 OUR AVERAGE					
7.7±1.7	2980	AGUILAR-...	78B	HBC	±0 0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
5.7±1.7	7338	AGUILAR-...	71B	HBC	-0 3.9,4.6 $K^- p$
6.3±4.1	283	¹⁷ BARASH	67B	HBC	0.0 $\bar{p}p$
¹⁷ Number of events in peak reevaluated by us.					

NODE=M018D;LINKAGE=W

K*(892) RANGE PARAMETER

NODE=M018R

NODE=M018R

All from partial wave amplitude analyses.

NODE=M018R

VALUE (GeV ⁻¹)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3.96±0.54 ^{+1.31} _{-0.90}	18k	¹⁸ LINK	05i	FOCS	0 $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
3.4 ±0.7		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
12.1 ±3.2 ±3.0		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
¹⁸ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.					

NODE=M018R;LINKAGE=LI

K*(892) WIDTH

NODE=M018215

CHARGED ONLY, HADROPRODUCEDNODE=M018W1
NODE=M018W1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
50.8±0.9 OUR FIT					
50.8±0.9 OUR AVERAGE					
49 ±2	5840	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
56 ±4		NAPIER	84	SPEC	- 200 $\pi^- p \rightarrow 2K_S^0 X$
51 ±2	4100	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
50.5±5.6		AJINENKO	80	HBC	+ 32 $K^+ p \rightarrow K^0 \pi^+ X$
45.8±3.6	1800	AGUILAR-...	78B	HBC	± 0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
52.0±2.5	6706	¹⁹ COOPER	78	HBC	± 0.76 $\bar{p}p \rightarrow (K\pi)^\pm X$
52.1±2.2	9000	²⁰ PALER	75	HBC	- 14.3 $K^- p \rightarrow (K\pi)^- X$
46.3±6.7	765	¹⁹ CLARK	73	HBC	- 3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
48.2±5.7	1150	^{19,21} CLARK	73	HBC	- 3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
54.3±3.3	4404	¹⁹ AGUILAR-...	71B	HBC	- 3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
46 ±5	1700	^{19,21} 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	²² ABELE	99D	CBAR	± 0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
45.2±1 ±2	79.7±0.8k	²³ 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	^{19,21} CLELAND	82	SPEC	+ 30 $K^+ p \rightarrow K_S^0 \pi^+ p$
62.0±4.4	3200	^{19,21} CLELAND	82	SPEC	+ 50 $K^+ p \rightarrow K_S^0 \pi^+ p$
55 ±4	3600	^{19,21} CLELAND	82	SPEC	- 50 $K^+ p \rightarrow K_S^0 \pi^- p$
62.6±3.8	380	DELFOSSSE	81	SPEC	+ 50 $K^\pm p \rightarrow K^\pm \pi^0 p$
50.5±3.9	187	DELFOSSSE	81	SPEC	- 50 $K^\pm p \rightarrow K^\pm \pi^0 p$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYSNODE=M018W5
NODE=M018W5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
46.2±0.6±1.2				
	53k	²⁴ 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		²⁵ BOITO	10	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.2±0.4		^{26,27} BOITO	09	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
47.5±0.4		^{26,28} JAMIN	08	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
55 ±8		²⁹ BARATE	99R	ALEP $\tau^- \rightarrow K^- \pi^0 \nu_\tau$

NEUTRAL ONLY

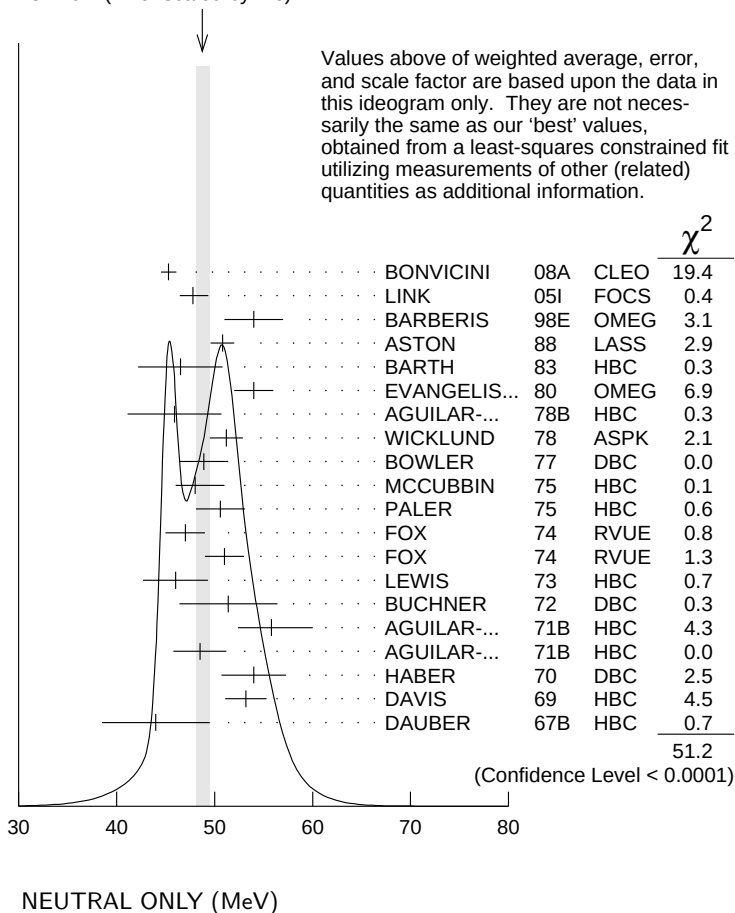
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
48.7 ±0.8 OUR FIT		Error includes scale factor of 1.7.			
48.7 ±0.7 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.			
45.3 ±0.5 ±0.6 141k	30	BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
47.79 ±0.86 ^{+1.32} _{-1.06} 18k	31	LINK	05I	FOCS	0 $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
54 ±3		BARBERIS	98E	OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
50.8 ±0.8 ±0.9		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
46.5 ±4.3 5900		BARTH	83	HBC	0 70 $K^+ p \rightarrow K^+ \pi^- X$
54 ±2 28k		EVANGELIS...	80	OMEG	0 10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
45.9 ±4.8 1180		AGUILAR-...	78B	HBC	0 0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
51.2 ±1.7		WICKLUND	78	ASPK	0 3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
48.9 ±2.5		BOWLER	77	DBC	0 5.4 $K^+ d \rightarrow K^+ \pi^- pp$
48 ⁺³ ₋₂ 3600		MCCUBBIN	75	HBC	0 3.6 $K^- p \rightarrow K^- \pi^+ n$
50.6 ±2.5 22k	20	PALER	75	HBC	0 14.3 $K^- p \rightarrow (K\pi)^0 X$
47 ±2 10k		FOX	74	RVUE	0 2 $K^- p \rightarrow K^- \pi^+ n$
51 ±2		FOX	74	RVUE	0 2 $K^+ n \rightarrow K^+ \pi^- p$
46.0 ±3.3 3186	19	LEWIS	73	HBC	0 2.1-2.7 $K^+ p \rightarrow K\pi\pi p$
51.4 ±5.0 1700	19	BUCHNER	72	DBC	0 4.6 $K^+ n \rightarrow K^+ \pi^- p$
55.8 ^{+4.2} _{-3.4} 2934	19	AGUILAR-...	71B	HBC	0 3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$
48.5 ±2.7 5362		AGUILAR-...	71B	HBC	0 3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$
54.0 ±3.3 4300	19,21	HABER	70	DBC	0 3 $K^- N \rightarrow K^- \pi^+ X$
53.2 ±2.1 10k	19	DAVIS	69	HBC	0 12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
44 ±5.5 1040	19	DAUBER	67B	HBC	0 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	32	MITCHELL	09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
50.6 ±0.9 20k	26	AUBERT	07AK	BABR	10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$

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NODE=M018W2

OCCUR=2

OCCUR=2

WEIGHTED AVERAGE
48.7±0.7 (Error scaled by 1.6)



- 19 Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.
 20 Inclusive reaction. Complicated background and phase-space effects.
 21 Number of events in peak reevaluated by us.
 22 K-matrix pole.
 23 From a partial wave amplitude analysis.
 24 From a fit in the $K_0^*(800) + K^*(892) + K^*(1410)$ model.
 25 From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.
 26 Systematic uncertainties not estimated.
 27 From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.
 28 Reanalysis of EPIFANOV 07 using resonance chiral theory.
 29 With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.
 30 From the isobar model with a complex pole for the κ .
 31 Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.
 32 This value comes from a fit with χ^2 of 178/117.

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 NODE=M018W2;LINKAGE=BO
 NODE=M018M2;LINKAGE=LI
 NODE=M018W2;LINKAGE=MI

NODE=M018220;NODE=M018

$K^*(892)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$K\pi$	~ 100	%
Γ_2	$(K\pi)^\pm$	$(99.901 \pm 0.009) \%$	
Γ_3	$(K\pi)^0$	$(99.761 \pm 0.021) \%$	
Γ_4	$K^0\gamma$	$(2.39 \pm 0.21) \times 10^{-3}$	
Γ_5	$K^\pm\gamma$	$(9.9 \pm 0.9) \times 10^{-4}$	
Γ_6	$K\pi\pi$	< 7	$\times 10^{-4}$ 95%

DESIG=1;OUR EVAL;→ NOT CHECKED ←
 DESIG=11
 DESIG=12
 DESIG=4
 DESIG=3
 DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 13 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 7.8$ for 11 degrees of freedom.

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

$$\begin{array}{c|cc} x_5 & -100 & \\ \Gamma & 19 & -19 \\ & x_2 & x_5 \end{array}$$

	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 21 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 51.2$ 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.

$$\begin{array}{c|cc} x_4 & -100 & \\ \Gamma & 18 & -18 \\ & x_3 & x_4 \end{array}$$

	Mode	Rate (MeV)	Scale factor
Γ_3	$(K\pi)^0$	48.6 ± 0.8	1.7
Γ_4	$K^0\gamma$	0.117 ± 0.010	

DESIG=12
 DESIG=4

K*(892) PARTIAL WIDTHS

NODE=M018225

 $\Gamma(K^0\gamma)$ Γ_4

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
117 ±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
2.39±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

ANTONELLI	10	EPJ C69 399	M. Antonelli <i>et al.</i>	(FlaviaNet Working Group)
BOITO	10	JHEP 1009 031	D.R. Boito, R. Escribano, M. Jamin	(BARC)
BOITO	09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin	
MITCHELL	09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
JAMIN	08	PL B664 78	M. Jamin, A. Pich, J. Portoles	
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
LINK	05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI	02	PRL 88 111803	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BARATE	99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS	98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)
BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
CARLSMITH	86	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, NIJM+)
WICKLUND	78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)
CARITHERS	75B	PRL 35 349	W.C.J. Carithers <i>et al.</i>	(ROCH, MCGI)
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)
PALER	75	NP B96 1	K. Paler <i>et al.</i>	(RHEL, SACL, EPOL)
FOX	74	NP B80 403	G.C. Fox, M.L. Griss	(CIT)
MATISON	74	PR D9 1872	M.J. Matison <i>et al.</i>	(LBL)
BEMPORAD	73	NP B51 1	C. Bemporad <i>et al.</i>	(CERN, ETH, LOIC)
CLARK	73	NP B54 432	A.G. Clark, L. Lyons, D. Radojicic	(OXF)
LEWIS	73	NP B60 283	P.H. Lewis <i>et al.</i>	(LOWC, LOIC, CDEF)
LINGLIN	73	NP B55 408	D. Linglin	(CERN)
BUCHNER	72	NP B45 333	K. Buchner <i>et al.</i>	(MPIM, CERN, BRUX)
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)
HABER	70	NP B17 289	B. Haber <i>et al.</i>	(REHO, SACL, BGNA, EPOL)
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)
DAVIS	69	PRL 23 1071	P.J. Davis <i>et al.</i>	(LRL)
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)
BARASH	67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIVP)
DAUBER	67B	PR 153 1403	P.M. Dauber <i>et al.</i>	(UCLA)
DEBAERE	67B	NC 51A 401	W. de Baere <i>et al.</i>	(BRUX, CERN)
WOJCICKI	64	PR 135 B484	S.G. Wojcicki	(LRL)

REFIID=53448
 REFIID=53632
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 REFIID=22379

$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M028

 $K_1(1270)$ MASS

NODE=M028205

VALUE (MeV)	DOCUMENT ID

NODE=M028MX

1272±7 OUR AVERAGE Includes data from the 2 datablocks that follow this one.**PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE**
 NODE=M028M2
 NODE=M028M2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

1275±10	700	GAVILLET	78	HBC	+	4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$

PRODUCED BY K BEAMS
 NODE=M028M3
 NODE=M028M3

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

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

1270±10	¹ DAUM	81C	CNTR	-	63 $K^- p \rightarrow K^- 2\pi p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1276	² TORNQVIST	82B	RVUE		
~ 1300	VERGEEST	79	HBC	-	4.2 $K^- p \rightarrow (\bar{K}\pi\pi)^- p$
1289±25	³ CARNEGIE	77	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
~ 1300	BRANDENB...	76	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
~ 1270	OTTER	76	HBC	-	10,14,16 $K^- p \rightarrow (\bar{K}\pi\pi)^- p$
1260	DAVIS	72	HBC	+	12 $K^+ p$
1234±12	FIRESTONE	72B	DBC	+	12 $K^+ d$

¹ Well described in the chiral unitary approach of GENG 07 with two poles at 1195 and 1284 MeV and widths of 246 and 146 MeV, respectively.² From a unitarized quark-model calculation.³ From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

NODE=M028M3;LINKAGE=DA

 NODE=M028M3;LINKAGE=T
 NODE=M028M3;LINKAGE=E
PRODUCED BY BEAMS OTHER THAN K MESONS
 NODE=M028M1
 NODE=M028M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1248.1± 3.3±1.4		GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1279 ±10	25k	⁴ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
1294 ±10	310	RODEBACK	81	HBC	$4 \pi^- p \rightarrow \Lambda K 2\pi$
1300	40	CRENNELL	72	HBC	0 $4.5 \pi^- p \rightarrow \Lambda K 2\pi$
1242 $^{+9}_{-10}$		⁵ ASTIER	69	HBC	0 $\bar{p} p$
1300	45	CRENNELL	67	HBC	0 $6 \pi^- p \rightarrow \Lambda K 2\pi$

⁴ Systematic errors not estimated.⁵ This was called the C meson.
 NODE=M028M1;LINKAGE=AB
 NODE=M028M1;LINKAGE=A
PRODUCED IN τ LEPTON DECAYS
 NODE=M028MT
 NODE=M028MT

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1254±33±34	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

 $K_1(1270)$ WIDTH

NODE=M028210

VALUE (MeV)	DOCUMENT ID

NODE=M028WX

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.

→ NOT CHECKED ←

87± 7 OUR AVERAGE Includes data from the 2 datablocks that follow this one.**PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE**
 NODE=M028W2
 NODE=M028W2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

75±15	700	GAVILLET	78	HBC	+	4.2 $K^- p \rightarrow \Xi^- K\pi\pi$

PRODUCED BY K BEAMS

VALUE (MeV) DOCUMENT ID TECN CHG COMMENT

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

90 ± 8 ⁶ DAUM 81C CNTR - $63 K^- p \rightarrow K^- 2\pi p$

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

~ 150 VERGEEST 79 HBC - $4.2 K^- p \rightarrow (\bar{K} \pi \pi)^- p$
 150 ± 71 ⁷ CARNEGIE 77 ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
 ~ 200 BRANDENB... 76 ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
 120 DAVIS 72 HBC + $12 K^+ p$
 188 ± 21 FIRESTONE 72B DBC + $12 K^+ d$

⁶ Well described in the chiral unitary approach of GENG 07 with two poles at 1195 and 1284 MeV and widths of 246 and 146 MeV, respectively.

⁷ From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

NODE=M028W3
 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 $\pm$ 5.2 $\pm$ 6.7 GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

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

131 ± 21 25k ⁸ ABLIKIM 06C BES2 $J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
 66 ± 15 310 RODEBACK 81 HBC $4 \pi^- p \rightarrow \Lambda K 2\pi$
 60 40 CRENNELL 72 HBC 0 $4.5 \pi^- p \rightarrow \Lambda K 2\pi$
 127 $+7$
 -25 ASTIER 69 HBC 0 $\bar{p} p$
 60 45 CRENNELL 67 HBC 0 $6 \pi^- p \rightarrow \Lambda K 2\pi$

⁸ Systematic errors not estimated.

NODE=M028W1
 NODE=M028W1

NODE=M028W1;LINKAGE=AB

PRODUCED IN τ LEPTON DECAYS

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

**260 $+90$
 -70 ± 80** 7k ASNER 00B CLEO $\pm$ $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

NODE=M028WT
 NODE=M028WT

 $K_1(1270)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
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;→ NOT CHECKED ←

 $K_1(1270)$ PARTIAL WIDTHS **$\Gamma(K \rho)$**

VALUE (MeV) DOCUMENT ID TECN CHG COMMENT

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

57 ± 5 MAZZUCATO 79 HBC + $4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
 75 ± 6 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

 $\Gamma(K_0^*(1430) \pi)$

VALUE (MeV) DOCUMENT ID TECN CHG COMMENT

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

26 ± 6 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

 $\Gamma(K^*(892) \pi)$

VALUE (MeV) DOCUMENT ID TECN CHG COMMENT

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

14 ± 11 MAZZUCATO 79 HBC + $4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
 2 ± 2 CARNEGIE 77B ASPK $\pm$ $13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

Γ_1

NODE=M028W5
 NODE=M028W5

Γ_2

NODE=M028W7
 NODE=M028W7

Γ_3

NODE=M028W4
 NODE=M028W4

$\Gamma(K\omega)$ Γ_4

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4 ± 4	MAZZUCATO 79	HBC	+	$4.2 K^- p \rightarrow \Xi^- (K\pi\pi)^+$
24 ± 3	CARNEGIE 77B	ASPK	$\pm$	$13 K^\pm p \rightarrow (K\pi\pi)^\pm p$

NODE=M028W6
 NODE=M028W6

 $\Gamma(K f_0(1370))$ Γ_5

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
22 ± 5	CARNEGIE 77B	ASPK	$\pm$	$13 K^\pm p \rightarrow (K\pi\pi)^\pm p$

NODE=M028W8
 NODE=M028W8

 $\Gamma(\gamma K^0)$ Γ_6

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
$73.2 \pm 6.1 \pm 28.3$	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$

NODE=M028W9
 NODE=M028W9

 $K_1(1270)$ BRANCHING RATIOS

NODE=M028225

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.42 ± 0.06	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.584 ± 0.043	¹⁰ GULER 11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$
dominant	RODEBACK 81	HBC	$4 \pi^- p \rightarrow \Lambda K 2\pi$

NODE=M028R2
 NODE=M028R2

 $\Gamma(K_0^*(1430)\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.28 ± 0.04	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.0201 ± 0.0064	¹⁰ GULER 11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M028R4
 NODE=M028R4

 $\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.16 ± 0.05	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.171 ± 0.023	¹⁰ GULER 11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M028R1
 NODE=M028R1

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.11 ± 0.02	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.225 ± 0.052	¹⁰ GULER 11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M028R3
 NODE=M028R3

 $\Gamma(K\omega)/\Gamma(K\rho)$ Γ_4/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.30	95	RODEBACK 81	HBC	$4 \pi^- p \rightarrow \Lambda K 2\pi$

NODE=M028R6
 NODE=M028R6

 $\Gamma(K f_0(1370))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.03 ± 0.02	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$

NODE=M028R5
 NODE=M028R5

 $D\text{-wave}/S\text{-wave RATIO FOR } K_1(1270) \rightarrow K^*(892)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
1.0 ± 0.7	⁹ DAUM 81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$

NODE=M028R9
 NODE=M028R9

⁹ Average from low and high t data.

¹⁰ Assuming that decays are saturated by the $K\rho$, $K_0^*(1430)\pi$, $K^*(892)\pi$, $K\omega$ decay modes and neglecting interference between them. The values $B(\omega \rightarrow \pi^+\pi^-) = (1.53^{+0.11}_{-0.13})\%$ and $B(K_0^*(1430) \rightarrow K\pi) = (93 \pm 10)\%$ are used. Systematic uncertainties not estimated.

NODE=M028R;LINKAGE=F
 NODE=M028R1;LINKAGE=GU

$K_1(1270)$ REFERENCES

GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
GENG	07	PR D75 014017	L.S. Geng <i>et al.</i>	
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
ASNER	00B	PR D62 072006	D.M. Asner <i>et al.</i>	(CLEO Collab.)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELSE)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
RODEBACK	81	ZPHY C9 9	S. Rodeback <i>et al.</i>	(CERN, CDEF, MADR+)
MAZZUCATO	79	NP B156 532	M. Mazzucato <i>et al.</i>	(CERN, ZEEM, NIJM+)
VERGEEST	79	NP B158 265	J.S.M. Vergeest <i>et al.</i>	(NIJM, AMST, CERN+)
GAVILLET	78	PL 76B 517	P. Gavillet <i>et al.</i>	(AMST, CERN, NIJM+) JP
CARNEGIE	77	NP B127 509	R.K. Carnegie <i>et al.</i>	(SLAC)
CARNEGIE	77B	PL 68B 287	R.K. Carnegie <i>et al.</i>	(SLAC)
BRANDENB...	76	PRL 36 703	G.W. Brandenburg <i>et al.</i>	(SLAC) JP
OTTER	76	NP B106 77	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP
CRENNELL	72	PR D6 1220	D.J. Crennell <i>et al.</i>	(BNL)
DAVIS	72	PR D5 2688	P.J. Davis <i>et al.</i>	(LBL)
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
ASTIER	69	NP B10 65	A. Astier <i>et al.</i>	(CDEF, CERN, IPNP, LIPV) IJP
CRENNELL	67	PRL 19 44	D.J. Crennell <i>et al.</i>	(BNL) I

NODE=M028

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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

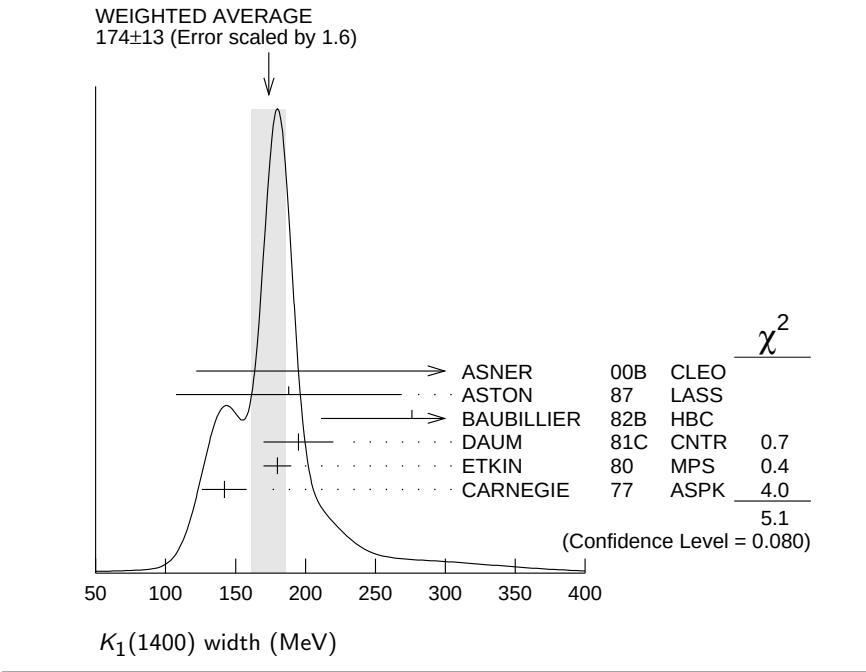
NODE=M064W

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

NODE=M064215;NODE=M064

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	(94 ± 6) %
Γ_2 $K\rho$	(1.2±0.6) %
Γ_3 $K f_0(1370)$	(2.0±2.0) %
Γ_4 $K\omega$	(1.0±1.0) %
Γ_5 $K_0^*(1430)\pi$	not seen
Γ_6 γK^0	seen

DESIG=1
DESIG=2
DESIG=8
DESIG=5
DESIG=7;OUR EST;→ NOT CHECKED ←
DESIG=9;OUR EST;→ NOT CHECKED ←

$K_1(1400)$ PARTIAL WIDTHS

NODE=M064220

$\Gamma(K^*(892)\pi)$	Γ_1
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
117±10	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\rho)$	Γ_2
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
2±1	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\omega)$	Γ_4
VALUE (MeV)	DOCUMENT ID TECN CHG COMMENT
23±12	CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(\gamma K^0)$	Γ_6
VALUE (keV)	DOCUMENT ID TECN COMMENT
280.8±23.2±40.4	ALAVI-HARATI02B KTEV $K + A \rightarrow K^* + A$

NODE=M064W1
NODE=M064W1

NODE=M064W2
NODE=M064W2

NODE=M064W5
NODE=M064W5

NODE=M064W6
NODE=M064W6

$K_1(1400)$ BRANCHING RATIOS

NODE=M064225

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
0.94±0.06	⁸ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$
$\Gamma(K\rho)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	DOCUMENT ID TECN COMMENT
0.03±0.03	⁸ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

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
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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;→ NOT CHECKED ←
DESIG=1
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=4;OUR EST;→ NOT CHECKED ←

 $K^*(1410)$ PARTIAL WIDTHS

$\Gamma(\gamma K^0)$					Γ_4
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<52.9	90	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$	

NODE=M094217

NODE=M094W1
NODE=M094W1

 $K^*(1410)$ BRANCHING RATIOS

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$						Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.17	95	ASTON	84	LASS	0	$11 K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094220

NODE=M094R1
NODE=M094R1

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.16	95	ASTON	84	LASS	0	$11 K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094R2
NODE=M094R2

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$0.066 \pm 0.010 \pm 0.008$	ASTON	88	LASS	0	$11 K^- p \rightarrow K^- \pi^+ n$	

NODE=M094R3
NODE=M094R3

 $K^*(1410)$ REFERENCES

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

 $K_0^*(1430)$

$$I(J^P) = \frac{1}{2}(0^+)$$

See our minireview in the 1994 edition and in this edition under the $f_0(500)$.

NODE=M019

NODE=M019

 $K_0^*(1430)$ MASS

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

NODE=M019M
→ NOT CHECKED ←

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

→ NOT CHECKED ←

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
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REFID=40262
REFID=22459
REFID=22443
REFID=22446

$K_2^*(1430)$

$$I(J^P) = \frac{1}{2}(2^+)$$

We consider that phase-shift analyses provide more reliable determinations of the mass and width.

NODE=M022

NODE=M022

 $K_2^*(1430)$ MASS

NODE=M022205

CHARGED ONLY, WITH FINAL STATE $K\pi$ NODE=M022M1
NODE=M022M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
1425.6± 1.5 OUR AVERAGE		Error includes scale factor of 1.1.				
1420 ± 4	1587	BAUBILLIER	84B	HBC	— 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$	
1436 ± 5.5	400	^{1,2} CLELAND	82	SPEC	+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1500	^{1,2} CLELAND	82	SPEC	+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1200	^{1,2} CLELAND	82	SPEC	—	50 $K^+ p \rightarrow K_S^0 \pi^- p$
1423 ± 5	935	TOAFF	81	HBC	—	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1428.0± 4.6		³ MARTIN	78	SPEC	+	10 $K^\pm p \rightarrow K_S^0 \pi p$
1423.8± 4.6		³ MARTIN	78	SPEC	—	10 $K^\pm p \rightarrow K_S^0 \pi p$
1420.0± 3.1	1400	AGUILAR-...	71B	HBC	—	3.9,4.6 $K^- p$
1425 ± 8.0	225	^{1,2} BARNHAM	71C	HBC	+	$K^+ p \rightarrow K^0 \pi^+ p$
1416 ±10	220	CRENNELL	69D	DBC	—	3.9 $K^- N \rightarrow \bar{K}^0 \pi^- N$
1414 ±13.0	60	¹ LIND	69	HBC	+	9 $K^+ p \rightarrow K^0 \pi^+ p$
1427 ±12	63	¹ SCHWEING...	68	HBC	—	5.5 $K^- p \rightarrow \bar{K} \pi N$
1423 ±11.0	39	¹ BASSANO	67	HBC	—	4.6–5.0 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

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

1423.4 ± 2 ± 3	24809 ± 820	⁴ BIRD	89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NEUTRAL ONLYNODE=M022M4
NODE=M022M4

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
1432.4 ± 1.3 OUR AVERAGE					
1431.2 ± 1.8 ± 0.7		⁵ ASTON	88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 4 ± 6		⁵ ASTON	87	LASS	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1433 ± 6 ± 10		⁵ ASTON	84B	LASS	11 $K^- p \rightarrow \bar{K}^0 2\pi n$
1471 ± 12		⁵ BAUBILLIER	82B	HBC	8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
1428 ± 3		⁵ ASTON	81C	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 2		⁵ ESTABROOKS	78	ASPK	13 $K^\pm p \rightarrow p K \pi$
1440 ± 10		⁵ BOWLER	77	DBC	5.5 $K^+ d \rightarrow K \pi p p$

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

1428.5 ± 3.9	1786 ± 127	⁶ AUBERT	07AK	BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
1420 ± 7	300	HENDRICK	76	DBC	8.25 $K^+ N \rightarrow K^+ \pi N$
1421.6 ± 4.2	800	MCCUBBIN	75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
1420.1 ± 4.3		⁷ LINGLIN	73	HBC	2–13 $K^+ p \rightarrow K^+ \pi^- X$
1419.1 ± 3.7	1800	AGUILAR-...	71B	HBC	3.9, 4.6 $K^- p$
1416 ± 6	600	CORDS	71	DBC	9 $K^+ n \rightarrow K^+ \pi^- p$
1421.1 ± 2.6	2200	DAVIS	69	HBC	12 $K^+ p \rightarrow K^+ \pi^- X$

¹ Errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

² Number of events in peak re-evaluated by us.

³ Systematic error added by us.

⁴ From a partial wave amplitude analysis.

⁵ From phase shift or partial-wave analysis.

⁶ Systematic errors not estimated.

⁷ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022M;LINKAGE=D
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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 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M022W1
NODE=M022W1

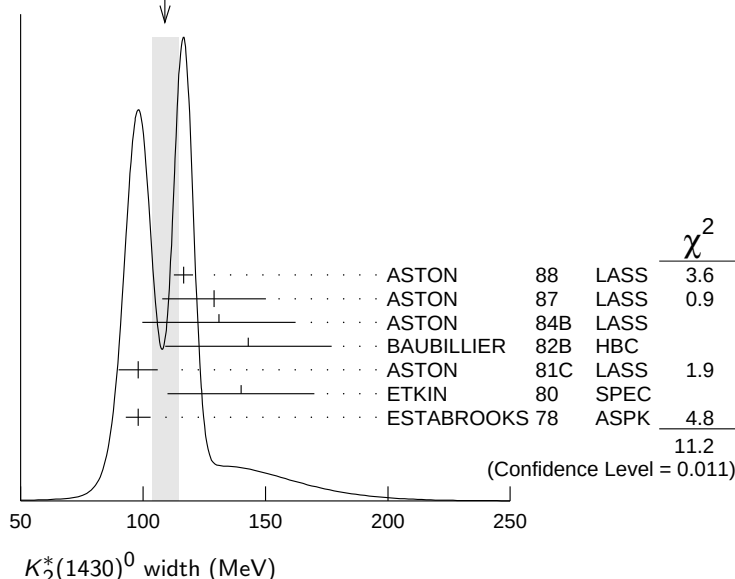
OCCUR=2

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=M022W4WEIGHTED 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;
→ NOT CHECKED ←

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

x_2	-9						
x_3	-40	-73					
x_4	-8	36	-52				
x_5	-11	-3	-26	-7			
x_6	-1	-1	-1	-1	0		
x_7	-4	-7	-5	-5	-2	0	
Γ	0	0	0	0	0	-13	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $K\pi$	49.1 ± 1.8	
Γ_2 $K^*(892)\pi$	24.3 ± 1.6	
Γ_3 $K^*(892)\pi\pi$	13.2 ± 2.2	
Γ_4 $K\rho$	8.5 ± 0.8	1.2
Γ_5 $K\omega$	2.9 ± 0.8	
Γ_6 $K^+\gamma$	0.24 ± 0.05	1.1
Γ_7 $K\eta$	$0.15^{+0.33}_{-0.10}$	1.3

DESIG=1
DESIG=2
DESIG=6
DESIG=3
DESIG=4
DESIG=8
DESIG=5

 $K_2^*(1430)$ PARTIAL WIDTHS

NODE=M022220

 $\Gamma(K^+\gamma)$ **Γ_6**

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
241 ± 50 OUR FIT	Error includes scale factor of 1.1.			
240 ± 45	CIHANGIR	82	SPEC +	200 $K^+ Z \rightarrow Z K^+ \pi^0$, $Z K_S^0 \pi^+$

NODE=M022W8
NODE=M022W8

 $\Gamma(K^0\gamma)$ **Γ_9**

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
< 5.4	90	ALAVI-HARATI02B	KTEV		$K + A \rightarrow K^* + A$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<84	90	CARLSMITH	87	SPEC 0	60-200 $K_L^0 A \rightarrow$ $K_S^0 \pi^0 A$

NODE=M022W9
NODE=M022W9

$K^*(1430)$ BRANCHING RATIOS

NODE=M022225

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.499 ± 0.012 OUR FIT				
0.488 ± 0.014 OUR AVERAGE				
$0.485 \pm 0.006 \pm 0.020$	¹⁴ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
0.49 ± 0.02	¹⁴ ESTABROOKS	78	ASPK	$\pm$ 13 $K^\pm p \rightarrow p K \pi$

NODE=M022R1
NODE=M022R1 **$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$** **$\Gamma_2/\Gamma_1$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.496 ± 0.034 OUR FIT				
0.47 ± 0.04 OUR AVERAGE				
0.44 ± 0.09	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
0.62 ± 0.19	LAUSCHER	75	HBC	0 10,16 $K^- p \rightarrow K^- \pi^+ n$
0.54 ± 0.16	DEHM	74	DBC	0 4.6 $K^+ N$
0.47 ± 0.08	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.47 ± 0.10	BASSANO	67	HBC	-0 4.6,5.0 $K^- p$
0.45 ± 0.13	BADIER	65C	HBC	- 3 $K^- p$

NODE=M022R4
NODE=M022R4 **$\Gamma(K\omega)/\Gamma(K\pi)$** **$\Gamma_5/\Gamma_1$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.059 ± 0.017 OUR FIT				
0.070 ± 0.035 OUR AVERAGE				
0.05 ± 0.04	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.13 ± 0.07	BASSOMPIE...	69	HBC	0 5 $K^+ p$

NODE=M022R5
NODE=M022R5

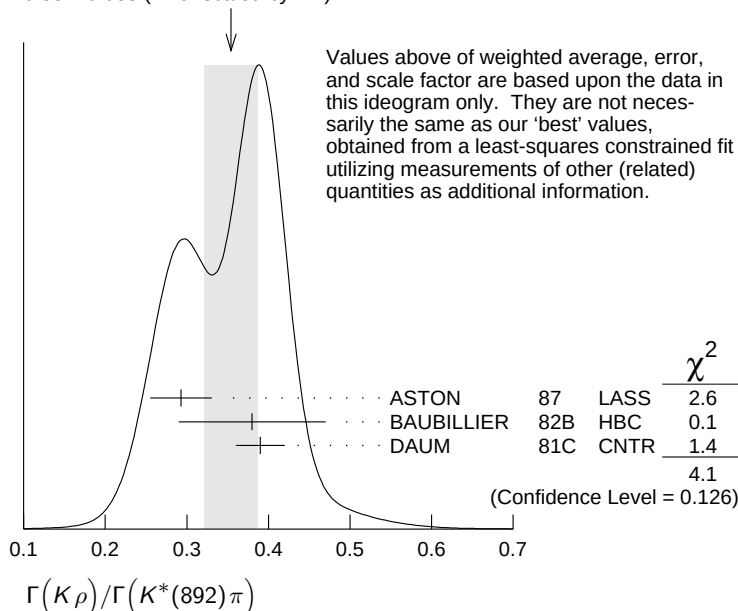
OCCUR=2

 $\Gamma(K\rho)/\Gamma(K\pi)$ **Γ_4/Γ_1**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.174 ± 0.017 OUR FIT	Error includes scale factor of 1.2.			
$0.150^{+0.029}_{-0.017}$ OUR AVERAGE				

NODE=M022R6
NODE=M022R6 **$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$** **$\Gamma_4/\Gamma_2$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.350 ± 0.031 OUR FIT	Error includes scale factor of 1.4.			
0.354 ± 0.033 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
$0.293 \pm 0.032 \pm 0.020$	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
0.38 ± 0.09	BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
0.39 ± 0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

NODE=M022R7
NODE=M022R7WEIGHTED AVERAGE
 0.354 ± 0.033 (Error scaled by 1.4)

$\Gamma(K\omega)/\Gamma(K^*(892)\pi)$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.118±0.034 OUR FIT				
0.10 ±0.04	FIELD	67	HBC	— 3.8 $K^- p$

NODE=M022R8
 NODE=M022R8

 $\Gamma(K\eta)/\Gamma(K^*(892)\pi)$ Γ_7/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.006^{+0.014}_{-0.004} OUR FIT	Error includes scale factor of 1.2.			
0.07 ±0.04	FIELD	67	HBC	— 3.8 $K^- p$

NODE=M022R9
 NODE=M022R9

 $\Gamma(K\eta)/\Gamma(K\pi)$ Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
0.0030^{+0.0070}_{-0.0020} OUR FIT		Error includes scale factor of 1.3.			
0 ±0.0056	15	ASTON	88B	LASS	— 11 $K^- p \rightarrow K^- \eta p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.04	95	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
<0.065	16	BASSOMPIE...	69	HBC	5.0 $K^+ p$
<0.02		BISHOP	69	HBC	3.5 $K^+ p$

NODE=M022R10
 NODE=M022R10

 $\Gamma(K^*(892)\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.134±0.022 OUR FIT				
0.12 ±0.04	¹⁷ GOLDBERG	76	HBC	— 3 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

NODE=M022R11
 NODE=M022R11

 $\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.27±0.05 OUR FIT				
0.21±0.08	^{16,17} JONGEJANS	78	HBC	— 4 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

NODE=M022R12
 NODE=M022R12

 $\Gamma(K\omega\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.72	95	0	JONGEJANS	78	HBC 4 $K^- p \rightarrow p \bar{K}^0 4\pi$

NODE=M022R13
 NODE=M022R13

¹⁴ From phase shift analysis.

¹⁵ ASTON 88B quote < 0.0092 at CL=95%. We convert this to a central value and 1 sigma error in order to be able to use it in our constrained fit.

¹⁶ Restated by us.

¹⁷ Assuming $\pi\pi$ system has isospin 1, which is supported by the data.

NODE=M022R;LINKAGE=P
 NODE=M022R;LINKAGE=PQ

NODE=M022R;LINKAGE=R
 NODE=M022R;LINKAGE=T

 $K_2^*(1430)$ REFERENCES

NODE=M022

AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)	REFID=48822
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
CARLSMITH	87	PR D36 3502	D. Carlsmith <i>et al.</i>	(EFI, SACL)	REFID=40557
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CIHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22821
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=22548
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22443
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
JONGEJANS	78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NIJ+)	REFID=22445
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=22446
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)	REFID=22437
GOLDBERG	76	LNC 17 253	J. Goldberg	(HAIF)	REFID=22742
HENDRICK	76	NP B112 189	K. Hendrickx <i>et al.</i>	(MONS, SACL, PARIS+)	REFID=22743
LAUSCHER	75	NP B86 189	P. Lauscher <i>et al.</i>	(ABCLV Collab.) JP	REFID=22582
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
DEHM	74	NP B75 47	G. Dehm <i>et al.</i>	(MPIM, BRUX, MONS, CERN)	REFID=22736
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
BARNHAM	71C	NP B28 171	K.W.J. Barnham <i>et al.</i>	(BIRM, GLAS)	REFID=22409
CORDS	71	PR D4 1974	D. Cords <i>et al.</i>	(PURD, UCD, IUPU)	REFID=22411
BASSOMPIE...	69	NP B13 189	G. Bassompierre <i>et al.</i>	(CERN, BRUX) JP	REFID=22710
BISHOP	69	NP B9 403	J.M. Bishop <i>et al.</i>	(WISC)	REFID=22485
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)	REFID=22399
DAVIS	69	PRL 23 1071	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) = 1/2(0^-)

OMITTED FROM SUMMARY TABLE
Observed in K pi pi partial-wave analysis.

K(1460) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1460	DAUM	81C	CNTR	- 63 K^- p -> K^- 2 pi p
~ 1400	¹ BRANDENB...	76B	ASPK	± 13 K^± p -> K^+ 2 pi p
¹ Coupled mainly to K f_0(1370). Decay into K*(892) pi seen.				

K(1460) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 260	DAUM	81C	CNTR	- 63 K^- p -> K^- 2 pi p
~ 250	² BRANDENB...	76B	ASPK	± 13 K^± p -> K^+ 2 pi p
² Coupled mainly to K f_0(1370). Decay into K*(892) pi seen.				

K(1460) DECAY MODES

Mode	Fraction (Gamma_i/Gamma)
Gamma_1 K*(892) pi	seen
Gamma_2 K rho	seen
Gamma_3 K*_0(1430) pi	seen

K(1460) PARTIAL WIDTHS

Gamma(K*(892) pi)				Gamma_1
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 109	DAUM	81C	CNTR	63 K^- p -> K^- 2 pi p
Gamma(K rho)				Gamma_2
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 34	DAUM	81C	CNTR	63 K^- p -> K^- 2 pi p
Gamma(K*_0(1430) pi)				Gamma_3
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 117	DAUM	81C	CNTR	63 K^- p -> K^- 2 pi p

K(1460) REFERENCES

DAUM	81C	NP B187 1	C. Daum et al.	(AMST, CERN, CRAC, MPIM+)
BRANDENB...	76B	PRL 36 1239	G.W. Brandenburg et al.	(SLAC) JP

NODE=M021

NODE=M021

NODE=M021M

NODE=M021M

NODE=M021M;LINKAGE=A

NODE=M021W

NODE=M021W

NODE=M021W;LINKAGE=A

NODE=M021215;NODE=M021

DESIG=1;OUR EST;=> NOT CHECKED <-
DESIG=2;OUR EST;=> NOT CHECKED <-
DESIG=3;OUR EST;=> NOT CHECKED <-

NODE=M021220

NODE=M021W1
NODE=M021W1

NODE=M021W2
NODE=M021W2

NODE=M021W3
NODE=M021W3

NODE=M021

REFID=22548
REFID=22767

$K_2(1580)$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of the $K^- \pi^+ \pi^-$ system. Needs confirmation.

NODE=M039

NODE=M039

$K_2(1580)$ MASS

NODE=M039M

NODE=M039M

VALUE (MeV)	DOCUMENT ID	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 1580	OTTER	79	— 10,14,16 $K^- p$

$K_2(1580)$ WIDTH

NODE=M039W

NODE=M039W

VALUE (MeV)	DOCUMENT ID	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 110	OTTER	79	— 10,14,16 $K^- p$

$K_2(1580)$ DECAY MODES

NODE=M039215;NODE=M039

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	seen
Γ_2 $K_2^*(1430)\pi$	possibly seen

DESIG=1

DESIG=2

$K_2(1580)$ BRANCHING RATIOS

NODE=M039220

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	OTTER	79	HBC	—	10,14,16 $K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$	

NODE=M039R1
NODE=M039R1

$\Gamma(K_2^*(1430)\pi)/\Gamma_{\text{total}}$					Γ_2/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
possibly seen	OTTER	79	HBC	—	10,14,16 $K^- p$

NODE=M039R2
NODE=M039R2

$K_2(1580)$ REFERENCES

NODE=M039

GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
OTTER	79	NP B147 1	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP

REFID=53668
REFID=22772

K(1630)

$$I(J^P) = \frac{1}{2}(?^?)$$

OMITTED FROM SUMMARY TABLE

Seen as a narrow peak, compatible with the experimental resolution, in the invariant mass of the $K_S^0 \pi^+ \pi^-$ system produced in $\pi^- p$ interactions at high momentum transfers.

NODE=M160

NODE=M160

K(1630) MASS

NODE=M160M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1629±7	~ 75	KARNAUKHOV98	BC	16.0 $\pi^- p \rightarrow$ ($K_S^0 \pi^+ \pi^-$) $X^+ \pi^- X^0$

NODE=M160M

K(1630) WIDTH

NODE=M160W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
16 ⁺¹⁹ ₋₁₆	~ 75	¹ KARNAUKHOV98	BC	16.0 $\pi^- p \rightarrow$ ($K_S^0 \pi^+ \pi^-$) $X^+ \pi^- X^0$

NODE=M160W

¹ Compatible with an experimental resolution of 14 ± 1 MeV.

NODE=M160W;LINKAGE=A

K(1630) DECAY MODES

NODE=M160215;NODE=M160

Mode
$\Gamma_1 \quad K_S^0 \pi^+ \pi^-$

DESIG=1

K(1630) REFERENCES

KARNAUKHOV 98 PAN 61 203 V.M. Karnaukhov, C. Coca, V.I. Moroz
Translated from YAF 61 252.

NODE=M160

REFID=46371

NODE=M099

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.

NODE=M099

K₁(1650) MASS

NODE=M099M

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 $K^- p \rightarrow K^- 2 \pi p$

NODE=M099M

K₁(1650) WIDTH

NODE=M099W

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 $K^- p \rightarrow K^- 2 \pi p$

NODE=M099W

K₁(1650) DECAY MODES

NODE=M099215;NODE=M099

Mode
$\Gamma_1 \quad K \pi \pi$
$\Gamma_2 \quad K \phi$

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 $\pi^- \bar{C} \rightarrow K_S^0 K_S^0 K_L^0 X$
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;→ NOT CHECKED ←

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=9;OUR EST;→ NOT CHECKED ←

DESIG=11

DESIG=10

DESIG=8

$K_2(1770)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$ Γ_2/Γ_1
 $(K_2^*(1430) \rightarrow K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

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

~ 0.03	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$
~ 1.0	⁹ FIRESTONE 72B	DBC +	12 $K^+ d$
<1.0	COLLEY 71	HBC	10 $K^+ p$
0.2 ± 0.2	AGUILAR-...	70C HBC -	4.6 $K^- p$
<1.0	BARTSCH 70C	HBC -	10.1 $K^- p$
1.0	BARBARO-...	69 HBC +	12.0 $K^+ p$

⁹ Produced in conjunction with excited deuteron.

NODE=M023220

NODE=M023R1

NODE=M023R1

NODE=M023R1

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

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

~ 0.23	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$ Γ_4/Γ_1

$(f_2(1270) \rightarrow \pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT

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

~ 0.74	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_0(980))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

possibly seen	TIKHOMIROV 03	SPEC	40.0 $\pi^- \bar{C} \rightarrow K_S^0 K_S^0 K_L^0 X$

NODE=M023R1;LINKAGE=P

NODE=M023R3

NODE=M023R3

NODE=M023R4

NODE=M023R4

NODE=M023R4

NODE=M023R6

NODE=M023R6

$\Gamma(K\phi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_6/Γ
seen	ARMSTRONG 83	OMEG	—	$18.5 K^- p \rightarrow K^- \phi N$	

NODE=M023R5
 NODE=M023R5

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_7/Γ
seen	OTTER 81	HBC	$\pm$	$8.25, 10, 16 K^\pm p$	
seen	CHUNG 74	HBC	—	$7.3 K^- p \rightarrow K^- \omega p$	

NODE=M023R2
 NODE=M023R2

 $K_2(1770)$ REFERENCES

PDG 04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
TIKHOMIROV 03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
	Translated from YAF 66 860.		
ASTON 93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
FRAME 86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG 83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM 81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
OTTER 81	NP B181 1	G. Otter	(AACH3, BERL, LOIC, VIEN, BIRM+)
CHUNG 74	PL 51B 413	S.U. Chung <i>et al.</i>	(BNL)
BLIEDEN 72	PL 39B 668	H.R. Blieden <i>et al.</i>	(STON, NEAS)
FIRESTONE 72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
COLLEY 71	NP B26 71	D.C. Colley <i>et al.</i>	(BIRM, GLAS)
DENEGRI 71	NP B28 13	D. Denegri <i>et al.</i>	(JHU) JP
AGUILAR-... 70C	PRL 25 54	M. Aguilar-Benitez <i>et al.</i>	(BNL)
BARTSCH 70C	PL 33B 186	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN+)
LUDLAM 70	PR D2 1234	T. Ludlam, J. Sandweiss, A.J. Slaughter	(YALE)
BARBARO-... 69	PRL 22 1207	A. Barbaro-Galtieri <i>et al.</i>	(LRL)

NODE=M023

REFID=49653
 REFID=49423

REFID=43597
 REFID=20569
 REFID=22801
 REFID=22548
 REFID=22549
 REFID=22735
 REFID=22788
 REFID=22506
 REFID=22785
 REFID=22497
 REFID=22782
 REFID=22783
 REFID=22784
 REFID=22483

NODE=M060

 $K_3^*(1780)$

$$I(J^P) = \frac{1}{2}(3^-)$$

 $K_3^*(1780)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1776$\pm$ 7 OUR AVERAGE		Error includes scale factor of 1.1.			
1781 $\pm$ 8 $\pm$ 4		¹ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1740 $\pm$ 14 $\pm$ 15		¹ ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1779 $\pm$ 11		² BALDI	76	SPEC	+
1776 $\pm$ 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 $\pm$ 10 $\pm$ 15	6111	⁴ BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1749 $\pm$ 10		ASTON	88B	LASS	— 11 $K^- p \rightarrow K^- \eta p$
1780 $\pm$ 9	300	BAUBILLIER	84B	HBC	— 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1790 $\pm$ 15		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$
1784 $\pm$ 9	2060	CLELAND	82	SPEC	$\pm$ 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
1786 $\pm$ 15		⁵ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1762 $\pm$ 9	190	TOAFF	81	HBC	— 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1850 $\pm$ 50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
1812 $\pm$ 28		BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1786 $\pm$ 8		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$

¹ From energy-independent partial-wave analysis.² From a fit to Y_6^2 moment. $J^P = 3^-$ found.³ Confirmed by phase shift analysis of ESTABROOKS 78, yields $J^P = 3^-$.⁴ From a partial wave amplitude analysis.⁵ From a fit to the Y_6^0 moment.

NODE=M060M;LINKAGE=K

NODE=M060M;LINKAGE=M

NODE=M060M;LINKAGE=A

NODE=M060M;LINKAGE=F

NODE=M060M;LINKAGE=J

 $K_3^*(1780)$ WIDTH

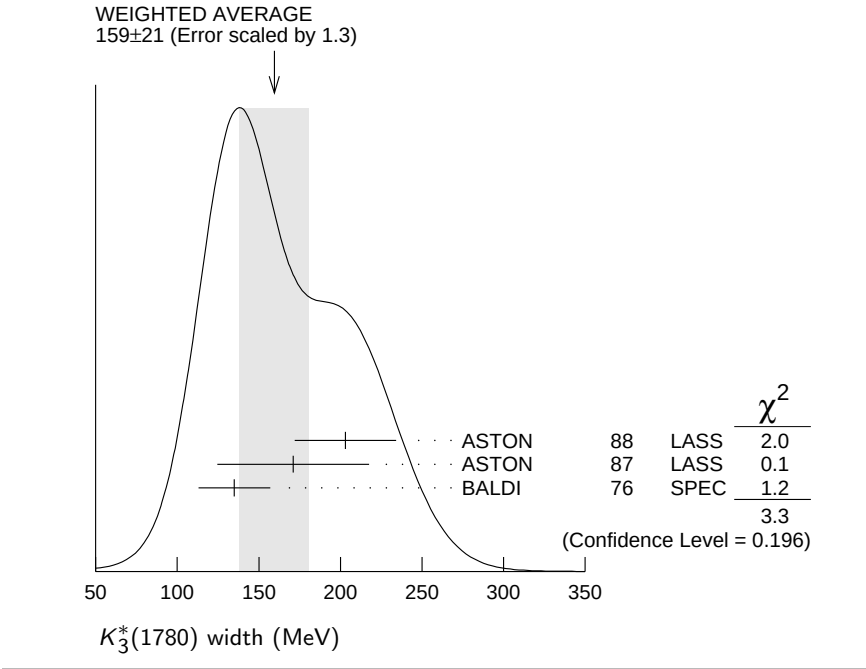
NODE=M060W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
159±21 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
203±30± 8		⁶ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
171±42±20		⁶ ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
135±22		⁷ BALDI	76	SPEC	+ 10 $K^+ p \rightarrow K^0 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
187±31±20	6111	⁸ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
193 ⁺⁵¹ ₋₃₇		ASTON	88B	LASS	- 11 $K^- p \rightarrow K^- \eta p$
99±30	300	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 130		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$
191±24	2060	CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
225±60		⁹ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
~ 80	190	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
240±50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
181±44		¹⁰ BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
96±31		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$
270±70		¹¹ BRANDENB...	76D	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\mp N$

⁶ From energy-independent partial-wave analysis.
⁷ From a fit to Y_6^2 moment. $J^P = 3^-$ found.
⁸ From a partial wave amplitude analysis.
⁹ From a fit to Y_6^0 moment.
¹⁰ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
¹¹ ESTABROOKS 78 find that BRANDENBURG 76D data are consistent with 175 MeV width. Not averaged.

NODE=M060W

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

K₂(1820)

$I(J^P) = \frac{1}{2}(2^-)$

See our mini-review in the 2004 edition of this *Review* (PDG 04) under *K₂(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;→ NOT CHECKED ←
DESIG=2;OUR EVAL;→ NOT CHECKED ←
DESIG=3;OUR EVAL;→ NOT CHECKED ←
DESIG=6;OUR EVAL;→ NOT CHECKED ←

NODE=M146220

NODE=M146R1
NODE=M146R1

NODE=M146R2
NODE=M146R2

NODE=M146R3
NODE=M146R3

NODE=M146

REFID=49653
REFID=43597
REFID=22548

K₂(1820) MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1816±13	¹ ASTON	93 LASS	11K ⁻ p → K ⁻ ωp
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 1840	² DAUM	81C CNTR	63 K ⁻ p → K ⁻ 2πp
¹ From a partial wave analysis of the K ⁻ ω system.			
² From a partial wave analysis of the K ⁻ 2π system.			

K₂(1820) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
276±35	³ ASTON	93 LASS	11K ⁻ p → K ⁻ ωp
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 230	⁴ DAUM	81C CNTR	63 K ⁻ p → K ⁻ 2πp
³ From a partial wave analysis of the K ⁻ ω system.			
⁴ From a partial wave analysis of the K ⁻ 2π system.			

K₂(1820) DECAY MODES

Mode	Fraction (Γ _{<i>i</i>} /Γ)
Γ ₁ Kππ	
Γ ₂ K ₂ [*] (1430)π	seen
Γ ₃ K [*] (892)π	seen
Γ ₄ K f ₂ (1270)	seen
Γ ₅ Kω	seen

K₂(1820) BRANCHING RATIOS

Γ(K ₂ [*] (1430)π)/Γ(Kππ)			Γ ₂ /Γ ₁
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.77	DAUM	81C CNTR	63K ⁻ p → $\overline{K}$ 2πp
Γ(K [*] (892)π)/Γ(Kππ)			Γ ₃ /Γ ₁
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.05	DAUM	81C CNTR	63K ⁻ p → $\overline{K}$ 2πp
Γ(K f ₂ (1270))/Γ(Kππ)			Γ ₄ /Γ ₁
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.18	DAUM	81C CNTR	63K ⁻ p → $\overline{K}$ 2πp

K₂(1820) REFERENCES

PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

K(1830)

I(J^P) = 1/2(0^-)

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of K^- phi system. Needs confirmation.

K(1830) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1830	ARMSTRONG 83	OMEG	-	18.5 K^- p -> 3K p

K(1830) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	ARMSTRONG 83	OMEG	-	18.5 K^- p -> 3K p

K(1830) DECAY MODES

Mode
Gamma_1 K phi

K(1830) REFERENCES

ARMSTRONG 83	NP B221 1	T.A. Armstrong et al.	(BARI, BIRM, CERN+) JP

K_0^*(1950)

I(J^P) = 1/2(0^+)

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of the K^- pi^+ system. Needs confirmation.

K_0^*(1950) MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1945 +/- 10 +/- 20	¹ ASTON 88	LASS	0	11 K^- p -> K^- pi^+ n
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1917 +/- 12	² ZHOU 06	RVUE		K p -> K^- pi^+ n
1820 +/- 40	³ ANISOVICH 97C	RVUE		11 K^- p -> K^- pi^+ n

¹We take the central value of the two solutions and the larger error given.
²S-matrix pole. Using ASTON 88 and assuming K_0^*(800), K_0^*(1430).
³T-matrix pole. Reanalysis of ASTON 88 data.

K_0^*(1950) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
201 +/- 34 +/- 79	⁴ ASTON 88	LASS	0	11 K^- p -> K^- pi^+ n
• • • We do not use the following data for averages, fits, limits, etc. • • •				
145 +/- 38	⁵ ZHOU 06	RVUE		K p -> K^- pi^+ n
250 +/- 100	⁶ ANISOVICH 97C	RVUE		11 K^- p -> K^- pi^+ n

⁴We take the central value of the two solutions and the larger error given.
⁵S-matrix pole. Using ASTON 88 and assuming K_0^*(800), K_0^*(1430).
⁶T-matrix pole. Reanalysis of ASTON 88 data.

K_0^*(1950) DECAY MODES

Mode	Fraction (Gamma_i / Gamma)
Gamma_1 K pi	(52 +/- 14) %

NODE=M088

NODE=M088

NODE=M088M

NODE=M088M

NODE=M088W

NODE=M088W

NODE=M088215;NODE=M088

DESIG=1

NODE=M088

REFID=22801

NODE=M134

NODE=M134

NODE=M134M

NODE=M134M

NODE=M134M;LINKAGE=A
NODE=M134M;LINKAGE=ZU
NODE=M134M;LINKAGE=A1

NODE=M134W

NODE=M134W

NODE=M134W;LINKAGE=A
NODE=M134W;LINKAGE=ZU
NODE=M134W;LINKAGE=A1

NODE=M134215;NODE=M134

DESIG=1

$K_0^*(1950)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$0.52 \pm 0.08 \pm 0.12$	⁷ ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
~ 0.60	⁸ ZHOU	06	RVUE		$K p \rightarrow K^- \pi^+ n$	
⁷ We take the central value of the two solutions and the larger error given.						
⁸ S-matrix pole. Using ASTON 88 and assuming $K_0^*(800)$, $K_0^*(1430)$.						

NODE=M134220

NODE=M134R1
NODE=M134R1NODE=M134R1;LINKAGE=A
NODE=M134R1;LINKAGE=ZU **$K_0^*(1950)$ REFERENCES**

ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev
ASTON	88	NP B296 493	D. Aston <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 → 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 → 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±14±19	¹ ASTON	86	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
¹ From a fit to all the moments.					

$K_5^*(2380)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
178±37±32	² ASTON	86	LASS	0	11 $K^-p \rightarrow K^- \pi^+ n$
² From a fit to all the moments.					

$K_5^*(2380)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
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

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
2490±20	¹ CLELAND	81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p}$
¹ $J^P = 4^-$ from moments analysis.					

$K_4(2500)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	² CLELAND	81	SPEC	$\pm$ 50 $K^+ p \rightarrow \Lambda \bar{p}$
² $J^P = 4^-$ from moments analysis.				

$K_4(2500)$ DECAY MODES

Mode
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

→ NOT CHECKED ←

3-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

3054±11 OUR AVERAGE

3060± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$

3056± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

3055± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

3045± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

NODE=M129M1

NODE=M129M1

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

3059±11 OUR AVERAGE

3067± 6±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

3060± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

3055± 7±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

3052± 8±20

¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

NODE=M129M2

NODE=M129M2

OCCUR=2

OCCUR=3

OCCUR=4

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

3105±30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

3115±30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

3095±30

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$

NODE=M129M3

NODE=M129M3

¹Supersedes ALEEV 90.

NODE=M129M;LINKAGE=A

K(3100) WIDTH

NODE=M129210

3-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

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

42±16

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$

36±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

50±18

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

30±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

NODE=M129W1

NODE=M129W1

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

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

22± 8

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

28±12

² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

32±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

30±15

² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

NODE=M129W2

NODE=M129W2

OCCUR=2

OCCUR=3

OCCUR=4

<30 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

<80 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

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

<30

90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$

NODE=M129W3

NODE=M129W3

²Supersedes 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
2006.98±0.15 OUR FIT			
[2006.93 ± 0.16 MeV OUR 2011 FIT]			

NODE=M061M

NEW

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

2006 ±1.5 ¹ GOLDHABER 77 MRK1 e^+e^-

¹ From simultaneous fit to $D^*(2010)^+, D^*(2007)^0, D^+$, and D^0 .

NODE=M061M;LINKAGE=G

 $m_{D^*(2007)^0} - m_{D^0}$

NODE=M061DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M061DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
142.12±0.07 OUR FIT				
142.12±0.07 OUR AVERAGE				

NODE=M061DM

142.2 ±0.3 ±0.2	145	ALBRECHT	95F	ARG	$e^+e^- \rightarrow \text{hadrons}$
142.12±0.05±0.05	1176	BORTOLETTO	92B	CLE2	$e^+e^- \rightarrow \text{hadrons}$

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

142.2 ±2.0 SADROZINSKI 80 CBAL $D^{*0} \rightarrow D^0 \pi^0$

142.7 ±1.7 ² GOLDHABER 77 MRK1 e^+e^-

²From simultaneous fit to $D^*(2010)^+$, $D^*(2007)^0$, D^+ , and D^0 .

NODE=M061DM;LINKAGE=G

$D^*(2007)^0$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	³ ABACHI	88B HRS	$D^{*0} \rightarrow D^+ \pi^-$

³ Assuming $m_{D^{*0}} = 2007.2 \pm 2.1 \text{ MeV}/c^2$.

NODE=M061W

NODE=M061W

NODE=M061W;LINKAGE=A

$D^*(2007)^0$ DECAY MODES

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^0$	(61.9 $\pm$ 2.9) %
$\Gamma_2 \quad D^0 \gamma$	(38.1 $\pm$ 2.9) %

NODE=M061220;NODE=M061

NODE=M061

DESIG=1

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to a branching ratio uses 3 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 0.5$ for 2 degrees of freedom.

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

$$x_2 \quad \begin{array}{|c} -100 \\ x_1 \end{array}$$

$D^*(2007)^0$ 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

2010.28±0.13 OUR FIT

[2010.22 ± 0.14 MeV OUR 2011 FIT]

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

2008 ±3	¹ GOLDHABER 77	MRK1 ±	$e^+ e^-$
2008.6 ±1.0	² PERUZZI 77	LGW ±	$e^+ e^-$

¹ From simultaneous fit to $D^*(2010)^+, D^*(2007)^0, D^+,$ and D^0 ; not independent of FELDMAN 77B mass difference below.

² PERUZZI 77 mass not independent of FELDMAN 77B mass difference below and PERUZZI 77 D^0 mass value.

NODE=M062M

NEW

NODE=M062M;LINKAGE=G

NODE=M062M;LINKAGE=P

 $m_{D^*(2010)^+} - m_{D^+}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062MD

NODE=M062MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

140.66±0.10 OUR FIT Error includes scale factor of 1.1.**140.64±0.08±0.06** 620 BORTOLETTO92B CLE2 $e^+ e^- \rightarrow$ hadrons

NODE=M062MD

 $m_{D^*(2010)^+} - m_{D^0}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062DM

NODE=M062DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

145.421±0.010 OUR FIT Error includes scale factor of 1.1.**145.421±0.010 OUR AVERAGE**

145.412±0.002±0.012		ANASTASSOV 02	CLE2	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$
145.54 ±0.08	611	³ ADINOLFI	99 BEAT	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.45 ±0.02		³ BREITWEG	99 ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$
145.42 ±0.05		³ BREITWEG	99 ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 3 \pi) \pi^\pm$
145.5 ±0.15	103	⁴ ADLOFF	97B H1	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.44 ±0.08	152	⁴ BREITWEG	97 ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$
145.42 ±0.11	199	⁴ BREITWEG	97 ZEUS	$D^{*0} \rightarrow K^- 3 \pi,$
145.4 ±0.2	48	⁴ DERRICK	95 ZEUS	$D^{*0} \rightarrow K^- \pi^+,$
145.39 ±0.06 ±0.03		BARLAG	92B ACCM	$\pi^- 230$ GeV
145.5 ±0.2	115	⁴ ALEXANDER	91B OPAL	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.30 ±0.06		⁴ DECAMP	91J ALEP	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.40 ±0.05 ±0.10		ABACHI	88B HRS	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.46 ±0.07 ±0.03		ALBRECHT	85F ARG	$D^{*\pm} \rightarrow D^0 \pi^+$
145.5 ±0.3	28	BAILEY	83 SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.5 ±0.3	60	FITCH	81 SPEC	$\pi^- A$
145.3 ±0.5	30	FELDMAN	77B MRK1	$D^{*+} \rightarrow D^0 \pi^+$

NODE=M062DM

OCCUR=2

OCCUR=2

OCCUR=2

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

145.44 ± 0.09	122	⁴ BREITWEG	97B	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^{\pm},$ $D^0 \rightarrow K^- \pi^+$
145.8 ± 1.5	16	AHLEN	83	HRS	$D^{*+} \rightarrow D^0 \pi^+$
145.1 ± 1.8	12	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^{\pm}$
145.1 ± 0.5	14	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^{\pm}$
145.5 ± 0.5	14	YELTON	82	MRK2	$29 e^+ e^- \rightarrow K^- \pi^+$
~ 145.5		AVERY	80	SPEC	γA
145.2 ± 0.6	2	BLIETSCHAU	79	BEBC	νp

³ Statistical errors only.

⁴ Systematic error not evaluated.

OCCUR=3

NODE=M062DM;LINKAGE=AV

NODE=M062DM;LINKAGE=A

$m_{D^*(2010)^+} - m_{D^*(2007)^0}$

VALUE (MeV) DOCUMENT ID TECN COMMENT

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

2.6 ± 1.8 ⁵ PERUZZI 77 LGW $e^+ e^-$

⁵ Not independent of FELDMAN 77B mass difference above, PERUZZI 77 D^0 mass, and GOLDHABER 77 $D^*(2007)^0$ mass.

NODE=M062EM

NODE=M062EM

NODE=M062EM;LINKAGE=P

$D^*(2010)^{\pm}$ WIDTH

VALUE (keV) CL% EVTS DOCUMENT ID TECN COMMENT

96 ± 4 ± 22 ANASTASSOV 02 CLE2 $D^{*\pm} \rightarrow D^0 \pi^{\pm} \rightarrow (K \pi) \pi^{\pm}$

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

<131 90 110 BARLAG 92B ACCM π^- 230 GeV

NODE=M062W

NODE=M062W

$D^*(2010)^{\pm}$ DECAY MODES

$D^*(2010)^-$ modes are charge conjugates of the modes below.

NODE=M062225;NODE=M062

NODE=M062

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 \pi^+$	(67.7 ± 0.5) %
Γ_2 $D^+ \pi^0$	(30.7 ± 0.5) %
Γ_3 $D^+ \gamma$	(1.6 ± 0.4) %

DESIG=1

DESIG=3

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 6 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.3$ for 4 degrees of freedom.

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

x_2	-62	
x_3	-43	-44
	x_1	x_2

$D^*(2010)^+$ BRANCHING RATIOS

NODE=M062230

$\Gamma(D^0 \pi^+) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE DOCUMENT ID TECN COMMENT

0.677 ± 0.005 OUR FIT

0.677 ± 0.006 OUR AVERAGE

NODE=M062R1

NODE=M062R1

0.6759 ± 0.0029 ± 0.0064	^{6,7,8} BARTELT	98	CLE2	$e^+ e^-$
0.688 ± 0.024 ± 0.013	ALBRECHT	95F	ARG	$e^+ e^- \rightarrow \text{hadrons}$
0.681 ± 0.010 ± 0.013	⁶ BUTLER	92	CLE2	$e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.57 ± 0.04 ± 0.04	ADLER	88D	MRK3	$e^+ e^-$
0.44 ± 0.10	COLES	82	MRK2	$e^+ e^-$
0.6 ± 0.15	⁸ GOLDHABER	77	MRK1	$e^+ e^-$

$\Gamma(D^+\pi^0)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.307 ± 0.005 OUR FIT					
0.3073 ± 0.0013 ± 0.0062	6,7,8	BARTELT	98	CLE2	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.312 ± 0.011 ± 0.008	1404	ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons
0.308 ± 0.004 ± 0.008	410	⁶ BUTLER	92	CLE2	$e^+e^- \rightarrow$ hadrons
0.26 ± 0.02 ± 0.02		ADLER	88D	MRK3	e^+e^-
0.34 ± 0.07		COLES	82	MRK2	e^+e^-

NODE=M062R3
NODE=M062R3

$\Gamma(D^+\gamma)/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.016 ± 0.004 OUR FIT					
0.016 ± 0.005 OUR AVERAGE					
0.0168 ± 0.0042 ± 0.0029			6,7	BARTELT	98 CLE2 e^+e^-
0.011 ± 0.014 ± 0.016		12	⁶ BUTLER	92 CLE2	$e^+e^- \rightarrow$ hadrons

NODE=M062R2
NODE=M062R2

• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.052	90	ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons
0.17 ± 0.05 ± 0.05		ADLER	88D	MRK3	e^+e^-
0.22 ± 0.12		⁹ COLES	82	MRK2	e^+e^-

⁶ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

⁷ Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

⁸ Assuming that isospin is conserved in the decay.

⁹ Not independent of $\Gamma(D^0\pi^+)/\Gamma_{\text{total}}$ and $\Gamma(D^+\pi^0)/\Gamma_{\text{total}}$ measurement.

NODE=M062R;LINKAGE=A

NODE=M062R;LINKAGE=B

NODE=M062R;LINKAGE=G

NODE=M062R;LINKAGE=C

$D^*(2010)^\pm$ REFERENCES

ANASTASSOV 02	PR D65 032003	A. Anastassov <i>et al.</i>	(CLEO Collab.)
ADINOLFI 99	NP B547 3	M. Adinolfi <i>et al.</i>	(Beatrice Collab.)
BREITWEG 99	EPJ C6 67	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
BARTELT 98	PRL 80 3919	J. Bartelt <i>et al.</i>	(CLEO Collab.)
ADLOFF 97B	ZPHY C72 593	C. Adloff <i>et al.</i>	(H1 Collab.)
BREITWEG 97	PL B401 192	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
BREITWEG 97B	PL B407 402	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
ALBRECHT 95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DERRICK 95	PL B349 225	M. Derrick <i>et al.</i>	(ZEUS Collab.)
BARLAG 92B	PL B278 480	S. Barlag <i>et al.</i>	(ACCMOR Collab.)
BORTOLETTO 92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
BUTLER 92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)
ALEXANDER 91B	PL B262 341	G. Alexander <i>et al.</i>	(OPAL Collab.)
DECAMP 91J	PL B266 218	D. Decamp <i>et al.</i>	(ALEPH Collab.)
ABACHI 88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)
ADLER 88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)
ALBRECHT 85F	PL 150B 235	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AHLEN 83	PRL 51 1147	S.P. Ahlen <i>et al.</i>	(ANL, IND, LBL+)
BAILEY 83	PL 132B 230	R. Bailey <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)
COLES 82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)
YELTON 82	PRL 49 430	J.M. Yelton <i>et al.</i>	(SLAC, LBL, UCB+)
FITCH 81	PRL 46 761	V.L. Fitch <i>et al.</i>	(PRIN, SACL, TORI+)
AVERY 80	PRL 44 1309	P. Avery <i>et al.</i>	(ILL, FNAL, COLU)
BLIETSCHAU 79	PL 86B 108	J. Blietschau <i>et al.</i>	(AACH3, BONN, CERN+)
FELDMAN 77B	PRL 38 1313	G.J. Feldman <i>et al.</i>	(Mark I Collab.)
GOLDHABER 77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)
PERUZZI 77	PRL 39 1301	I. Peruzzi <i>et al.</i>	(LGW Collab.)

NODE=M062

REFID=48550
REFID=46925
REFID=46604
REFID=46349
REFID=45421
REFID=45520
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REFID=22867
REFID=22863
REFID=11498
REFID=22861
REFID=22858
REFID=11434
REFID=11435

NODE=M178

$D_0^*(2400)^0$

$$I(J^P) = \frac{1}{2}(0^+)$$

$J^P = 0^+$ assignment favored (ABE 04D).

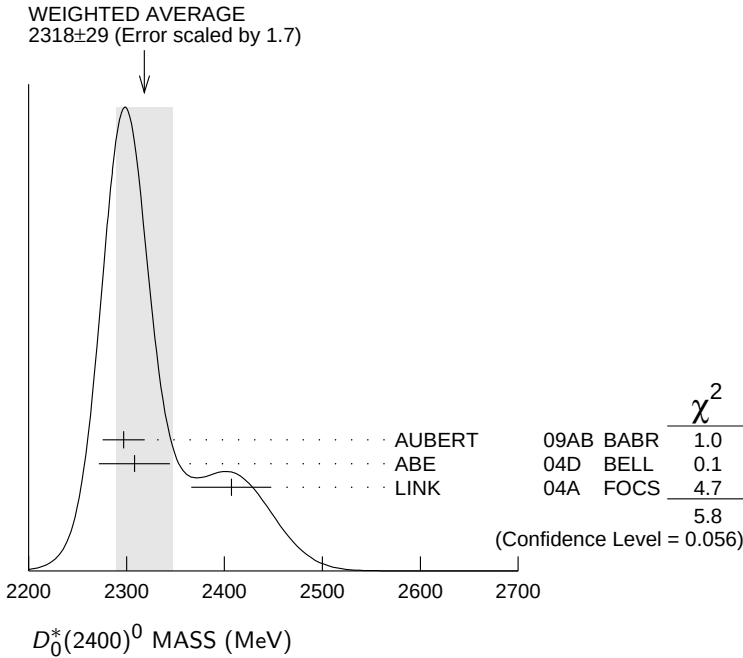
NODE=M178

NODE=M178M

NODE=M178M

$D_0^*(2400)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2318±29 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.				
2297± 8±20	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
2308±17±32		ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
2407±21±35	9.8k	LINK	04A FOCS	γ A



$D_0^*(2400)^0$ WIDTH

NODE=M178W

NODE=M178W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
267±40 OUR AVERAGE				
273±12±48	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
276±21±63		ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
240±55±59	9.8k	LINK	04A FOCS	γ A

$D_0^*(2400)^0$ DECAY MODES

NODE=M178215;NODE=M178

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^+ \pi^-$	seen

DESIG=1;OUR EVAL;→ NOT CHECKED ←

$D_0^*(2400)^0$ REFERENCES

NODE=M178

AUBERT	09AB PR D79 112004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04D PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)
LINK	04A PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

REFID=52941
REFID=50011
REFID=49775

$$D_0^*(2400)^\pm$$

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE

J, P need confirmation.

$D_0^*(2400)^\pm$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2403 ± 14 ± 35	18.8k	LINK	04A	FOCS γ A

$D_0^*(2400)^\pm$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
283 ± 24 ± 34	18.8k	LINK	04A	FOCS γ A

$D_0^*(2400)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^+$	seen

$D_0^*(2400)^\pm$ REFERENCES

LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

$$D_1(2420)^0$$

$$I(J^P) = \frac{1}{2}(1^+)$$

I needs confirmation.

$D_1(2420)^0$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2421.3 ± 0.6 OUR FIT	Error includes scale factor of 1.2.			
2420.9 ± 0.8 OUR AVERAGE	Error includes scale factor of 1.2.			
2420.1 ± 0.1 ± 0.8	103k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2426 ± 3 ± 1	151	ABE	05A	BELL $B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
2421.4 ± 1.5 ± 0.9		¹ ABE	04D	BELL $B^- \rightarrow D^{*+} \pi^- \pi^-$
2421 $^{+1}_{-2}$ ± 2	286	AVERY	94C	CLE2 $e^+ e^- \rightarrow D^{*+} \pi^- X$
2422 ± 2 ± 2	51	FRABETTI	94B	E687 $\gamma \text{Be} \rightarrow D^{*+} \pi^- X$
2428 ± 3 ± 2	279	AVERY	90	CLEO $e^+ e^- \rightarrow D^{*+} \pi^- X$
2414 ± 2 ± 5	171	ALBRECHT	89H	ARG $e^+ e^- \rightarrow D^{*+} \pi^- X$
2428 ± 8 ± 5	171	ANJOS	89C	TPS $\gamma N \rightarrow D^{*+} \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2420.5 ± 2.1 ± 0.9	3110 ± 340	² CHEKANOV	09	ZEUS $e^\pm p \rightarrow D^{*+} \pi^- X$
2421.7 ± 0.7 ± 0.6	7.5k	ABULENCIA	06A	CDF 1900 $p \bar{p} \rightarrow D^{*+} \pi^- X$
2425 ± 3	235	³ ABREU	98M	DLPH $e^+ e^-$

¹ Fit includes the contribution from $D_1^*(2430)^0$.

² 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.

³ No systematic error given.

$$m_{D_1^0} - m_{D^{*+}}$$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M179

NODE=M179

NODE=M179M

NODE=M179M

NODE=M179W

NODE=M179W

NODE=M179215;NODE=M179

DESIG=1;OUR EVAL;→ NOT CHECKED ←

NODE=M179

REFID=49775

NODE=M097

NODE=M097M

NODE=M097M

NODE=M097M

NODE=M097M;LINKAGE=AB

NODE=M097M;LINKAGE=CH

NODE=M097M;LINKAGE=K

NODE=M097DM

NODE=M097DM

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
411.0±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
27.1± 2.7 OUR AVERAGE Error includes scale factor of 2.4. See the ideogram below.				
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		⁴ ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^{-} \pi^{-}$
20 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 6 \\ 5 \end{smallmatrix} \pm 3$	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^{-} X$
15 ± 8 ± 4	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} \pi^{-} X$
23 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 8 \\ 6 \end{smallmatrix} \begin{smallmatrix} +10 \\ -3 \end{smallmatrix}$	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^{-} X$
13 ± 6 $\begin{smallmatrix} +10 \\ -5 \end{smallmatrix}$	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^{-} X$

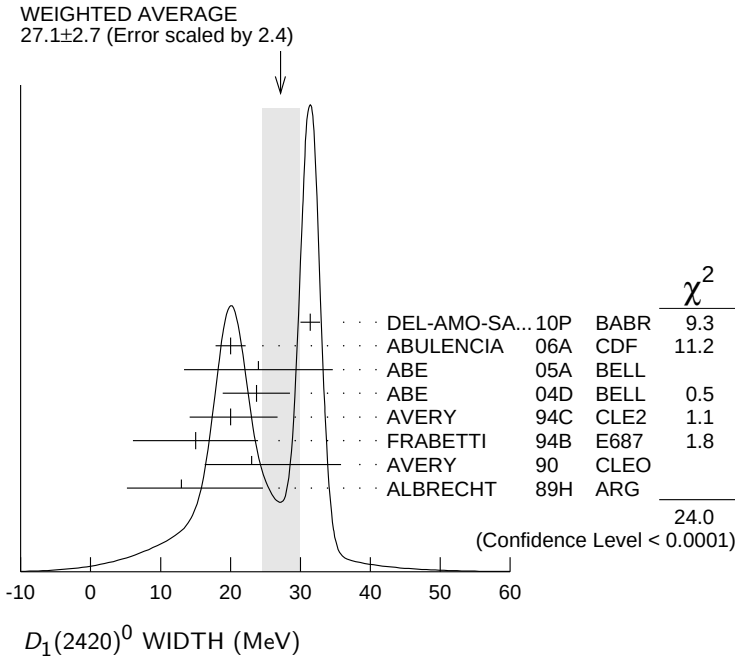
NODE=M097W

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

53.2± 7.2 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 3.3 \\ 4.9 \end{smallmatrix}$	3110±340	CHEKANOV	09 ZEUS	$e^{\pm} p \rightarrow D^{*+} \pi^{-} X$
58 ±14 ±10	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+} \pi^{-} X$

⁴ Fit includes the contribution from $D_1^*(2430)^0$.

NODE=M097W;LINKAGE=AB



$D_1(2420)^0$ DECAY MODES

NODE=M097215;NODE=M097

$\bar{D}_1(2420)^0$ modes are charge conjugates of modes below.

NODE=M097

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*}(2010)^+ \pi^{-}$	seen
Γ_2 $D^0 \pi^+ \pi^{-}$	seen
Γ_3 $D^0 \rho^0$	
Γ_4 $D^0 f_0(500)$	
Γ_5 $D_0^{*}(2400)^+ \pi^{-}$	
Γ_6 $D^+ \pi^{-}$	not seen
Γ_7 $D^{*0} \pi^+ \pi^{-}$	not seen

DESIG=1
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=4
DESIG=5
DESIG=6
DESIG=2;OUR EST;→ NOT CHECKED ←
DESIG=7;OUR EST;→ NOT CHECKED ←

$D_1(2420)^0$ BRANCHING RATIOS

NODE=M097220

$\Gamma(D^*(2010)^+\pi^-)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		ACKERSTAFF	97W OPAL	$e^+e^- \rightarrow D^{*+}\pi^-X$	
seen		AVERY	90 CLEO	$e^+e^- \rightarrow D^{*+}\pi^-X$	
seen		ALBRECHT	89H ARG	$e^+e^- \rightarrow D^*\pi^-X$	
seen		ANJOS	89C TPS	$\gamma N \rightarrow D^{*+}\pi^-X$	
$\Gamma(D^+\pi^-)/\Gamma(D^*(2010)^+\pi^-)$					Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.24	90	AVERY	90 CLEO	$e^+e^- \rightarrow D^+\pi^-X$	

NODE=M097R1
NODE=M097R1NODE=M097R2
NODE=M097R2 **$D_1(2420)^0$ POLARIZATION AMPLITUDE A_{D_1}**

NODE=M097PAH

A polarization amplitude A_{D_1} is a parameter that depends on the initial polarization of the D_1 and is sensitive to a possible S -wave contribution to its decay. For D_1 decays the helicity angle, θ_h , distribution varies like $1 + A_{D_1} \cos^2 \theta_h$, where θ_h is the angle in the D^* rest frame between the two pions emitted by the $D_1 \rightarrow D^*\pi$ and the $D^* \rightarrow D\pi$.

NODE=M097PAH

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
5.72±0.25 OUR AVERAGE				
5.72±0.25	103k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^-X$
5.9 $^{+3.0}_{-1.7}$ $^{+2.4}_{-1.0}$		CHEKANOV 09	ZEUS	$e^\pm p \rightarrow D^{*+}\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.8 ±0.6 ±0.8		⁵ AUBERT 09Y	BABR	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
2.74 $^{+1.40}_{-0.93}$		⁶ AVERY 94C	CLE2	$e^+e^- \rightarrow D^{*+}\pi^-X$
⁵ 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.				
⁶ Systematic uncertainties not estimated.				

NODE=M097PAH

NODE=M097PAH;LINKAGE=AU

NODE=M097PAH;LINKAGE=AV

 $D_1(2420)^0$ REFERENCES

NODE=M097

DEL-AMO-SA...10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53534
AUBERT 09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52929
CHEKANOV 09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52733
ABULENCIA 06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)	REFID=51054
ABE 05A	PRL 94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50755
ABE 04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50011
ABREU 98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46315
ACKERSTAFF 97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
AVERY 94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)	REFID=44096
FRABETTI 94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
AVERY 90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT 89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP	REFID=41001
ANJOS 89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)	REFID=40737

NODE=M120

$D_1(2420)^\pm$

$I(J^P) = \frac{1}{2}(?)$

I needs confirmation.

OMITTED FROM SUMMARY TABLE
Seen in $D^*(2007)^0 \pi^+$. $J^P = 0^+$ ruled out.

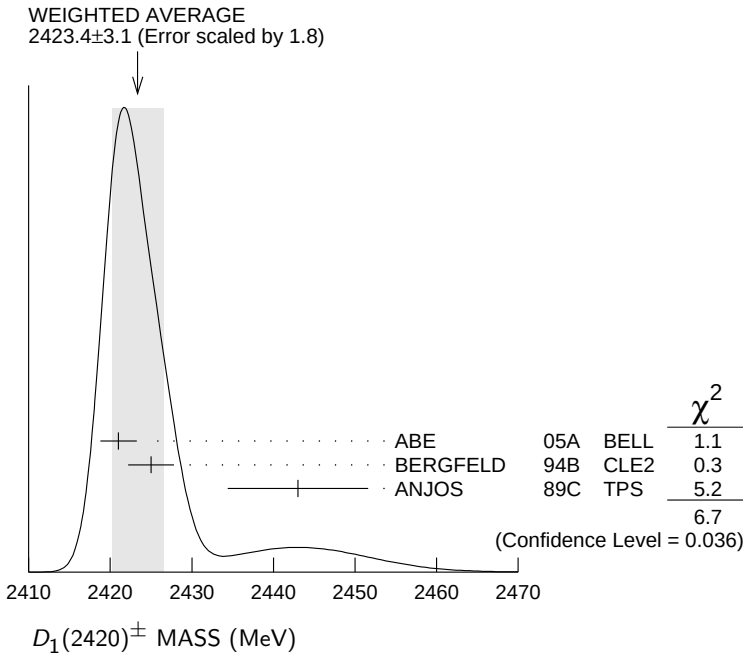
NODE=M120

NODE=M120M

NODE=M120M

$D_1(2420)^\pm$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2423.4±3.1 OUR AVERAGE		Error includes scale factor of 1.8.		See the ideogram below.
2421 ±2 ±1	124	ABE	05A BELL	$\bar{B}^0 \rightarrow D^+ \pi^+ \pi^- \pi^-$
2425 ±2 ±2	146	BERGFELD	94B CLE2	$e^+ e^- \rightarrow D^{*0} \pi^+ X$
2443 ±7 ±5	190	ANJOS	89C TPS	$\gamma N \rightarrow D^0 \pi^+ X^0$



$m_{D_1^*(2420)^\pm} - m_{D_1^*(2420)^0}$

NODE=M120DM

NODE=M120DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4^{+2}_{-3} \pm 3$	BERGFELD	94B CLE2	$e^+ e^- \rightarrow \text{hadrons}$

$D_1(2420)^\pm$ WIDTH

NODE=M120W

NODE=M120W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
25± 6 OUR AVERAGE				
21± 5±8	124	ABE	05A BELL	$\bar{B}^0 \rightarrow D^+ \pi^+ \pi^- \pi^-$
$26^{+8}_{-7} \pm 4$	146	BERGFELD	94B CLE2	$e^+ e^- \rightarrow D^{*0} \pi^+ X$
41±19±8	190	ANJOS	89C TPS	$\gamma N \rightarrow D^0 \pi^+ X^0$

$D_1(2420)^\pm$ DECAY MODES

NODE=M120215;NODE=M120

NODE=M120

$D_1^*(2420)^-$ 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

DESIG=1
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=4
DESIG=5
DESIG=6
DESIG=2;OUR EVAL;→ NOT CHECKED ←
DESIG=7;OUR EST;→ NOT CHECKED ←

$D_1(2420)^\pm$ BRANCHING RATIOS

$\Gamma(D^*(2007)^0\pi^+)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen		ANJOS	89C	TPS	$\gamma N \rightarrow D^0\pi^+\chi^0$
$\Gamma(D^0\pi^+)/\Gamma(D^*(2007)^0\pi^+)$	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=M120220

NODE=M120R1
NODE=M120R1NODE=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. • • •			
$3.8 \pm 0.6 \pm 0.8$	¹ AUBERT	09Y	BABR $B^0 \rightarrow D_1^- \ell^+ \nu_\ell$
¹ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0\bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths and helicity angle distributions for charged and neutral D_1 mesons.			

NODE=M120PAH

NODE=M120PAH;LINKAGE=AU

 $D_1(2420)^\pm$ REFERENCES

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=52929
REFID=50755
REFID=44099
REFID=40737

NODE=M180

 $D_1(2430)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE
 $J = 1^+$ assignment favored (ABE 04D).

NODE=M180

 $D_1(2430)^0$ 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.			

NODE=M180M

NODE=M180M

NODE=M180M;LINKAGE=AU

 $D_1(2430)^0$ 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.			

NODE=M180W

NODE=M180W

NODE=M180W;LINKAGE=AU

 $D_1(2430)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^*(2010)^+\pi^-$	seen

NODE=M180215;NODE=M180

DESIG=1;OUR EVAL;→ NOT CHECKED ←

 $D_1(2430)^0$ 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.)

NODE=M180

REFID=51140
REFID=50011

$$D_2^*(2460)^0$$

$$I(J^P) = \frac{1}{2}(2^+)$$

$J^P = 2^+$ assignment strongly favored(ALBRECHT 89B, ALBRECHT 89H), natural parity confirmed by the helicity analysis(DEL-AMO-SANCHEZ 10P),

NODE=M119

NODE=M119

$D_2^*(2460)^0$ MASS

NODE=M119M

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M119M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2462.6±0.7 OUR FIT	Error includes scale factor of 1.3. [2462.6 ± 0.7 MeV OUR 2011 FIT Scale factor = 1.3]			
2461.8±0.8 OUR AVERAGE	Error includes scale factor of 1.2.			
2462.2±0.1±0.8	243k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^-X$
2460.4±1.2±2.2	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+\pi^-\pi^-$
2461.6±2.1±3.3		¹ ABE	04D BELL	$B^- \rightarrow D^+\pi^-\pi^-$
2464.5±1.1±1.9	5.8k	¹ LINK	04A FOCS	γA
2465 ±3 ±3	486	AVERY	94C CLE2	$e^+e^- \rightarrow D^+\pi^-X$
2453 ±3 ±2	128	FRABETTI	94B E687	$\gamma Be \rightarrow D^+\pi^-X$
2461 ±3 ±1	440	AVERY	90 CLEO	$e^+e^- \rightarrow D^{*+}\pi^-X$
2455 ±3 ±5	337	ALBRECHT	89B ARG	$e^+e^- \rightarrow D^+\pi^-X$
2459 ±3 ±2	153	ANJOS	89C TPS	$\gamma N \rightarrow D^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2469.1±3.7 ^{+1.2} _{-1.3}	1560 ± 230	² 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	³ ABREU	98M DLPH	e^+e^-
2466 ±7	1	ASRATYAN	95 BEBC	53,40 $\nu(\bar{\nu}) \rightarrow pX, dX$

¹ Fit includes the contribution from $D_0^*(2400)^0$.

² 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.

³ No systematic error given.

NODE=M119M

NEW

NODE=M119M;LINKAGE=LI

NODE=M119M;LINKAGE=CH

NODE=M119M;LINKAGE=K

$$m_{D_2^{*0}} - m_{D^{*+}}$$

NODE=M119DM

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M119DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
593.0±0.7 OUR FIT	Error includes scale factor of 1.3. [593.0 ± 0.7 MeV OUR 2011 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

$$m_{D_2^{*0}} - m_{D^{*+}}$$

NODE=M119DM2

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M119DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
452.3±0.7 OUR FIT	Error includes scale factor of 1.3. [452.4 ± 0.7 MeV OUR 2011 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

$$D_2^*(2460)^0 \text{ WIDTH}$$

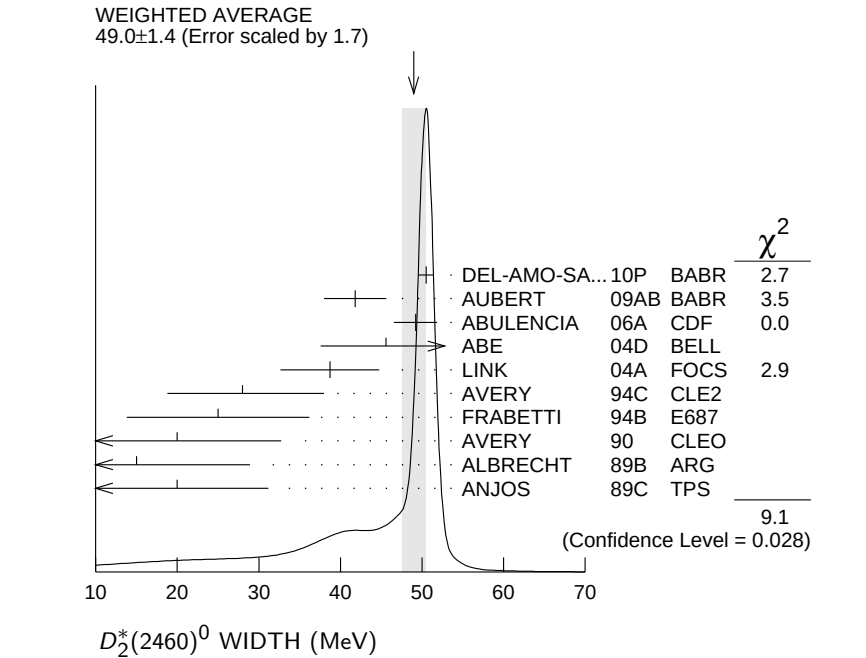
NODE=M119W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
49.0± 1.4 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.				
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		⁴ ABE	04D BELL	$B^- \rightarrow D^+\pi^-\pi^-$
38.7± 5.3± 2.9	5.8k	⁴ LINK	04A FOCS	γA
28 $\pm \frac{8}{7}$ ± 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 $\pm \frac{9}{12}$ $\pm \frac{9}{10}$	440	AVERY	90 CLEO	$e^+e^- \rightarrow D^{*+}\pi^-X$
15 $\pm \frac{13}{10}$ $\pm \frac{5}{10}$	337	ALBRECHT	89B ARG	$e^+e^- \rightarrow D^+\pi^-X$
20 ±10 ± 5	153	ANJOS	89C TPS	$\gamma N \rightarrow D^+\pi^-X$

⁴ Fit includes the contribution from $D_0^{*}(2400)^0$.

NODE=M119W

NODE=M119W;LINKAGE=LI



$D_2^{*}(2460)^0$ DECAY MODES

NODE=M119215;NODE=M119

$\bar{D}_2^{*}(2460)^0$ modes are charge conjugates of modes below.

NODE=M119

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^+\pi^-$	seen
Γ_2 $D^{*}(2010)^+\pi^-$	seen
Γ_3 $D^0\pi^+\pi^-$	not seen
Γ_4 $D^{*0}\pi^+\pi^-$	not seen

CLUMP=A;DESIG=1
DESIG=2
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=4;OUR EST;→ NOT CHECKED ←

$D_2^{*}(2460)^0$ BRANCHING RATIOS

NODE=M119220

$\Gamma(D^+\pi^-)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+\pi^-\pi^-$	
seen	337	ALBRECHT	89B ARG	$e^+e^- \rightarrow D^+\pi^-X$	
seen		ANJOS	89C TPS	$\gamma N \rightarrow D^+\pi^-X$	
$\Gamma(D^{*}(2010)^+\pi^-)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		ACKERSTAFF	97W OPAL	$e^+e^- \rightarrow D^{*+}\pi^-X$	
seen		AVERY	90 CLEO	$e^+e^- \rightarrow D^{*+}\pi^-X$	
seen		ALBRECHT	89H ARG	$e^+e^- \rightarrow D^{*}\pi^-X$	

NODE=M119R1
NODE=M119R1

NODE=M119R2
NODE=M119R2

$\Gamma(D^+\pi^-)/\Gamma(D^*(2010)^+\pi^-)$ Γ_1/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.56±0.16 OUR AVERAGE				
1.47±0.03±0.16	379k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$
2.8 ±0.8 $^{+0.5}_{-0.6}$	1560±230	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
2.2 ±0.7 ±0.6		AVERY	94C CLE2	$e^+e^- \rightarrow D^{*+}\pi^- X$
2.3 ±0.8		AVERY	90 CLEO	e^+e^-
3.0 ±1.1 ±1.5		ALBRECHT	89H ARG	$e^+e^- \rightarrow D^*\pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.9 ±0.5		ABE	04D BELL	$B^- \rightarrow D^{(*)+}\pi^- \pi^-$

NODE=M119R3
 NODE=M119R3

 $\Gamma(D^+\pi^-)/[\Gamma(D^+\pi^-) + \Gamma(D^*(2010)^+\pi^-)]$ $\Gamma_1/(\Gamma_1+\Gamma_2)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.62±0.03±0.02	8414	⁵ AUBERT	09Y BABR	$B^+ \rightarrow D_2^{*0} \ell^+ \nu_\ell$
⁵ 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 D_2 decays the helicity angle, θ_H , distribution varies like $1 + A_{D_2} \cos(\theta_H)$, 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. • • •				
consistent with -1	243k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^- X$
-0.74 $^{+0.49}_{-0.38}$		⁶ AVERY	94C CLE2	$e^+e^- \rightarrow D^{*+}\pi^- X$
⁶ Systematic uncertainties not estimated.				

NODE=M119PAM

NODE=M119PAM;LINKAGE=AV

 $D_2^*(2460)^0$ REFERENCES

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=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

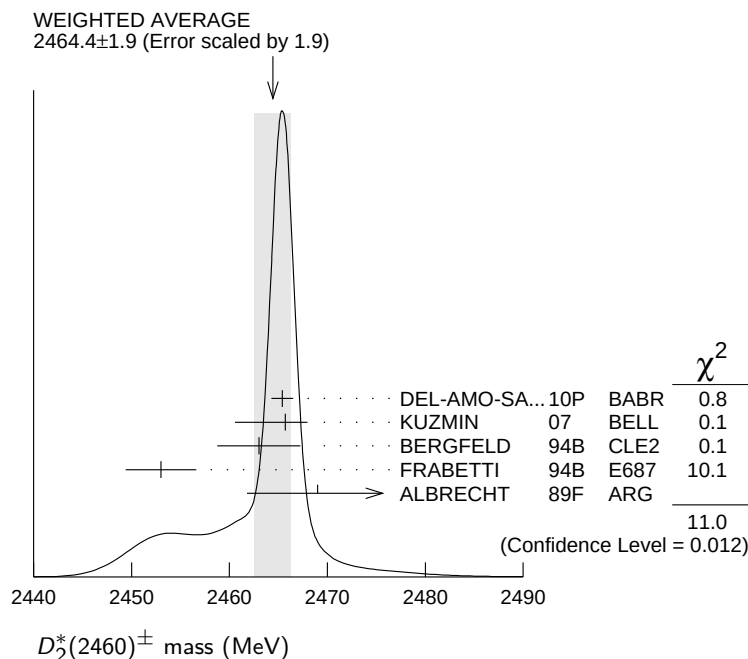
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2464.4 ± 1.9 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
2465.4 ± 0.2 ± 1.1	111k	¹ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^0\pi^+X$
2465.7 ± 1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07	BELL $e^+e^- \rightarrow$ hadrons
2463 ± 3 ± 3	310	BERGFELD	94B	CLE2 $e^+e^- \rightarrow D^0\pi^+X$
2453 ± 3 ± 2	185	FRABETTI	94B	E687 $\gamma\text{Be} \rightarrow D^0\pi^+X$
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	² LINK	04A	FOCS γA

¹ At a fixed width of 50.5 MeV.

² 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=DE

NODE=M150M;LINKAGE=LI



$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0}$

NODE=M150DM

NODE=M150DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2.4 ± 1.7 OUR AVERAGE			
3.1 ± 1.9 ± 0.9	LINK	04A	FOCS γA
- 2 ± 4 ± 4	BERGFELD	94B	CLE2 $e^+e^- \rightarrow$ hadrons
0 ± 4	FRABETTI	94B	E687 $\gamma\text{Be} \rightarrow D\pi X$
14 ± 5 ± 8	ALBRECHT	89F	ARG $e^+e^- \rightarrow D^0\pi^+X$

$D_2^*(2460)^\pm$ WIDTH

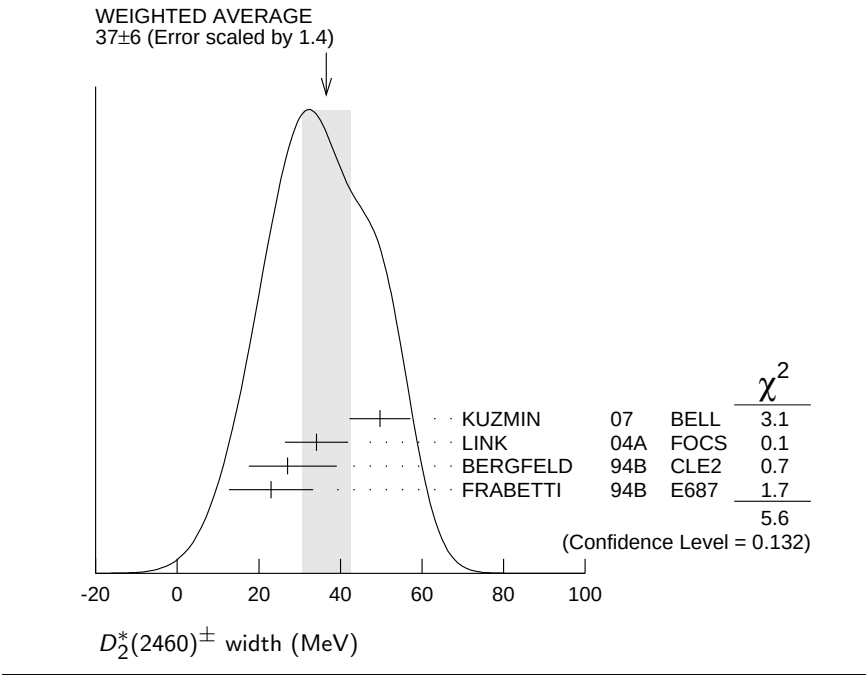
NODE=M150W

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 $e^+e^- \rightarrow$ hadrons
34.1 ± 6.5 ± 4.2	3.5k	³ 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 $\gamma\text{Be} \rightarrow D^0\pi^+X$

³ Fit includes the contribution from $D_0^*(2400)^\pm$.

NODE=M150W;LINKAGE=LI



$D_2^*(2460)^\pm$ DECAY MODES

NODE=M150215;NODE=M150

$D_2^*(2460)^-$ modes are charge conjugates of modes below.

NODE=M150

Mode		Fraction (Γ_i/Γ)
Γ_1	$D^0 \pi^+$	seen
Γ_2	$D^{*0} \pi^+$	seen
Γ_3	$D^+ \pi^+ \pi^-$	not seen
Γ_4	$D^{*+} \pi^+ \pi^-$	not seen

DESIG=1
DESIG=2;OUR EST;→ NOT CHECKED ←
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=4;OUR EST;→ NOT CHECKED ←

$D_2^*(2460)^\pm$ BRANCHING RATIOS

NODE=M150220

$\Gamma(D^0 \pi^+)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	ALBRECHT 89F ARG $e^+ e^- \rightarrow D^0 \pi^+ X$

NODE=M150R1
NODE=M150R1

$\Gamma(D^0 \pi^+)/\Gamma(D^{*0} \pi^+)$	Γ_1/Γ_2
VALUE	DOCUMENT ID TECN COMMENT
$1.9 \pm 1.1 \pm 0.3$	BERGFELD 94B CLE2 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M150R2
NODE=M150R2

$\Gamma(D^0 \pi^+)/[\Gamma(D^0 \pi^+) + \Gamma(D^{*0} \pi^+)]$	$\Gamma_1/(\Gamma_1 + \Gamma_2)$
VALUE	DOCUMENT ID TECN COMMENT

NODE=M150R01
NODE=M150R01

• • • We do not use the following data for averages, fits, limits, etc. • • •
 $0.62 \pm 0.03 \pm 0.02$ 3361 ⁴ AUBERT 09Y BABR $\bar{B}^0 \rightarrow D_2^{*+} \ell^- \nu_\ell$

⁴ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.

NODE=M150R01;LINKAGE=AU

$D_2^*(2460)^\pm$ REFERENCES

NODE=M150

DEL-AMO-SA... 10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT 09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
KUZMIN 07	PR D76 012006	A. Kuzmin <i>et al.</i>	(BELLE Collab.)
LINK 04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)
BERGFELD 94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)
FRABETTI 94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ALBRECHT 89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT 89F	PL B231 208	H. Albrecht <i>et al.</i>	(ARGUS Collab.)

REFID=53534
REFID=52929
REFID=51854
REFID=49775
REFID=44099
REFID=43687
REFID=40736
REFID=40931

NODE=M198

$D(2550)^0$

$$I(J^P) = \frac{1}{2}(0^-)$$

OMITTED FROM SUMMARY TABLE
 $J^P = 0^-$ assignment based on the helicity analysis (DEL-AMO-SANCHEZ 10P).

NODE=M198

D(2550)⁰ MASS

NODE=M198M

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

D(2550)⁰ WIDTH

NODE=M198W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
130±12±13	34k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^-X$

NODE=M198W

D(2550)⁰ DECAY MODES

NODE=M198215;NODE=M198

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^{*+}\pi^-$	seen

DESIG=1;OUR EVAL;→ NOT CHECKED ←

D(2550)⁰ REFERENCES

NODE=M198

DEL-AMO-SA... 10P PR D82 111101 P. del Amo Sanchez *et al.* (BABAR Collab.)

REFID=53534

NODE=M199

$D(2600)$

$$I(J^P) = \frac{1}{2}(?^?)$$

OMITTED FROM SUMMARY TABLE
 J^P consistent with natural parity (DEL-AMO-SANCHEZ 10P).

NODE=M199

D(2600) MASS

NODE=M199M

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	+	$e^+e^- \rightarrow D^0\pi^+X$

NODE=M199M

OCCUR=2

NODE=M199M;LINKAGE=DE

¹ At a fixed width of 93 MeV.

D(2600) WIDTH

NODE=M199W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
93±6±13	26k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^+\pi^-X$

NODE=M199W

D(2600) DECAY MODES

NODE=M199215;NODE=M199

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

DESIG=1;OUR EVAL;→ NOT CHECKED ←

DESIG=2;OUR EVAL;→ NOT CHECKED ←

DESIG=3;OUR EVAL;→ NOT CHECKED ←

DESIG=4;OUR EVAL;→ NOT CHECKED ←

DESIG=5;OUR EVAL;→ NOT CHECKED ←

D(2600) BRANCHING RATIOS

NODE=M199220

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}\pi^-)$				Γ_2/Γ_5	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.32±0.02±0.09	76k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^-X$	

NODE=M199R01

NODE=M199R01

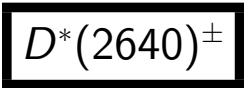
D(2600) REFERENCES

NODE=M199

DEL-AMO-SA... 10P PR D82 111101 P. del Amo Sanchez *et al.* (BABAR Collab.)

REFID=53534

NODE=M158



$$I(J^P) = \frac{1}{2}(??)$$

OMITTED FROM SUMMARY TABLE
Seen in Z decays by ABREU 98M. Not seen by ABBIENDI 01N and
CHEKANOV 09. Needs confirmation.

NODE=M158

$D^*(2640)^\pm$ 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;→ NOT CHECKED ←

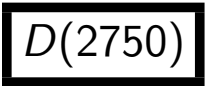
$D^*(2640)^\pm$ REFERENCES

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

$D(2750)$ MASS

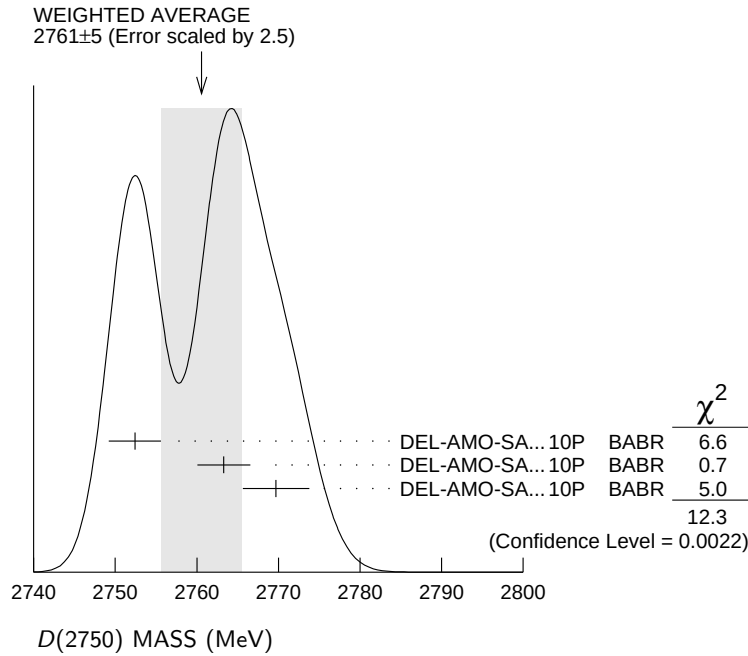
NODE=M203M

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;→ NOT CHECKED ←

DESIG=2;OUR EVAL;→ NOT CHECKED ←

DESIG=3;OUR EVAL;→ NOT CHECKED ←

DESIG=4;OUR EVAL;→ NOT CHECKED ←

DESIG=5;OUR EVAL;→ NOT CHECKED ←

NODE=M203220

NODE=M203R01

NODE=M203R01

NODE=M203R01;LINKAGE=DE

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM;LINKAGE=DE

NODE=M203

REFID=53534

CHARMED, STRANGE MESONS ($C = S = \pm 1$)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \text{ similarly for } D_s^{*+}s$$

$$D_s^{*\pm}$$

$$I(J^P) = 0(?)$$

J^P is natural, width and decay modes consistent with 1^- .

$D_s^{*\pm}$ MASS

The fit includes $D_s^\pm, D_s^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2112.3$\pm$0.5 OUR FIT	Error includes scale factor of 1.1.		
2106.6$\pm$2.1$\pm$2.7	¹ BLAYLOCK	87	MRK3 $e^+e^- \rightarrow D_s^\pm \gamma X$
¹ Assuming $D_s^\pm$ mass = 1968.7 $\pm$ 0.9 MeV.			

$$m_{D_s^{*\pm}} - m_{D_s^\pm}$$

The fit includes $D_s^\pm, D_s^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
143.8 $\pm$ 0.4 OUR FIT				
143.9 $\pm$ 0.4 OUR AVERAGE				
143.76 $\pm$ 0.39 $\pm$ 0.40		GRONBERG	95	CLE2 e^+e^-
144.22 $\pm$ 0.47 $\pm$ 0.37		BROWN	94	CLE2 e^+e^-
142.5 $\pm$ 0.8 $\pm$ 1.5		² ALBRECHT	88	ARG $e^+e^- \rightarrow D_s^\pm \gamma X$
139.5 $\pm$ 8.3 $\pm$ 9.7	60	AIHARA	84D	TPC $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
143.0 $\pm$ 18.0	8	ASRATYAN	85	HLBC FNAL 15-ft, ν - ² H
110 $\pm$ 46		BRANDELIK	79	DASP $e^+e^- \rightarrow D_s^\pm \gamma X$
² Result includes data of ALBRECHT 84B.				

$D_s^{*\pm}$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.9	90	GRONBERG	95	CLE2 e^+e^-
< 4.5	90	ALBRECHT	88	ARG $E_{cm}^{ee} = 10.2$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.9	90	BROWN	94	CLE2 e^+e^-
< 22	90	BLAYLOCK	87	MRK3 $e^+e^- \rightarrow D_s^\pm \gamma X$

D_s^{*-} DECAY MODES

D_s^{*-} modes are charge conjugates of the modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D_s^+ \gamma$	(94.2 $\pm$ 0.7) %
$\Gamma_2 \quad D_s^+ \pi^0$	(5.8 $\pm$ 0.7) %

NODE=MXXX040

NODE=MXXX040

NODE=S074

NODE=S074

NODE=S074M

NODE=S074M

NODE=S074M

NODE=S074M;LINKAGE=E

NODE=S074DM

NODE=S074DM

NODE=S074DM

NODE=S074DM;LINKAGE=A

NODE=S074W

NODE=S074W

NODE=S074215;NODE=S074

NODE=S074

DESIG=1

DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to a branching ratio uses 2 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 0.0$ for 1 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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.

$$x_2 \begin{vmatrix} & -100 \\ & x_1 \end{vmatrix}$$

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.)	REFID=50942
GRONBERG	95	PRL 75 3232	J. Gronberg <i>et al.</i>	(CLEO Collab.)	REFID=44568
BROWN	94	PR D50 1884	D. Brown <i>et al.</i>	(CLEO Collab.)	REFID=43868
ASRATYAN	91	PL B257 525	A.E. Asratyan <i>et al.</i>	(ITEP, BELG, SACL+)	REFID=41582
ALBRECHT	88	PL B207 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40269
BLAYLOCK	87	PRL 58 2171	G.T. Blaylock <i>et al.</i>	(Mark III Collab.)	REFID=40005
ASRATYAN	85	PL 156B 441	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)	REFID=22887
AIHARA	84D	PRL 53 2465	H. Aihara <i>et al.</i>	(TPC Collab.)	REFID=11561
ALBRECHT	84B	PL 146B 111	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22886
BRANDELIK	79	PL 80B 412	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=11442

$$D_{s0}^*(2317)^\pm$$

$$I(J^P) = 0(0^+)$$

J, P need confirmation.

AUBERT 06P does not observe neutral and doubly charged partners of the $D_{s0}^*(2317)^\pm$.

NODE=M172

NODE=M172

$D_{s0}^*(2317)^\pm$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M172M

NODE=M172M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2317.8±0.6 OUR FIT	Error includes scale factor of 1.1.			
2318.0±1.0 OUR AVERAGE	Error includes scale factor of 1.4.			
2319.6±0.2±1.4	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0 X$
2317.3±0.4±0.8	1022	¹ AUBERT	04E BABR	10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2317.2±1.3	88	² AUBERT,B	04S BABR	$B \rightarrow D_{s0}^{(*)}(2317)^+\bar{D}^{(*)}$
2317.2±0.5±0.9	761	³ MIKAMI	04 BELL	10.6 e^+e^-
2316.8±0.4±3.0	1267 ± 53	^{3,4} AUBERT	03G BABR	10.6 e^+e^-
2317.6±1.3	273 ± 33	^{3,5} AUBERT	03G BABR	10.6 e^+e^-
2319.8±2.1±2.0	24	³ KROKOVNY	03B BELL	10.6 e^+e^-
¹ Supersedes AUBERT 03G.				
² Systematic errors not evaluated.				
³ Not independent of the corresponding $m_{D_{s0}^*(2317)} - m_{D_s}$.				
⁴ From $D_s^+ \rightarrow K^+K^-\pi^+$ decay.				
⁵ From $D_s^+ \rightarrow K^+K^-\pi^+\pi^0$ decay.				

NODE=M172M

OCCUR=2

NODE=M172M;LINKAGE=AU

NODE=M172M;LINKAGE=AB

NODE=M172M;LINKAGE=B1

NODE=M172M;LINKAGE=A1

NODE=M172M;LINKAGE=A2

$$m_{D_{s0}^*(2317)^\pm} = m_{D_s^\pm}$$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M172DM

NODE=M172DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
349.3±0.6 OUR FIT	Error includes scale factor of 1.1.			
349.2±0.7 OUR AVERAGE				
348.7±0.5±0.7	761	MIKAMI	04 BELL	10.6 e^+e^-
350.0±1.2±1.0	135	BESSON	03 CLE2	10.6 e^+e^-
351.3±2.1±1.9	24	⁶ KROKOVNY	03B BELL	10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
349.6±0.4±3.0	1267	^{7,8} AUBERT	03G BABR	10.6 e^+e^-
350.2±1.3	273	^{9,10} AUBERT	03G BABR	10.6 e^+e^-
⁶ Recalculated by us using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.				
⁷ From $D_s^+ \rightarrow K^+K^-\pi^+$ decay.				
⁸ Recalculated by us using $m_{D_s^+} = 1967.20 \pm 0.03$ MeV.				
⁹ From $D_s^+ \rightarrow K^+K^-\pi^+\pi^0$ decay.				
¹⁰ Recalculated by us using $m_{D_s^+} = 1967.4 \pm 0.2$ MeV. Systematic errors not estimated.				

NODE=M172DM

OCCUR=2

NODE=M172DM;LINKAGE=K3

NODE=M172DM;LINKAGE=A1

NODE=M172DM;LINKAGE=C1

NODE=M172DM;LINKAGE=A2

NODE=M172DM;LINKAGE=C2

$D_{s0}^*(2317)^\pm$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.8	95	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0 X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 4.6	90	761	MIKAMI	04 BELL	10.6 e^+e^-
<10			AUBERT	03G BABR	10.6 e^+e^-
< 7	90	135	BESSON	03 CLE2	10.6 e^+e^-

NODE=M172W

NODE=M172W

$D_{s0}^*(2317)^\pm$ DECAY MODES $D_{s0}^*(2317)^-$ modes are charge conjugates of modes below.

NODE=M172215;NODE=M172

NODE=M172

Mode	Fraction (Γ_i/Γ)
Γ_1 $D_s^+ \pi^0$	seen
Γ_2 $D_s^+ \gamma$	
Γ_3 $D_s^*(2112)^+ \gamma$	
Γ_4 $D_s^+ \gamma \gamma$	
Γ_5 $D_s^*(2112)^+ \pi^0$	
Γ_6 $D_s^+ \pi^+ \pi^-$	
Γ_7 $D_s^+ \pi^0 \pi^0$	not seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7;OUR EVAL;→ NOT CHECKED ←

 $D_{s0}^*(2317)^\pm$ 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
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.05	90	MIKAMI	04	BELL	10.6 $e^+ e^-$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
<0.14	95	AUBERT	06P	BABR	10.6 $e^+ e^-$	
<0.052	90	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 031101R	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49747
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50195
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)	REFID=49629
AUBERT	03G	PRL 90 242001	B. Aubert <i>et al.</i>	(BaBar Collab.)	REFID=49417
BESSON	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=49583
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)	REFID=49615

$$D_{s1}(2460)^{\pm}$$

$$I(J^P) = 0(1^+)$$

NODE=M173

$D_{s1}(2460)^{\pm}$ MASS

NODE=M173M

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2459.6±0.6 OUR FIT Error includes scale factor of 1.1. [2459.5 ± 0.6 MeV OUR 2011 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.

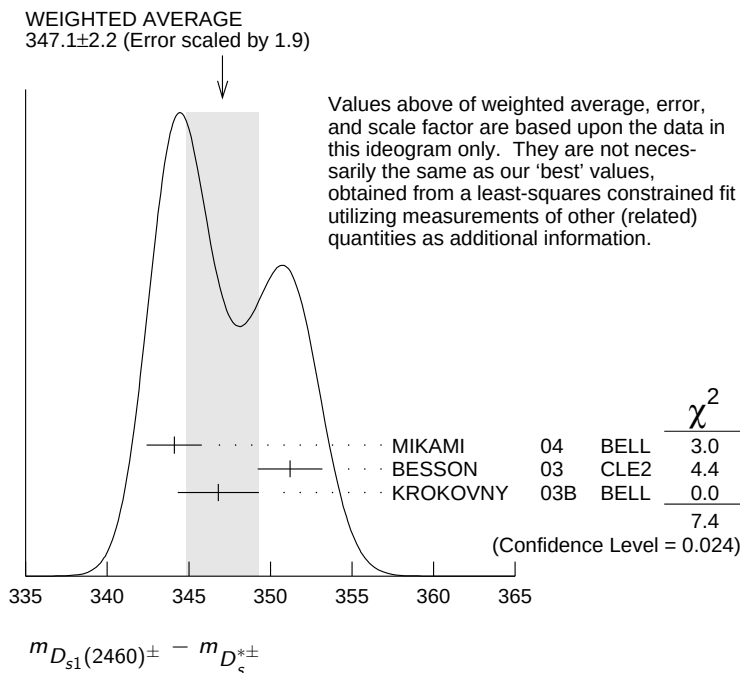
NODE=M173MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
347.2±0.7 OUR FIT Error includes scale factor of 1.2. [347.3 ± 0.8 MeV OUR 2011 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 $D^{\pm}, D^0, D_s^{\pm}, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^{*}(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173DM

NODE=M173DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
491.1±0.7 OUR FIT	Error includes scale factor of 1.1.			
491.3±1.4 OUR AVERAGE				
491.0±1.3±1.9	152	⁹ MIKAMI	04 BELL	10.6 e^+e^-
491.4±0.9±1.5	60	¹⁰ MIKAMI	04 BELL	10.6 e^+e^-

⁹ From the decay to $D_s^{\pm}\gamma$.

¹⁰ From the decay to $D_s^{\pm}\pi^+\pi^-$.

NODE=M173DM

OCCUR=2

NODE=M173DM;LINKAGE=M1

NODE=M173DM;LINKAGE=M2

$D_{s1}(2460)^{\pm}$ WIDTH

NODE=M173W

NODE=M173W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.5	95	123	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	95	560	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0\gamma X$
<10		195	AUBERT	04E BABR	10.6 e^+e^-
< 5.5	90	126	MIKAMI	04 BELL	10.6 e^+e^-
< 7	90	41	BESSON	03 CLE2	10.6 e^+e^-

OCCUR=2

$D_{s1}(2460)^+$ DECAY MODES

NODE=M173215;NODE=M173

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

NODE=M173

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $D_s^{*+}\pi^0$	(48 ± 11) %	
Γ_2 $D_s^+\gamma$	(18 ± 4) %	
Γ_3 $D_s^+\pi^+\pi^-$	(4.3 ± 1.3) %	S=1.1
Γ_4 $D_s^{*+}\gamma$	< 8 %	CL=90%
Γ_5 $D_{s0}^*(2317)^+\gamma$	(3.7 ^{+5.0} _{-2.4}) %	
Γ_6 $D_s^+\pi^0$		
Γ_7 $D_s^+\pi^0\pi^0$		
Γ_8 $D_s^+\gamma\gamma$		

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=7

DESIG=8

DESIG=9

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 8 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 3.4$ for 4 degrees of freedom.

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

x_2	80		
x_3	68	62	
x_5	-3	25	26
	x_1	x_2	x_3

$D_{s1}(2460)^\pm$ BRANCHING RATIOS

NODE=M173220

$\Gamma(D_s^{*+} \pi^0) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.48 ± 0.11 OUR FIT

0.56 ± 0.13 ± 0.09 ¹¹ AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^{(*)}$

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

seen 41 BESSON 03 CLE2 10.6 $e^+ e^-$

¹¹ Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.

NODE=M173R1
NODE=M173R1

$\Gamma(D_s^+ \gamma) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.18 ± 0.04 OUR FIT

0.16 ± 0.04 ± 0.03 ¹² AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^{(*)}$

¹² Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.

NODE=M173R6
NODE=M173R6

NODE=M173R6;LINKAGE=AU

$\Gamma(D_s^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_2 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.38 ± 0.05 OUR FIT

0.44 ± 0.09 OUR AVERAGE

0.55 ± 0.13 ± 0.08 152 MIKAMI 04 BELL 10.6 $e^+ e^-$

0.38 ± 0.11 ± 0.04 38 KROKOVNY 03B BELL 10.6 $e^+ e^-$

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

0.274 ± 0.045 ± 0.020 251 ¹³ AUBERT,B 04s BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$

< 0.49 90 BESSON 03 CLE2 10.6 $e^+ e^-$

¹³ Used by AUBERT 06N in their measurement of $B(D_s^{*-} \pi^0)$ and $B(D_s^- \gamma)$.

NODE=M173R2
NODE=M173R2

NODE=M173R2;LINKAGE=AU

$\Gamma(D_s^+ \pi^+ \pi^-) / \Gamma(D_s^{*+} \pi^0)$ Γ_3 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.090 ± 0.020 OUR FIT Error includes scale factor of 1.2.

0.14 ± 0.04 ± 0.02 60 MIKAMI 04 BELL 10.6 $e^+ e^-$

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

< 0.08 90 BESSON 03 CLE2 10.6 $e^+ e^-$

NODE=M173R3
NODE=M173R3

$\Gamma(D_s^{*+} \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_4 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 0.16 90 BESSON 03 CLE2 10.6 $e^+ e^-$

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

< 0.31 90 MIKAMI 04 BELL 10.6 $e^+ e^-$

NODE=M173R4
NODE=M173R4

$\Gamma(D_{s0}^*(2317)^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_5 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 0.22 95 AUBERT 04E BABR 10.6 $e^+ e^-$

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

< 0.58 90 BESSON 03 CLE2 10.6 $e^+ e^-$

NODE=M173R5
NODE=M173R5

$$\Gamma(D_s^{*+}\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_1/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.93±0.09 OUR FIT			
0.97±0.09±0.05	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R7
NODE=M173R7

$$\Gamma(D_s^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_2/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.35 ±0.04 OUR FIT			
0.337±0.036±0.038	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R8
NODE=M173R8

$$\Gamma(D_s^+\pi^+\pi^-)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_3/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.083±0.017 OUR FIT			Error includes scale factor of 1.2.
0.077±0.013±0.008	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R9
NODE=M173R9

$$\Gamma(D_s^{*+}\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_4/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R10
NODE=M173R10

$$\Gamma(D_{s0}^*(2317)^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_5/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.25	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R11
NODE=M173R11

$$\Gamma(D_s^+\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_6/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.042	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R12
NODE=M173R12

$$\Gamma(D_s^+\pi^0\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_7/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.68	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R13
NODE=M173R13

$$\Gamma(D_s^+\gamma\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)] \quad \Gamma_8/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.33	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R14
NODE=M173R14

$D_{s1}(2460)^\pm$ REFERENCES

AUBERT	06N	PR D74 031103R	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 031101R	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.)

NODE=M173

REFID=51142
REFID=51144
REFID=49747
REFID=50195
REFID=49629
REFID=49583
REFID=49615

$$D_{s1}(2536)^{\pm}$$

$$I(J^P) = 0(1^+)$$

J, P need confirmation.

Seen in $D^*(2010)^+ K^0$, $D^*(2007)^0 K^+$, and $D_s^+ \pi^+ \pi^-$. Not seen in $D^+ K^0$ or $D^0 K^+$. $J^P = 1^+$ assignment strongly favored.

NODE=M121

NODE=M121

$D_{s1}(2536)^{\pm}$ MASS

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M121M

NODE=M121M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

2535.12 $\pm$ 0.13 OUR FIT

[2535.28 $\pm$ 0.20 MeV OUR 2011 FIT]

2535.18 $\pm$ 0.24 OUR AVERAGE

2535.7 $\pm$ 0.6 $\pm$ 0.5	46 $\pm$ 9	1 ABAZOV	09G D0	$B_s^0 \rightarrow D_{s1}^- \mu^+ \nu_{\mu} X$
2534.78 $\pm$ 0.31 $\pm$ 0.40	182	AUBERT	08B BABR	$B \rightarrow \bar{D}^{(*)} D^* K$
2534.6 $\pm$ 0.3 $\pm$ 0.7	193	AUBERT	06P BABR	$10.6 e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$
2535.3 $\pm$ 0.7	92	2 HEISTER	02B ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2534.2 $\pm$ 1.2	9	ASRATYAN	94 BEBC	$\nu N \rightarrow D^{*+} K^0 X, D^{*0} K^{\pm} X$
2535 $\pm$ 0.6 $\pm$ 1	75	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2535.3 $\pm$ 0.2 $\pm$ 0.5	134	ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*0} K^+ X$
2534.8 $\pm$ 0.6 $\pm$ 0.6	44	ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.2 $\pm$ 0.5 $\pm$ 1.5	28	ALBRECHT	92R ARG	$10.4 e^+ e^- \rightarrow D^{*0} K^+ X$
2536.6 $\pm$ 0.7 $\pm$ 0.4		AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.9 $\pm$ 0.6 $\pm$ 2.0		ALBRECHT	89E ARG	$D_{s1}^+ \rightarrow D^*(2010) K^0$

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

2534.1 $\pm$ 0.6	116	3 AUSHEV	11 BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
2535.08 $\pm$ 0.01 $\pm$ 0.15	8038	4 LEES	11B BABR	$10.6 e^+ e^- \rightarrow D^{*+} K_S^0 X$
2535.57 $^{+0.44}_{-0.41}$ $\pm$ 0.10	236 $\pm$ 30	5 CHEKANOV	09 ZEUS	$e^{\pm} p \rightarrow D^{*+} K_S^0 X$, $D^{*0} K^+ X$
2535 $\pm$ 28		6 ASRATYAN	88 HLBC	$\nu N \rightarrow D_s \gamma \gamma X$

¹ Using the $D^*(2010)^{\pm}$ mass of 2010.0 $\pm$ 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

NEW

OCCUR=2

NODE=M121M;LINKAGE=AB

NODE=M121M;LINKAGE=HI

NODE=M121M;LINKAGE=AU

NODE=M121M;LINKAGE=LE

NODE=M121M;LINKAGE=CH

NODE=M121M;LINKAGE=B

$$m_{D_{s1}(2536)^{\pm}} - m_{D_s^*(2111)}$$

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M121DM

NODE=M121DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

422.8 $\pm$ 0.5 OUR FIT Error includes scale factor of 1.1. [423.0 $\pm$ 0.5 MeV OUR 2011 FIT Scale factor = 1.1]

424 $\pm$ 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				
[525.06 ± 0.22 MeV OUR 2011 FIT]				
524.84 ± 0.04 OUR AVERAGE				
[525.30 ± 0.35 MeV OUR 2011 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

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				
[528.36 ± 0.23 MeV OUR 2011 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

NEW

$D_{s1}(2536)^\pm$ 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	$\gamma \text{Be} \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
< 2.3	90	ALEXANDER	93 CLEO	$e^+e^- \rightarrow D^{*0} K^+ X$
< 3.9	90	ALBRECHT	92R ARG	10.4 $e^+e^- \rightarrow D^{*0} K^+ X$
< 5.44	90	VERY	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)
Γ_1 $D^{*}(2010)^+ K^0$	seen
Γ_2 $(D^{*}(2010)^+ K^0)_{S\text{-wave}}$	
Γ_3 $(D^{*}(2010)^+ K^0)_{D\text{-wave}}$	
Γ_4 $D^+ \pi^- K^+$	
Γ_5 $D^{*}(2007)^0 K^+$	seen
Γ_6 $D^+ K^0$	not seen
Γ_7 $D^0 K^+$	not seen
Γ_8 $D_s^{*+} \gamma$	possibly seen
Γ_9 $D_s^+ \pi^+ \pi^-$	seen

DESIG=1;OUR EST;→ NOT CHECKED ←

DESIG=7

DESIG=9

DESIG=8

DESIG=4;OUR EST;→ NOT CHECKED ←

DESIG=2;OUR EST;→ NOT CHECKED ←

DESIG=5;OUR EST;→ NOT CHECKED ←

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				
[1.36 ± 0.20 OUR 2011 AVERAGE]				

NODE=M121R6
 NODE=M121R6
 NEW

0.88±0.24±0.08	116	AUSHEV	11	BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
2.3 ± 0.6 ± 0.3	236 ± 30	CHEKANOV	09	ZEUS	$e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$
1.32±0.47±0.23	92	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

$$\Gamma((D^*(2010)^+ K^0)_{S=wave})/\Gamma(D^*(2010)^+ K^0)$$

 Γ_2/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.72±0.05±0.01	5485	BALAGURA	08	BELL

NODE=M121R8
 NODE=M121R8

$$\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$$

 Γ_4/Γ_1

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.27±0.18±0.37	1264	BALAGURA	08	BELL

NODE=M121R9
 NODE=M121R9

$$\Gamma(D^+ K^0)/\Gamma(D^*(2010)^+ K^0)$$

 Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.40	90	ALEXANDER	93	CLEO
<0.43	90	ALBRECHT	89E	ARG

NODE=M121R1
 NODE=M121R1

$$\Gamma(D^0 K^+)/\Gamma(D^*(2007)^0 K^+)$$

 Γ_7/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.12	90	ALEXANDER	93	CLEO

NODE=M121R4
 NODE=M121R4

$$\Gamma(D_s^{*+} \gamma)/\Gamma_{\text{total}}$$

 Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	ASRATYAN	88	HLBC

NODE=M121R3
 NODE=M121R3

$$\Gamma(D_s^{*+} \gamma)/\Gamma(D^*(2007)^0 K^+)$$

 Γ_8/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42	90	ALEXANDER	93	CLEO

NODE=M121R5
 NODE=M121R5

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

 Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	06P	BABR

NODE=M121R7
 NODE=M121R7

 $D_{s1}(2536)^\pm$ REFERENCES

NODE=M121

AUSHEV	11	PR D83 051102	T. Aushev <i>et al.</i>	(BELLE Collab.)
LEES	11B	PR D83 072003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABAZOV	09G	PRL 102 051801	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
AUBERT	08B	PR D77 011102R	B. Aubert <i>et al.</i>	(BABAR Collab.)
BALAGURA	08	PR D77 032001	V. Balagura <i>et al.</i>	(BELLE Collab.)
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
ASRATYAN	94	ZPHY C61 563	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ALEXANDER	93	PL B303 377	J. Alexander <i>et al.</i>	(CLEO Collab.)
ALBRECHT	92R	PL B297 425	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)
ALBRECHT	89E	PL B230 162	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ASRATYAN	88	ZPHY C40 483	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)

NODE=M121
 REFID=16505
 REFID=16773
 REFID=52652
 REFID=52733
 REFID=52120
 REFID=52133
 REFID=51144
 REFID=51004
 REFID=48562
 REFID=45788
 REFID=43667
 REFID=43687
 REFID=43316
 REFID=43179
 REFID=41013
 REFID=40914
 REFID=40916

$D_{s2}^*(2573)$

$$I(J^P) = 0(?)^?$$

J^P is natural, width and decay modes consistent with 2^+ .

NODE=M148

NODE=M148

NODE=M148M

NODE=M148M

NEW

NODE=M148M;LINKAGE=EV

NODE=M148M;LINKAGE=HI

NODE=M148DM

NODE=M148DM

NODE=M148DM;LINKAGE=EV

NODE=M148W

NODE=M148W

NEW

NODE=M148W;LINKAGE=EV

$D_{s2}^*(2573)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2571.9±0.8 OUR AVERAGE				
[2572.6 ± 0.9 MeV OUR 2011 AVERAGE]				
2569.4±1.6±0.5	82 ± 17	AAIJ	11A LHCb	$pp \rightarrow D_{s2}^* X$
2572.2±0.3±1.0		AUBERT,BE	06E BABR	$e^+ e^- \rightarrow DKX$
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.

$m_{D_{s2}^*(2573)} - m_{D^0}$

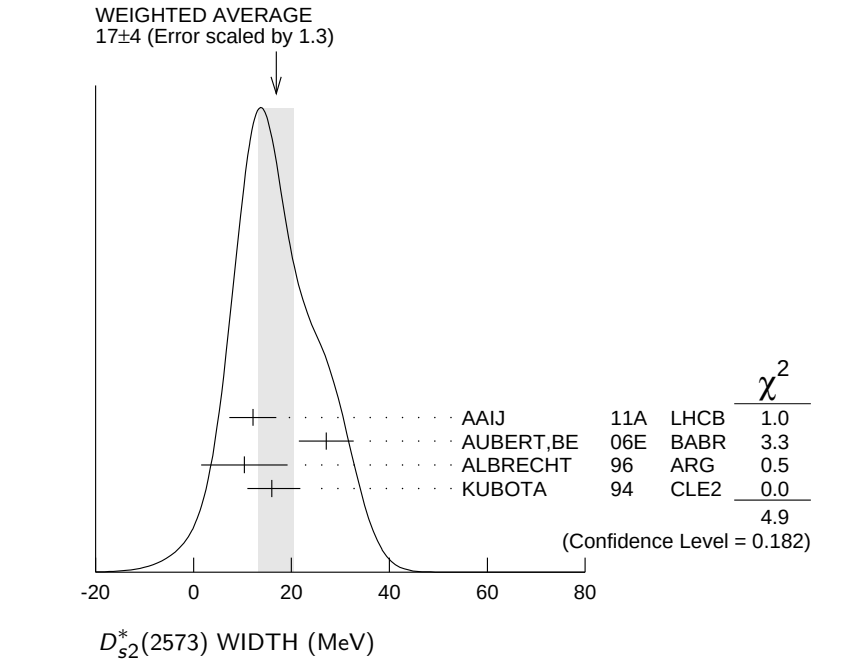
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
704 ±3 ±1	64	HEISTER	02B ALEP	$e^+ e^- \rightarrow D^0 K^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
705.4±4.3	25	³ EVDOKIMOV	04 SELX	$600 \Sigma^- A \rightarrow D^0 K^+ X$

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.				
[20 ± 5 MeV OUR 2011 AVERAGE Scale factor = 1.3]				
12.1±4.5±1.6	82 ± 17	AAIJ	11A LHCb	$pp \rightarrow D_{s2}^* X$
27.1±0.6±5.6		AUBERT,BE	06E BABR	$e^+ e^- \rightarrow DKX$
10.4±8.3±3.0		ALBRECHT	96 ARG	$e^+ e^- \rightarrow D^0 K^+ X$
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.



$D_{s2}^*(2573)^+$ DECAY MODES

NODE=M148215;NODE=M148

$D_{s2}^*(2573)^-$ modes are charge conjugates of the modes below.

NODE=M148

Mode		Fraction (Γ_i/Γ)
Γ_1	$D^0 K^+$	seen
Γ_2	$D^{*0}(2007)^0 K^+$	not seen

DESIG=1
DESIG=2;OUR EVAL;→ NOT CHECKED ←

$D_{s2}^*(2573)^+$ BRANCHING RATIOS

NODE=M148220

$\Gamma(D^0 K^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	217	KUBOTA	94	CLE2	$\pm$	$e^+ e^- \sim 10.5 \text{ GeV}$

$\Gamma(D^{*0}(2007)^0 K^+)/\Gamma(D^0 K^+)$						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=M148R2
NODE=M148R2

NODE=M148R1
NODE=M148R1

$D_{s2}^*(2573)$ REFERENCES

NODE=M148

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.)

REFID=16665
REFID=51512
REFID=50337
REFID=48562
REFID=44631
REFID=43781

$$D_{s1}^*(2700)^\pm$$

$$I(J^P) = 0(1^-)$$

OMITTED FROM SUMMARY TABLE

NODE=M182

$D_{s1}^*(2700)^+$ MASS

NODE=M182M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M182M

2709^{+9}_{-6} OUR AVERAGE

$2710 \pm 2^{+12}_{-7}$	10.4k	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

$2708 \pm 9^{+11}_{-10}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$

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

$2688 \pm 4 \pm 3$		² AUBERT,BE	06E BABR	$10.6 e^+e^- \rightarrow DKX$

¹ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

² Superseded by AUBERT 09AR.

NODE=M182M;LINKAGE=AB

NODE=M182M;LINKAGE=AU

$D_{s1}^*(2700)^+$ WIDTH

NODE=M182W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M182W

125 ± 30 OUR AVERAGE

$149 \pm 7^{+39}_{-52}$	10.4k	³ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

$108 \pm 23^{+36}_{-31}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$

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

$112 \pm 7 \pm 36$		⁴ AUBERT,BE	06E BABR	$10.6 e^+e^- \rightarrow DKX$

³ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁴ Superseded by AUBERT 09AR.

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

NODE=M182R01

NODE=M182R01

$0.91 \pm 0.13 \pm 0.12$	10.4k	⁵ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

⁵ From the average of the corresponding ratios with $D^{(*)0}K^+$ and $D^{(*)+}K_S^0$.

NODE=M182R01;LINKAGE=AU

$\Gamma(D^{*0}K^+)/\Gamma(D^0K^+)$

 Γ_5/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M182R02

NODE=M182R02

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

$0.88 \pm 0.14 \pm 0.14$	7716	⁶ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

⁶ From the $D^{*0}K^+$ and D^0K^+ , where $D^{*0} \rightarrow D^0\pi^0$.

NODE=M182R02;LINKAGE=AU

$\Gamma(D^{*+}K_S^0)/\Gamma(D^+K_S^0)$

 Γ_6/Γ_3

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M182R03

NODE=M182R03

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

$1.14 \pm 0.39 \pm 0.23$	2700	⁷ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

⁷ From the $D^{*+}K_S^0$ and $D^+K_S^0$, where $D^{*+} \rightarrow D^+\pi^0$.

NODE=M182R03;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ REFERENCES

AUBERT	09AR	PR D80	092003	B. Aubert <i>et al.</i>	(BABAR Collb.)
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=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

$2862 \pm 2 \begin{smallmatrix} +5 \\ -2 \end{smallmatrix}$	3122	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

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

$2856.6 \pm 1.5 \pm 5.0$		² AUBERT,BE	06E BABR	$e^+e^- \rightarrow DKX$

¹ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.² Superseded by AUBERT 09AR.

NODE=M196M

NODE=M196M;LINKAGE=AB

NODE=M196M;LINKAGE=AU

 $D_{sJ}^*(2860)^+$ WIDTH

NODE=M196W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

$48 \pm 3 \pm 6$	3122	³ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

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

$47 \pm 7 \pm 10$		⁴ AUBERT,BE	06E BABR	$e^+e^- \rightarrow DKX$

³ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.⁴ Superseded by AUBERT 09AR.

NODE=M196W

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^0K^+
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

$1.10 \pm 0.15 \pm 0.19$	3122	⁵ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

⁵ From the average of the corresponding ratios with $D^{(*)0}K^+$ and $D^{(*)+}K_S^0$.

NODE=M196R01

NODE=M196R01

NODE=M196R01;LINKAGE=AU

 $\Gamma(D^{*0}K^+)/\Gamma(D^0K^+)$ **Γ_5/Γ_2**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

$1.04 \pm 0.17 \pm 0.20$	2241	⁶ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

⁶ From the $D^{*0}K^+$ and D^0K^+ , where $D^{*0} \rightarrow D^0\pi^0$.

NODE=M196R02

NODE=M196R02

NODE=M196R02;LINKAGE=AU

 $\Gamma(D^{*+}K_S^0)/\Gamma(D^+K_S^0)$ **Γ_6/Γ_3**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

$1.38 \pm 0.35 \pm 0.49$	881	⁷ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

⁷ 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

AUBERT 09AR PR D80 092003 B. Aubert *et al.* (BABAR Collb.)
AUBERT,BE 06E PRL 97 222001 B. Aubert *et al.* (BABAR Collab.)

NODE=M196

REFID=53135
REFID=51512

NODE=M197

$D_{sJ}(3040)^\pm$

$$I(J^P) = 0(?)^?$$

OMITTED FROM SUMMARY TABLE
Observed by AUBERT 09AR in inclusive production of $D^* K$ in $e^+ e^-$ annihilation.

NODE=M197

$D_{sJ}(3040)^+$ MASS

NODE=M197M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$3044 \pm 8^{+30}_{-5}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

NODE=M197M

$D_{sJ}(3040)^+$ WIDTH

NODE=M197W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$239 \pm 35^{+46}_{-42}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

NODE=M197W

$D_{sJ}(3040)^\pm$ DECAY MODES

NODE=M197215;NODE=M197

Mode	
Γ_1	$D^* K$
Γ_2	$D^{*0} K^+$
Γ_3	$D^{*+} K_S^0$

DESIG=1
DESIG=2
DESIG=3

$D_{sJ}(3040)^\pm$ REFERENCES

AUBERT 09AR PR D80 092003 B. Aubert *et al.* (BABAR Collb.)

NODE=M197

REFID=53135

OTHER RELATED PAPERS

SUN 09 PR D80 074037 Z.-F. Sun, X. Lin

REFID=53128

BOTTOM MESONS

$(B = \pm 1)$

NODE=MXXX045

$$B^+ = u\bar{b}, B^0 = d\bar{b}, \bar{B}^0 = \bar{d}b, B^- = \bar{u}b, \text{ similarly for } B^{*'}\text{'s}$$

NODE=MXXX045

BOTTOM, STRANGE MESONS

$(B = \pm 1, S = \mp 1)$

NODE=MXXX046

$$B_s^0 = s\bar{b}, \bar{B}_s^0 = \bar{s}b, \text{ similarly for } B_s^{*'}\text{'s}$$

NODE=MXXX046

BOTTOM, CHARMED MESONS

$(B = C = \pm 1)$

NODE=MXXX049

$$B_c^+ = c\bar{b}, B_c^- = \bar{c}b, \text{ similarly for } B_c^{*'}\text{'s}$$

NODE=MXXX049

c $\bar{c}$ MESONS

NODE=MXXX025

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M826

$\eta_c(1S)$

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

NODE=M026

η_c(1S) MASS

NODE=M026M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2981.0 ± 1.1 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below. [2980.3 ± 1.2 MeV OUR 2011 AVERAGE Scale factor = 1.6]				
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 ⁺ _{-2.0}	920	¹ VINOKUROVA 11	BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	² LEES	10 BABR	$10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K^{(*)} \rightarrow K \bar{K} \pi K^{(*)}$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow \text{hadrons}$
2970 ± 5 ± 6	501	³ ABE	07 BELL	$e^+ e^- \rightarrow J/\psi (c\bar{c})$
2971 ± 3 ± 2 ₋₁	195	WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$
2974 ± 7 ± 2 ₋₁	20	WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
2981.8 ± 1.3 ± 1.5	592	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
2984.1 ± 2.1 ± 1.0	190	⁴ AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma\gamma$
2977.5 ± 1.0 ± 1.2		^{5,6} BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$
2976.3 ± 2.3 ± 1.2		^{6,7,8} BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c$ and $\psi(2S) \rightarrow \gamma \eta_c$
2969 ± 4 ± 4	80	⁶ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2984 ± 2.3 ± 4.0		⁶ GAISER	86 CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$

NODE=M026M
NEW

OCCUR=2

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

2982.5 ± 0.4 ± 1.4	12k	⁹ DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
2982.2 ± 0.6		⁶ MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
2982 ± 5	270	¹⁰ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	¹¹ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
2979.6 ± 2.3 ± 1.6	180	¹² FANG	03 BELL	$B \rightarrow \eta_c K$
2976.6 ± 2.9 ± 1.3	140	^{6,7,13} BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c$
2980.4 ± 2.3 ± 0.6		¹⁴ BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
2975.8 ± 3.9 ± 1.2		^{7,13} BAI	99B BES	Sup. by BAI 00F
2999 ± 8	25	ABREU	98O DLPH	$e^+ e^- \rightarrow e^+ e^- + \text{hadrons}$
2988.3 ⁺ _{-3.1}		ARMSTRONG	95F E760	$\bar{p} p \rightarrow \gamma\gamma$
2974.4 ± 1.9		^{6,13} BISELLO	91 DM2	$J/\psi \rightarrow \eta_c \gamma$
2956 ± 12 ± 12		⁶ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2982.6 ⁺ _{-2.3}	12	BAGLIN	87B SPEC	$\bar{p} p \rightarrow \gamma\gamma$
2980.2 ± 1.6		^{6,13} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
2976 ± 8		^{6,15} BALTRUSAIT..84	MRK3	$J/\psi \rightarrow 2\phi\gamma$
2982 ± 8	18	¹⁶ HIMEL	80B MRK2	$e^+ e^-$
2980 ± 9		¹⁶ PARTRIDGE	80B CBAL	$e^+ e^-$

OCCUR=2

OCCUR=2

OCCUR=3

¹ Accounts for interference with non-resonant continuum.

² Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

³ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE, K 02 and ABE 04G.

⁴ Using mass of $\psi(2S) = 3686.00$ MeV.

⁵ From a simultaneous fit of five decay modes of the η_c .

⁶ 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.

⁷ Using an η_c width of 13.2 MeV.

NODE=M026M;LINKAGE=VA
NODE=M026M;LINKAGE=LE
NODE=M026M;LINKAGE=EB
NODE=M026M;LINKAGE=BG
NODE=M026M;LINKAGE=AK
NODE=M026M;LINKAGE=MI

NODE=M026M;LINKAGE=C1

⁸Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples.

⁹Not independent from the measurements reported by LEES 10.

¹⁰From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹¹Superseded by LEES 10.

¹²Superseded by VINOKUROVA 11.

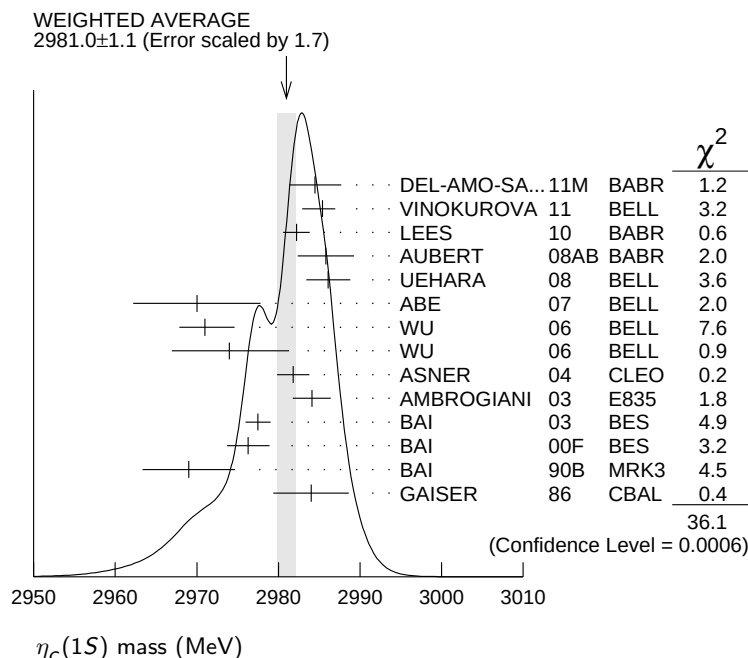
¹³Average of several decay modes.

¹⁴Superseded by ASNER 04.

¹⁵ $\eta_c \rightarrow \phi\phi$.

¹⁶Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.

NODE=M026M;LINKAGE=KZ
 NODE=M026M;LINKAGE=DE
 NODE=M026M;LINKAGE=AU
 NODE=M026M;LINKAGE=UB
 NODE=M026M;LINKAGE=FA
 NODE=M026M;LINKAGE=A
 NODE=M026M;LINKAGE=NN
 NODE=M026M;LINKAGE=B
 NODE=M026M;LINKAGE=M



$\eta_c(1S)$ WIDTH

NODE=M026W

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
29.6$\pm$ 1.0 OUR FIT					
29.7$\pm$ 2.1 OUR AVERAGE					Error includes scale factor of 2.0. See the ideogram below.
[28.6 $\pm$ 2.2 MeV OUR 2011 AVERAGE Scale factor = 2.0]					
36.2 $\pm$ 2.8 $\pm$ 3.0		11k	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
35.1 $\pm$ 3.1 $^{+1.0}_{-1.6}$		920	¹⁷ VINOKUROVA 11	BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
31.7 $\pm$ 1.2 $\pm$ 0.8		14k	¹⁸ LEES	10 BABR	$10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
36.3 $^{+3.7}_{-3.6} \pm 4.4$		921 $\pm$ 32	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K^{(*)} \rightarrow K \bar{K} \pi K^{(*)}$
28.1 $\pm$ 3.2 $\pm$ 2.2		7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow \text{hadrons}$
48 $^{+8}_{-7} \pm 5$		195	WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$
40 $\pm 19 \pm 5$		20	WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
24.8 $\pm$ 3.4 $\pm$ 3.5		592	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
20.4 $^{+7.7}_{-6.7} \pm 2.0$		190	AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma\gamma$
17.0 $\pm$ 3.7 $\pm$ 7.4			¹⁹ BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$
11.0 $\pm$ 8.1 $\pm$ 4.1			²⁰ BAI	00F BES	$J/\psi \rightarrow \gamma \eta_c$ and $\psi(2S) \rightarrow \gamma \eta_c$
23.9 $^{+12.6}_{-7.1}$			ARMSTRONG	95F E760	$\bar{p} p \rightarrow \gamma\gamma$
7.0 $^{+7.5}_{-7.0}$		12	BAGLIN	87B SPEC	$\bar{p} p \rightarrow \gamma\gamma$
10.1 $^{+33.0}_{-8.2}$		23	²¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma p \bar{p}$
11.5 $\pm$ 4.5			GAISER	86 CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$

NODE=M026W

NEW

OCCUR=2

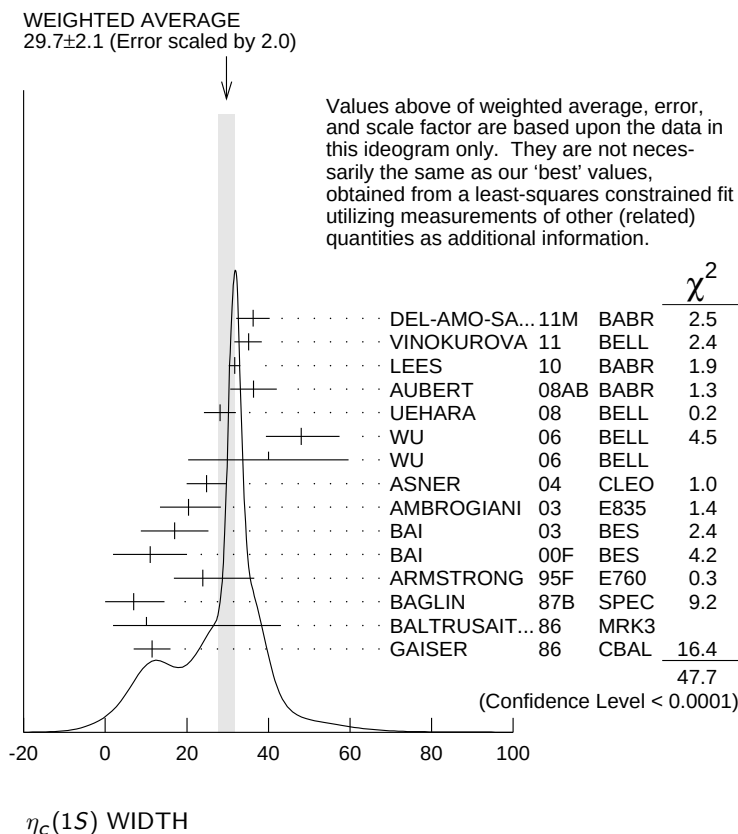
• • • We do not use the following data for averages, fits, limits, etc. • • •

32.1 ± 1.1 ± 1.3	12k	22	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
34.3 ± 2.3 ± 0.9	2547 ± 90	23	AUBERT	04D	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow$
29 ± 8 ± 6	182 ± 25	24	FANG	03	BELL $B \rightarrow \eta_c K$
27.0 ± 5.8 ± 1.4		25	BRANDENB...	00B	CLE2 $\gamma\gamma \rightarrow \eta_c \rightarrow$
					$K^\pm K_S^0 \pi^\mp$
< 40	90	18	HIMEL	80B	MRK2 $e^+ e^-$
< 20	90		PARTRIDGE	80B	CBAL $e^+ e^-$

- 17 Accounts for interference with non-resonant continuum.
 18 Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
 19 From a simultaneous fit of five decay modes of the η_c .
 20 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.
 21 Positive and negative errors correspond to 90% confidence level.
 22 Not independent from the measurements reported by LEES 10.
 23 Superseded by LEES 10.
 24 Superseded by VINOKUROVA 11.
 25 Superseded by ASNER 04.

OCCUR=2

NODE=M026W;LINKAGE=VA
 NODE=M026W;LINKAGE=LE
 NODE=M026W;LINKAGE=AK
 NODE=M026W;LINKAGE=KZ
 NODE=M026W;LINKAGE=L
 NODE=M026W;LINKAGE=DE
 NODE=M026W;LINKAGE=UB
 NODE=M026W;LINKAGE=FA
 NODE=M026W;LINKAGE=NN



$\eta_c(1S)$ 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 $\rho\rho$	(2.0 ± 0.7) %	
Γ_3 $K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(2.0 ± 0.7) %	
Γ_4 $K^*(892) \bar{K}^*(892)$	(9.2 ± 3.4) × 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 $\phi\phi$	(2.7 ± 0.9) × 10 ⁻³	
Γ_8 $\phi 2(\pi^+ \pi^-)$	< 3.5 × 10 ⁻³	90%

NODE=M026;CLUMP=A
 DESIG=24
 DESIG=19
 DESIG=26
 DESIG=18
 DESIG=57
 DESIG=28
 DESIG=17
 DESIG=58

Γ_9	$a_0(980)\pi$	< 2	%	90%	DESIG=21
Γ_{10}	$a_2(1320)\pi$	< 2	%	90%	DESIG=22
Γ_{11}	$K^*(892)\bar{K} + \text{c.c.}$	< 1.28	%	90%	DESIG=40
Γ_{12}	$f_2(1270)\eta$	< 1.1	%	90%	DESIG=23
Γ_{13}	$\omega\omega$	< 3.1	$\times 10^{-3}$	90%	DESIG=20
Γ_{14}	$\omega\phi$	< 1.7	$\times 10^{-3}$	90%	DESIG=47
Γ_{15}	$f_2(1270)f_2(1270)$	$(7.6 \pm_{-3.4}^{+3.0}) \times 10^{-3}$			DESIG=46
Γ_{16}	$f_2(1270)f_2'(1525)$	$(9.5 \pm 3.2) \times 10^{-3}$			DESIG=59
Decays into stable hadrons					
Γ_{17}	$K\bar{K}\pi$	$(7.0 \pm 1.2) \%$			NODE=M026;CLUMP=B DESIG=14
Γ_{18}	$\eta\pi^+\pi^-$	$(4.9 \pm 1.8) \%$			DESIG=16
Γ_{19}	$K^+K^-\pi^+\pi^-$	$(1.5 \pm 0.6) \%$			DESIG=15
Γ_{20}	$K^+K^-\pi^+\pi^-\pi^0$	$(3.3 \pm 0.8) \%$			DESIG=60
Γ_{21}	$K^+K^--2(\pi^+\pi^-)$	$(7.1 \pm 2.9) \times 10^{-3}$			DESIG=55
Γ_{22}	$2(K^+K^-)$	$(1.36 \pm 0.30) \times 10^{-3}$			DESIG=27
Γ_{23}	$2(\pi^+\pi^-)$	$(1.20 \pm 0.30) \%$			DESIG=11
Γ_{24}	$3(\pi^+\pi^-)$	$(1.5 \pm 0.5) \%$			DESIG=56
Γ_{25}	$p\bar{p}$	$(1.3 \pm 0.4) \times 10^{-3}$			DESIG=12
Γ_{26}	$\Lambda\bar{\Lambda}$	$(9 \pm 4) \times 10^{-4}$			DESIG=45
Γ_{27}	$K\bar{K}\eta$	< 3.1	%	90%	DESIG=25
Γ_{28}	$\pi^+\pi^-p\bar{p}$	< 1.2	%	90%	DESIG=13
Radiative decays					
Γ_{29}	$\gamma\gamma$	$(1.75 \pm 0.16) \times 10^{-4}$			NODE=M026;CLUMP=C DESIG=31
Charge conjugation (C), Parity (P), Lepton family number (LF) violating modes					
Γ_{30}	$\pi^+\pi^-$	P, CP	< 1.1	$\times 10^{-4}$	90% DESIG=51
Γ_{31}	$\pi^0\pi^0$	P, CP	< 3.5	$\times 10^{-5}$	90% DESIG=52
Γ_{32}	K^+K^-	P, CP	< 6	$\times 10^{-4}$	90% DESIG=53
Γ_{33}	$K_S^0 K_S^0$	P, CP	< 3.1	$\times 10^{-4}$	90% DESIG=54

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 7 combinations of partial widths obtained from integrated cross section, and 14 branching ratios uses 72 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 135.1$ for 63 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	15							
x_{17}	28	35						
x_{19}	15	17	32					
x_{22}	11	14	29	13				
x_{23}	17	20	38	20	15			
x_{25}	19	23	46	22	18	26		
x_{29}	-33	-39	-72	-38	-29	-45	-55	
Γ	-3	-3	-6	-3	-2	-4	10	-31
	x_4	x_7	x_{17}	x_{19}	x_{22}	x_{23}	x_{25}	x_{29}

Mode	Rate (MeV)	
Γ_4	$K^*(892)\bar{K}^*(892)$	0.20 $\pm$ 0.04 DESIG=18
Γ_7	$\phi\phi$	0.058 $\pm$ 0.009 DESIG=17
Γ_{17}	$K\bar{K}\pi$	2.15 $\pm$ 0.19 DESIG=14
Γ_{19}	$K^+K^-\pi^+\pi^-$	0.183 $\pm$ 0.035 DESIG=15
Γ_{22}	$2(K^+K^-)$	0.040 $\pm$ 0.009 DESIG=27
Γ_{23}	$2(\pi^+\pi^-)$	0.26 $\pm$ 0.04 DESIG=11
Γ_{25}	$p\bar{p}$	0.042 $\pm$ 0.005 DESIG=12
Γ_{29}	$\gamma\gamma$	0.0052 $\pm$ 0.0005 DESIG=31

$\eta_c(1S)$ PARTIAL WIDTHS

NODE=M026217

 $\Gamma(\gamma\gamma)$ Γ_{29}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.2± 0.7± 2.0 OUR EVALUATION				Error includes scale factor of 1.3. Treating systematic errors as correlated.

NODE=M026W1
 NODE=M026W1

→ NOT CHECKED ←

5.2± 0.5 OUR FIT

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

5.2± 1.2	273 ± 43	26,27 AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
5.5± 1.2± 1.8	157 ± 33	28 KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$
7.4± 0.4± 2.3		29 ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
13.9± 2.0± 3.0	41	30 ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \eta_c$
3.8 ⁺ _{-1.0} +1.1 ⁺ _{-1.0} -1.9 ⁺ _{-1.0}	190	31 AMBROGIANI	03 E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
7.6± 0.8± 2.3		29,32 BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
6.9± 1.7± 2.1	76	33 ACCIARRI	99T L3	$e^+e^- \rightarrow e^+e^-\eta_c$
27 ±16 ±10	5	29 SHIRAI	98 AMY	58 e^+e^-
6.7 ⁺ _{-1.7} +2.4 ⁺ _{-1.7} -2.3 ⁺ _{-1.7}		28 ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$
11.3± 4.2		34 ALBRECHT	94H ARG	$e^+e^- \rightarrow e^+e^-\eta_c$
8.0± 2.3± 2.4	17	35 ADRIANI	93N L3	$e^+e^- \rightarrow e^+e^-\eta_c$
5.9 ⁺ _{-1.8} +2.1 ⁺ _{-1.8} -1.9 ⁺ _{-1.8}		31 CHEN	90B CLEO	$e^+e^- \rightarrow e^+e^-\eta_c$
6.4 ⁺ _{-3.4} +5.0 ⁺ _{-3.4} -3.4 ⁺ _{-3.4}		36 AIHARA	88D TPC	$e^+e^- \rightarrow e^+e^-X$
4.3 ⁺ _{-3.7} +3.4 ⁺ _{-3.7} -2.4 ⁺ _{-3.7}		28 BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
28 ±15		29,37 BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$

26 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.

27 Systematic errors not evaluated.

28 Normalized to $B(\eta_c \rightarrow p\bar{p}) = (1.3 \pm 0.4) \times 10^{-3}$.

29 Normalized to $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$.

30 Average of $K_S^0 K^\pm \pi^\mp$, $\pi^+ \pi^- K^+ K^-$, and $2(K^+ K^-)$ decay modes.

31 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 $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.

32 Superseded by ASNER 04.

33 Normalized to the sum of 9 branching ratios.

34 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 $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.

35 Superseded by ACCIARRI 99T.

36 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 $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.

37 Re-evaluated by AIHARA 88D.

NODE=M026W1;LINKAGE=AU

NODE=M026W1;LINKAGE=NS

NODE=M026W1;LINKAGE=N3

NODE=M026W1;LINKAGE=N2

NODE=M026W;LINKAGE=FF

NODE=M026W1;LINKAGE=N6

NODE=M026W1;LINKAGE=NN

NODE=M026W1;LINKAGE=N1

NODE=M026W1;LINKAGE=N5

NODE=M026W1;LINKAGE=WD

NODE=M026W1;LINKAGE=N4

NODE=M026W1;LINKAGE=A

 $\eta_c(1S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M026220

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_{29}/\Gamma$

VALUE (keV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.375±0.021 OUR FIT				
0.407±0.027 OUR AVERAGE				Error includes scale factor of 1.2.
0.374±0.009±0.031	14k	38 LEES	10 BABR	10.6 $e^+e^- \rightarrow e^+e^-K_S^0 K^\pm \pi^\mp$
0.407±0.022±0.028		39,40 ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
0.60 ±0.12 ±0.09	41	40,41 ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1.47 ±0.87 ±0.27		40 SHIRAI	98 AMY	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
0.84 ±0.21		40 ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^\pm K_S^0 \pi^\mp$
0.60 ⁺ _{-0.23} -0.20 ⁺ _{-0.20}		40 CHEN	90B CLEO	$\gamma\gamma \rightarrow \eta_c K^\pm K_S^0 \pi^\mp$
1.06 ±0.41 ±0.27	11	40 BRAUNSCH...	89 TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$
1.5 ⁺ _{-0.45} +0.60 ⁺ _{-0.45} -0.3 ⁺ _{-0.45}	7	40 BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$

NODE=M026G14
 NODE=M026G14

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

0.386±0.008±0.021	12k	42	DEL-AMO-SA...11M BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
0.418±0.044±0.022		40,43	BRANDENB... 00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
<0.63	95	40	BEHREND	89 CELL $\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
<4.4	95		ALTHOFF	85B TASS $\gamma\gamma \rightarrow K \bar{K} \pi$

38 From the corrected and unfolded mass spectrum.

39 Calculated by us from the value reported in ASNER 04 that assumes $B(\eta_c \rightarrow K \bar{K} \pi) = 5.5 \pm 1.7\%$

40 We have multiplied $K^\pm K_S^0 \pi^\mp$ measurement by 3 to obtain $K \bar{K} \pi$.

41 Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (1.5 \pm 0.4)\%$.

42 Not independent from the measurements reported by LEES 10.

43 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

$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{19}\Gamma_{29}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

32 ± 6 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	44 ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$
170 ± 80 ± 20	13.9 ± 6.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

44 Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow \pi^+ \pi^- K^+ K^-) = (2.0 \pm 0.7)\%$.

NODE=M026G15
NODE=M026G15

NODE=M026G;LINKAGE=CC

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{20}\Gamma_{29}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

0.190±0.006±0.028	11k	45	DEL-AMO-SA...11M BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

45 Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M026G02
NODE=M026G02

NODE=M026G02;LINKAGE=DE

$\Gamma(K^*(892) \bar{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_{29}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

36 ± 6 OUR FIT

32.4±4.2±5.8	882 ± 115	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

$\Gamma(f_2(1270) f_2'(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{16}\Gamma_{29}/\Gamma$

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

$\Gamma(2(K^+ K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_{29}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

7.1± 1.5 OUR FIT

5.8± 1.9 OUR AVERAGE

5.6 ± 1.1 ± 1.6	216 ± 42	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(K^+ K^-)$
350 ± 90 ± 60	46	46 ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow 2(K^+ K^-)$
231 ± 90 ± 23	9.1 ± 3.3	47 ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(K^+ K^-)$

46 Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow 2(K^+ K^-)) = (2.1 \pm 1.2)\%$.

47 Includes all topological modes except $\eta_c \rightarrow \phi\phi$.

NODE=M026G27
NODE=M026G27

NODE=M026G;LINKAGE=DD

NODE=M026G;LINKAGE=EE

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_{29}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

10.2±1.4 OUR FIT

6.8±1.2±1.3	132 ± 23	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(K^+ K^-)$

NODE=M026G07
NODE=M026G07

$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{23}\Gamma_{29}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

45 ± 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

$$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_2\Gamma_{29}/\Gamma$$

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

$$\Gamma(\psi(1270)\psi(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{29}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

69±17±12	3182±766	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

NODE=M026G19
NODE=M026G19

$$\Gamma(\rho\bar{\rho}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_{29}/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

7.4 ±0.8 OUR FIT

7.2 ±1.7 OUR AVERAGE [6.2^{+1.1}_{-1.0} eV OUR 2011 AVERAGE Scale factor = 1.1]

NODE=M026G01
NODE=M026G01

NEW

7.20±1.53 ^{+0.67} _{-0.75}	157 ± 33	48 KUO	05	BELL $\gamma\gamma \rightarrow \rho\bar{\rho}$

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

4.6 ^{+1.3} _{-1.1} ±0.4	190	48 AMBROGIANI	03	E835 $\bar{\rho}\rho \rightarrow \gamma\gamma$

8.1 ^{+2.9} _{-2.0}		48 ARMSTRONG	95F	E760 $\bar{\rho}\rho \rightarrow \gamma\gamma$

⁴⁸ Not independent from the $\Gamma_{\gamma\gamma}$ reported by the same experiment.

NODE=M026G01;LINKAGE=GG

$\eta_c(1S)$ BRANCHING RATIOS

NODE=M026225

HADRONIC DECAYS

NODE=M026305

$$\Gamma(\eta(958)\pi\pi)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.041±0.017	14	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$

NODE=M026R14
NODE=M026R14

$$\Gamma(\rho\rho)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE (units 10 ⁻³)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

20 ± 7 OUR EVALUATION (Treating systematic errors as correlated.)

18 ± 5 OUR AVERAGE

12.6± 3.8±5.1	72	49 ABLIKIM	05L	BES2 $J/\psi \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$

26.0± 2.4±8.8	113	49 BISELLO	91	DM2 $J/\psi \rightarrow \gamma\rho^0\rho^0$

23.6±10.6±8.2	32	49 BISELLO	91	DM2 $J/\psi \rightarrow \gamma\rho^+\rho^-$

OCCUR=2

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

<14	90	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$

$$\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.02±0.007	63	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$

NODE=M026R16
NODE=M026R16

$$\Gamma(K^*(892)\bar{K}^*(892))/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

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

92±34 OUR EVALUATION (Treating systematic errors as correlated.)

69±13 OUR FIT

91±26 OUR AVERAGE

108±25±44	60	49 ABLIKIM	05L	BES2 $J/\psi \rightarrow K^+K^-\pi^+\pi^-\gamma$

82±28±27	14	49 BISELLO	91	DM2 $e^+e^- \rightarrow \gamma K^+K^-\pi^+\pi^-$

90±50	9	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$

NODE=M026R8
NODE=M026R8

→ NOT CHECKED ←

$$\Gamma(K^{*0}\bar{K}^{*0}\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

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

112±47±26	45	50 ABLIKIM	06A	BES2 $J/\psi \rightarrow K^{*0}\bar{K}^{*0}\pi^+\pi^-\gamma$

NODE=M026R25
NODE=M026R25

$$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

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

2.9 ^{+0.9} _{-0.8} ±1.1	14.1 ^{+4.4} _{-3.7}	51 HUANG	03	BELL $B^+ \rightarrow (\phi K^+ K^-) K^+$

NODE=M026R21
NODE=M026R21

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_7/Γ

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

27 ± 9 OUR EVALUATION (Treating systematic errors as correlated.)

NODE=M026R7
NODE=M026R7

→ NOT CHECKED ←

19.7 ± 3.0 OUR FIT**30 ± 5 OUR AVERAGE**

NEW

[(27 ± 5) × 10⁻⁴ OUR 2011 AVERAGE]

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
25.3 ± 5.1 ± 9.1	72	49 ABLIKIM	05L BES2	$J/\psi \rightarrow K^+ K^- K^+ K^- \gamma$
26 ± 9	357 ± 64	49 BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
31 ± 7 ± 10	19	49 BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
30 ⁺¹⁸ ₋₁₂ ± 10	5	49 BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
74 ± 18 ± 24	80	49 BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
67 ± 21 ± 24		49 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. • • •

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
18 ⁺⁸ ₋₆ ± 7	7.0 ^{+3.0} _{-2.3}	51 HUANG	03 BELL	$B^+ \rightarrow (\phi\phi) K^+$

 $\Gamma(\phi\phi)/\Gamma(K\bar{K}\pi)$ Γ_7/Γ_{17}

VALUE EVTS DOCUMENT ID TECN COMMENT

0.027 ± 0.004 OUR FIT

NODE=M026R39
NODE=M026R39

0.044 ^{+0.012}_{-0.010} OUR AVERAGE

NEW

[0.055 ± 0.015 OUR 2011 AVERAGE]

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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	51 HUANG	03 BELL	$B^\pm \rightarrow K^\pm \phi\phi$

 $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10⁻⁴) CL% DOCUMENT ID TECN COMMENT

<35 90 52 ABLIKIM 06A BES2 $J/\psi \rightarrow \phi 2(\pi^+ \pi^-) \gamma$

NODE=M026R26
NODE=M026R26

 $\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

<0.02 90 49,53 BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

NODE=M026R11
NODE=M026R11

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

<0.02 90 49 BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

NODE=M026R12
NODE=M026R12

 $\Gamma(K^*(892)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

<0.0128 90 BISELLO 91 DM2 $J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

<0.0132 90 49 BISELLO 91 DM2 $J/\psi \rightarrow \gamma K^+ K^- \pi^0$

NODE=M026R17
NODE=M026R17

OCCUR=2

 $\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

<0.011 90 49 BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

NODE=M026R13
NODE=M026R13

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

VALUE CL% DOCUMENT ID TECN COMMENT

<0.0031 90 49 BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

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

<0.0063 90 49 ABLIKIM 05L BES2 $J/\psi \rightarrow \pi^+ \pi^- \pi^0 \pi^+ \pi^- \pi^0 \gamma$

<0.0063 49 BISELLO 91 DM2 $J/\psi \rightarrow \gamma \omega \omega$

NODE=M026R10
NODE=M026R10

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

VALUE CL% DOCUMENT ID TECN COMMENT

<0.0017 90 49 ABLIKIM 05L BES2 $J/\psi \rightarrow \pi^+ \pi^- \pi^0 K^+ K^- \gamma$

NODE=M026R22
NODE=M026R22

 $\Gamma(f_2(1270)f_2(1270))/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10⁻²) EVTS DOCUMENT ID TECN COMMENT

0.76 ^{+0.25}_{-0.29} ± 0.18 91.2 ± 19.8 54 ABLIKIM 04M BES $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M026R19
NODE=M026R19

$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.0 $\pm$ 1.2	OUR EVALUATION (Treating systematic errors as correlated.)				
7.2 $\pm$ 0.6	OUR FIT				
6.1 $\pm$ 0.8	OUR AVERAGE				
8.5 $\pm$ 1.8			55 AUBERT	06E BABR	$B^{\pm} \rightarrow K^{\pm} X_{c\bar{c}}$
5.1 $\pm$ 2.1		609 $\pm$ 71	49 BAI	04 BES	$J/\psi \rightarrow \gamma K^{\pm} \pi^{\mp} K_S^0$
6.90 $\pm$ 1.42 $\pm$ 1.32		33	49 BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
5.43 $\pm$ 0.94 $\pm$ 0.94		68	49 BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^{\pm} \pi^{\mp} K_S^0$
4.8 $\pm$ 1.7		95	49,56 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
16.1 $^{+9.2}_{-7.3}$			57 HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 10.7		90	49 PARTRIDGE	80B CBAL	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R4
 NODE=M026R4
 → NOT CHECKED ←

OCCUR=2

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.049 $\pm$ 0.018	OUR EVALUATION			
0.047 $\pm$ 0.015	OUR AVERAGE			
0.054 $\pm$ 0.020	75	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
0.037 $\pm$ 0.013 $\pm$ 0.020	18	49 PARTRIDGE	80B CBAL	$J/\psi \rightarrow \eta\pi^+\pi^-\gamma$

NODE=M026R6
 NODE=M026R6
 → NOT CHECKED ←

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.015 $\pm$ 0.006	OUR EVALUATION			
0.0062 $\pm$ 0.0012	OUR FIT			
0.0142 $\pm$ 0.0033	OUR AVERAGE			
0.012 $\pm$ 0.004	413 $\pm$ 54	49 BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
0.021 $\pm$ 0.007	110	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
0.014 $^{+0.022}_{-0.009}$		57 HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R5
 NODE=M026R5
 → NOT CHECKED ←

 $\Gamma(K^+K^-\pi^+\pi^0)/\Gamma(K\bar{K}\pi)$ Γ_{20}/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.477 $\pm$ 0.017 $\pm$ 0.070	11k	58 DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M026R01
 NODE=M026R01

 $\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
71 $\pm$ 23 $\pm$ 16	100	59 ABLIKIM	06A BES2	$J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

NODE=M026R23
 NODE=M026R23

 $\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.36 $\pm$ 0.30	OUR FIT			
1.4 $\pm$ 0.8	OUR AVERAGE [0.0015 $\pm$ 0.0007 OUR 2011 AVERAGE]			
1.4 $^{+0.5}_{-0.4}$ $\pm$ 0.6	14.5 $^{+4.6}_{-3.0}$	51 HUANG	03 BELL	$B^+ \rightarrow 2(K^+ K^-) K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
21 $\pm$ 10 $\pm$ 6		60 ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^+ K^- K^+ K^-$

NODE=M026R20
 NODE=M026R20

NEW

 $\Gamma(2(K^+K^-))/\Gamma(K\bar{K}\pi)$ Γ_{22}/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.019±0.004 OUR FIT				
0.024±0.007 OUR AVERAGE				
[0.023 ± 0.009 OUR 2011 AVERAGE]				
0.023±0.007±0.006		AUBERT,B	04B BABR	$B^{\pm} \rightarrow K^{\pm} \eta_c$
$0.026^{+0.009}_{-0.007} \pm 0.007$	15	⁵¹ HUANG	03 BELL	$B^{\pm} \rightarrow K^{\pm} (2K^+ 2K^-)$

NODE=M026R38
 NODE=M026R38

NEW

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2 $\pm$ 0.3	OUR EVALUATION			
0.87 $\pm$ 0.13	OUR FIT			
1.15 $\pm$ 0.26	OUR AVERAGE			
1.0 $\pm$ 0.5	542 $\pm$ 75	49 BAI	04 BES	$J/\psi \rightarrow \gamma 2(\pi^+ \pi^-)$
1.05 $\pm$ 0.17 $\pm$ 0.34	137	49 BISELLO	91 DM2	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$
1.3 $\pm$ 0.6	25	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
2.0 $^{+1.5}_{-1.0}$		57 HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R1
 NODE=M026R1
 → NOT CHECKED ←

$\Gamma(\phi K^+ K^-)/\Gamma(K \bar{K} \pi)$ Γ_6/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.052^{+0.016}_{-0.014} \pm 0.014$	7	51 HUANG	03 BELL	$B^\pm \rightarrow K^\pm \phi \phi$

NODE=M026R02
 NODE=M026R02

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$152 \pm 33 \pm 35$	479	61 ABLIKIM	06A BES2	$J/\psi \rightarrow 3(\pi^+ \pi^-) \gamma$

NODE=M026R24
 NODE=M026R24

 $\Gamma(p \bar{p})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13 $\pm$ 4 OUR EVALUATION				(Treating systematic errors as correlated.)

NODE=M026R2
 NODE=M026R2

14.3 $\pm$ 1.7 OUR FIT

→ NOT CHECKED ←

12.5 $\pm$ 3.2 OUR AVERAGE

NEW

[(14.0 $\pm$ 2.2) $\times 10^{-4}$ OUR 2011 AVERAGE]

15 $\pm$ 6	213 $\pm$ 33	49 BAI	04 BES	$J/\psi \rightarrow \gamma p \bar{p}$
10 $\pm$ 3 $\pm$ 4	18	49 BISELLO	91 DM2	$J/\psi \rightarrow \gamma p \bar{p}$
11 $\pm$ 6	23	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
29 $^{+29}_{-15}$		57 HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

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

15.5 $^{+2.1}_{-2.5} \pm 2.1$	195	62 WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$

 $\Gamma(p \bar{p})/\Gamma(K \bar{K} \pi)$ Γ_{25}/Γ_{17}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0197 $\pm$ 0.0022 OUR FIT				

NODE=M026R03
 NODE=M026R03

0.021 $\pm$ 0.002 $^{+0.004}_{-0.006}$	195	51 WU	06 BELL	$B^\pm \rightarrow K^\pm p \bar{p}$

 $\Gamma(p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi \phi)/\Gamma_{\text{total}}$ $\Gamma_{25}/\Gamma \times \Gamma_7/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
0.28 $\pm$ 0.06 OUR FIT			

NODE=M026R33
 NODE=M026R33

4.0 $^{+3.5}_{-3.2}$	BAGLIN	89 SPEC	$\bar{p} p \rightarrow K^+ K^- K^+ K^-$

 $\Gamma(\Lambda \bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{26}/Γ

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

NODE=M026R18
 NODE=M026R18

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

10.4 $^{+2.9}_{-2.7} \pm 1.4$	20	63 WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
<20	90	49 BISELLO	91 DM2	$e^+ e^- \rightarrow \gamma \Lambda \bar{\Lambda}$

 $\Gamma(\Lambda \bar{\Lambda})/\Gamma(p \bar{p})$ Γ_{26}/Γ_{25}

VALUE	DOCUMENT ID	TECN	COMMENT
0.67 $^{+0.19}_{-0.16} \pm 0.12$	64 WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+, \Lambda \bar{\Lambda} K^+$

NODE=M026R27
 NODE=M026R27

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.031	90	49 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R15
 NODE=M026R15

 $\Gamma(\pi^+ \pi^- p \bar{p})/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.012	90	HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R3
 NODE=M026R3

⁴⁹ 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

⁵⁰ 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

⁵¹ 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

⁵² 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

⁵³ We are assuming $B(a_0(980) \rightarrow \eta \pi) > 0.5$.

NODE=M026R;LINKAGE=F

- 54 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.
- 55 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.
- 56 Average from $K^+ K^- \pi^0$ and $K^\pm K_S^0 \pi^\mp$ decay channels.
- 57 Estimated using $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.
- 58 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.
- 59 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.
- 60 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 $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.
- 61 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.
- 62 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 $B(B^+ \rightarrow \eta_c K^+) = (9.1 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 63 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 $B(B^+ \rightarrow \eta_c K^+) = (9.1 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 64 Not independent from other $\eta_c \rightarrow \Lambda\bar{\Lambda}$, $p\bar{p}$ branching ratios reported by WU 06.

NODE=M026R19;LINKAGE=AB

NODE=M026R4;LINKAGE=AB

NODE=M026R;LINKAGE=D

NODE=M026R;LINKAGE=A

NODE=M026R01;LINKAGE=DE

NODE=M026R23;LINKAGE=AB

NODE=M026R;LINKAGE=AL

NODE=M026R24;LINKAGE=AB

NODE=M026R2;LINKAGE=WU

NODE=M026R18;LINKAGE=WU

NODE=M026R27;LINKAGE=WU

NODE=M026310

NODE=M026R31
NODE=M026R31

NEW

RADIATIVE DECAYS

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{29}/Γ

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

1.75±0.16 OUR FIT**1.4 $^{+0.7}_{-0.6}$ OUR AVERAGE** $[(1.8^{+0.6}_{-0.5}) \times 10^{-4}]$ OUR 2011 AVERAGE]**1.4 $^{+0.7}_{-0.5} \pm 0.3$** $1.2^{+2.8}_{-1.1}$ 65 ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

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

2.4 $^{+1.1}_{-0.8} \pm 0.3$ 13 66 WICHT 08 BELL $B^\pm \rightarrow K^\pm \gamma\gamma$ 2.80 $^{+0.67}_{-0.58} \pm 1.0$ 67 ARMSTRONG 95F E760 $\bar{p}p \rightarrow \gamma\gamma$ < 9 90 68 BISELLO 91 DM2 $J/\psi \rightarrow \gamma\gamma\gamma$ 6 $^{+4}_{-3} \pm 4$ 67 BAGLIN 87B SPEC $\bar{p}p \rightarrow \gamma\gamma$ < 18 90 69 BLOOM 83 CBAL $J/\psi \rightarrow \eta_c \gamma$

65 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.

NODE=M026R31;LINKAGE=AD

66 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 $B(B^+ \rightarrow \eta_c K^+) = (9.1 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R31;LINKAGE=WI

67 Not independent from the values of the total and two-photon width quoted by the same experiment.

NODE=M026R31;LINKAGE=AB

68 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=M026R31;LINKAGE=E

69 Using $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=C

$\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{29}/Γ_{17}

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

2.4±0.4 OUR FIT**3.2^{+1.3+0.8}_{-1.0-0.6}**

13

70

WICHT

08

BELL

 $B^\pm \rightarrow K^\pm \gamma\gamma$

⁷⁰ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K\bar{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R04
NODE=M026R04

NODE=M026R04;LINKAGE=BB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{25}/\Gamma \times \Gamma_{29}/\Gamma$

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

0.249±0.026 OUR FIT**0.26 ±0.05 OUR AVERAGE**

Error includes scale factor of 1.4.

0.224^{+0.038}_{-0.037} ±0.020

190

AMBROGIANI 03

E835

 $\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$ 0.336^{+0.080}_{-0.070}

ARMSTRONG 95F

E760

 $\bar{p}p \rightarrow \gamma\gamma$ 0.68^{+0.42}_{-0.31}

12

BAGLIN

87B

SPEC

 $\bar{p}p \rightarrow \gamma\gamma$

NODE=M026R32
NODE=M026R32

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

NODE=M026320

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

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

<11 (CL = 90%) [$<60 \times 10^{-5}$ (CL = 90%) OUR 2011 BEST LIMIT]**<11**

90

71

ABLIKIM

11G

BES3

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

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

<60

90

72

ABLIKIM

06B

BES2

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

⁷¹ 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 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

⁷² ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$ $< 1.1 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R34
NODE=M026R34

NODE=M026R34;LINKAGE=AL

NODE=M026R34;LINKAGE=AB

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

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

< 3.5 (CL = 90%) [$<40 \times 10^{-5}$ (CL = 90%) OUR 2011 BEST LIMIT]**< 3.5**

90

73

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

74

ABLIKIM

06B

BES2

 $J/\psi \rightarrow \pi^0\pi^0\gamma$

⁷³ 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 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

⁷⁴ ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$ $< 0.71 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R35
NODE=M026R35

NODE=M026R35;LINKAGE=AL

NODE=M026R35;LINKAGE=AB

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

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

<60

90

75

ABLIKIM

06B

BES2

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

⁷⁵ ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K^+K^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$ $< 0.96 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R36
NODE=M026R36

NODE=M026R36;LINKAGE=AB

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{33}/Γ

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

<31

90

76

ABLIKIM

06B

BES2

 $J/\psi \rightarrow K_S^0 K_S^0 \gamma$

⁷⁶ 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 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R37
NODE=M026R37

NODE=M026R37;LINKAGE=AB

$\eta_c(1S)$ REFERENCES

NODE=M026

ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BES-III Collab.)	REFID=53711
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=53927
LEES	10	PR D81 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53236
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
ADAMS	08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=52261
AUBERT	08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52267
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
ABLIKIM	06A	PL B633 19	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50987
ABLIKIM	06B	EPJ C45 337	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50988
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05L	PR D72 072005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50837
KUO	05	PL B621 41	C.C. Kuo <i>et al.</i>	(BELLE Collab.)	REFID=50801
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=49745
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49746
AUBERT,B	04B	PR D70 011101R	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50043
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49620
ABDALLAH	03J	EPJ C31 481	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49625
AMBROGIANI	03	PL B566 45	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=49465
BAI	03	PL B555 174	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49185
FANG	03	PRL 90 071801	F. Fang <i>et al.</i>	(BELLE Collab.)	REFID=49206
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REFID=49621
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
BAI	00F	PR D62 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48546
BRANDENB...	00B	PRL 85 3095	G. Brandenburg <i>et al.</i>	(CLEO Collab.)	REFID=48553
ACCIARRI	99T	PL B461 155	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=47476
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46553
SHIRAI	98	PL B424 405	M. Shirai <i>et al.</i>	(AMY Collab.)	REFID=46381
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=44623
ALBRECHT	94H	PL B338 390	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44098
ADRIANI	93N	PL B318 575	O. Adriani <i>et al.</i>	(L3 Collab.)	REFID=43670
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41668
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41354
CHEN	90B	PL B243 169	W.Y. Chen <i>et al.</i>	(CLEO Collab.)	REFID=41360
BAGLIN	89	PL B231 557	C. Baglin, S. Baird, G. Bassompierre	(R704 Collab.)	REFID=41015
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40732
BRAUNSCH...	89	ZPHY C41 533	W. Braunschweig <i>et al.</i>	(TASSO Collab.)	REFID=40728
AIHARA	88D	PRL 60 2355	H. Aihara <i>et al.</i>	(TPC Collab.)	REFID=40588
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)	REFID=40018
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
BERGER	86	PL 167B 120	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=22010
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+) JP	REFID=22006
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
HIMEL	80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)	REFID=22003
PARTRIDGE	80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22004

$J/\psi(1S)$

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

NODE=M070

 $J/\psi(1S)$ MASS

NODE=M070M

NODE=M070M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3096.916±0.011 OUR AVERAGE				
3096.917±0.010±0.007		AULCHENKO 03	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3096.89 ±0.09	502	¹ ARTAMONOV 00	OLYA	$e^+e^- \rightarrow \text{hadrons}$
3096.91 ±0.03 ±0.01		² ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
3096.95 ±0.1 ±0.3	193	BAGLIN 87	SPEC	$\bar{p}p \rightarrow e^+e^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3097.5 ±0.3		GRIBUSHIN 96	FMPS	$515 \pi^- \text{Be} \rightarrow 2\mu X$
3098.4 ±2.0	38k	LEMOIGNE 82	GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3096.93 ±0.09	502	³ ZHOLENTZ 80	REDE	e^+e^-
3097.0 ±1		⁴ BRANDELIK 79C	DASP	e^+e^-
¹ Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).				
² Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.				
³ Superseded by ARTAMONOV 00.				
⁴ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$ and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.				

NODE=M070M;LINKAGE=AR

NODE=M070M;LINKAGE=NW

NODE=M070M;LINKAGE=RZ

NODE=M070M;LINKAGE=F

 $J/\psi(1S)$ WIDTH

NODE=M070W

NODE=M070W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
92.9± 2.8 OUR AVERAGE Error includes scale factor of 1.1.				
96.1± 3.2	13k	⁵ ADAMS 06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
84.4± 8.9		BAI 95B	BES	e^+e^-
91 ±11 ±6		⁶ ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
85.5 ⁺ ₋ 6.1 5.8		⁷ HSUEH 92	RVUE	See Υ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •				
94.1± 2.7		⁸ ANASHIN 10	KEDR	$3.097 e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
93.7± 3.5	7.8k	⁵ AUBERT 04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
⁵ 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 $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.				
⁶ The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].				
⁷ Using data from COFFMAN 92, BALDINI-CELIO 75, BOYARSKI 75, ESPOSITO 75B, BRANDELIK 79C.				
⁸ 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 ±0.5) %	DESIG=250
Γ_5 e^+e^-	(5.94 ±0.06) %	DESIG=1
Γ_6 $e^+e^-\gamma$	[a] (8.8 ±1.4) $\times 10^{-3}$	DESIG=5
Γ_7 $\mu^+\mu^-$	(5.93 ±0.06) %	DESIG=2

Decays involving hadronic resonances

NODE=M070;CLUMP=A

Γ ₈	$\rho\pi$	(1.69 ± 0.15) %	S=2.4	DESIG=20
Γ ₉	$\rho^0\pi^0$	(5.6 ± 0.7) × 10 ⁻³		DESIG=21
Γ ₁₀	$a_2(1320)\rho$	(1.09 ± 0.22) %		DESIG=43
Γ ₁₁	$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 ± 3.4) × 10 ⁻³		DESIG=26
Γ ₁₂	$\omega\pi^+\pi^-\pi^0$	(4.0 ± 0.7) × 10 ⁻³		DESIG=211
Γ ₁₃	$\omega\pi^+\pi^-$	(8.6 ± 0.7) × 10 ⁻³	S=1.1	DESIG=24
Γ ₁₄	$\omega f_2(1270)$	(4.3 ± 0.6) × 10 ⁻³		DESIG=28
Γ ₁₅	$K^*(892)^0\bar{K}^*(892)^0$	(2.3 ± 0.7) × 10 ⁻⁴		DESIG=46
Γ ₁₆	$K^*(892)^\pm\bar{K}^*(892)^\mp$	(1.00 ± 0.22) × 10 ⁻³		DESIG=256
Γ ₁₇	$K^*(892)^\pm\bar{K}^*(800)^\mp$	(1.1 ± 1.0) × 10 ⁻³		DESIG=257
Γ ₁₈	$\eta K^*(892)^0\bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 ⁻³		DESIG=252
Γ ₁₉	$K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}$	(6.0 ± 0.6) × 10 ⁻³		DESIG=48
Γ ₂₀	$K^*(892)^0\bar{K}_2^*(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(6.9 ± 0.9) × 10 ⁻⁴		DESIG=235
Γ ₂₁	$\omega K^*(892)\bar{K} + \text{c.c.}$	(6.1 ± 0.9) × 10 ⁻³		DESIG=102
Γ ₂₂	$K^+\bar{K}^*(892)^- + \text{c.c.}$	(5.12 ± 0.30) × 10 ⁻³		DESIG=121
Γ ₂₃	$K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	(1.97 ± 0.20) × 10 ⁻³		DESIG=231
Γ ₂₄	$K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp$	(3.0 ± 0.4) × 10 ⁻³		DESIG=232
Γ ₂₅	$K^0\bar{K}^*(892)^0 + \text{c.c.}$	(4.39 ± 0.31) × 10 ⁻³		DESIG=122
Γ ₂₆	$K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp$	(3.2 ± 0.4) × 10 ⁻³		DESIG=233
Γ ₂₇	$K_1(1400)^\pm K^\mp$	(3.8 ± 1.4) × 10 ⁻³		DESIG=132
Γ ₂₈	$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$	seen		DESIG=214
Γ ₂₉	$\omega\pi^0\pi^0$	(3.4 ± 0.8) × 10 ⁻³		DESIG=140
Γ ₃₀	$b_1(1235)^\pm\pi^\mp$	[b] (3.0 ± 0.5) × 10 ⁻³		DESIG=49
Γ ₃₁	$\omega K^\pm K_S^0\pi^\mp$	[b] (3.4 ± 0.5) × 10 ⁻³		DESIG=101
Γ ₃₂	$b_1(1235)^0\pi^0$	(2.3 ± 0.6) × 10 ⁻³		DESIG=160
Γ ₃₃	$\eta K^\pm K_S^0\pi^\mp$	[b] (2.2 ± 0.4) × 10 ⁻³		DESIG=230
Γ ₃₄	$\phi K^*(892)\bar{K} + \text{c.c.}$	(2.18 ± 0.23) × 10 ⁻³		DESIG=104
Γ ₃₅	$\omega K\bar{K}$	(1.70 ± 0.32) × 10 ⁻³		DESIG=27
Γ ₃₆	$\omega f_0(1710) \rightarrow \omega K\bar{K}$	(4.8 ± 1.1) × 10 ⁻⁴		DESIG=130
Γ ₃₇	$\phi 2(\pi^+\pi^-)$	(1.66 ± 0.23) × 10 ⁻³		DESIG=35
Γ ₃₈	$\Delta(1232)^{++}\bar{p}\pi^-$	(1.6 ± 0.5) × 10 ⁻³		DESIG=70
Γ ₃₉	$\omega\eta$	(1.74 ± 0.20) × 10 ⁻³	S=1.6	DESIG=30
Γ ₄₀	$\phi K\bar{K}$	(1.83 ± 0.24) × 10 ⁻³	S=1.5	DESIG=36
Γ ₄₁	$\phi f_0(1710) \rightarrow \phi K\bar{K}$	(3.6 ± 0.6) × 10 ⁻⁴		DESIG=129
Γ ₄₂	$\phi f_2(1270)$	(7.2 ± 1.3) × 10 ⁻⁴		DESIG=39
Γ ₄₃	$\Delta(1232)^{++}\bar{\Delta}(1232)^{--}$	(1.10 ± 0.29) × 10 ⁻³		DESIG=66
Γ ₄₄	$\Sigma(1385)^-\bar{\Sigma}(1385)^+ (\text{or c.c.})$	[b] (1.03 ± 0.13) × 10 ⁻³		DESIG=67
Γ ₄₅	$\phi f_2'(1525)$	(8 ± 4) × 10 ⁻⁴	S=2.7	DESIG=40
Γ ₄₆	$\phi\pi^+\pi^-$	(8.7 ± 0.8) × 10 ⁻⁴		DESIG=34
Γ ₄₇	$\phi\pi^0\pi^0$	(5.6 ± 1.6) × 10 ⁻⁴		DESIG=76
Γ ₄₈	$\phi K^\pm K_S^0\pi^\mp$	[b] (7.2 ± 0.8) × 10 ⁻⁴		DESIG=103
Γ ₄₉	$\omega f_1(1420)$	(6.8 ± 2.4) × 10 ⁻⁴		DESIG=105
Γ ₅₀	$\phi\eta$	(7.5 ± 0.8) × 10 ⁻⁴	S=1.5	DESIG=37
Γ ₅₁	$\Xi^0\Xi^0$	(1.20 ± 0.24) × 10 ⁻³		DESIG=248
Γ ₅₂	$\Xi(1530)^-\Xi^+$	(5.9 ± 1.5) × 10 ⁻⁴		DESIG=107
Γ ₅₃	$pK^-\bar{\Sigma}(1385)^0$	(5.1 ± 3.2) × 10 ⁻⁴		DESIG=74
Γ ₅₄	$\omega\pi^0$	(4.5 ± 0.5) × 10 ⁻⁴	S=1.4	DESIG=32
Γ ₅₅	$\phi\eta'(958)$	(4.0 ± 0.7) × 10 ⁻⁴	S=2.1	DESIG=38
Γ ₅₆	$\phi f_0(980)$	(3.2 ± 0.9) × 10 ⁻⁴	S=1.9	DESIG=41
Γ ₅₇	$\phi f_0(980) \rightarrow \phi\pi^+\pi^-$	(2.2 ± 0.4) × 10 ⁻⁴		DESIG=236
Γ ₅₈	$\phi f_0(980) \rightarrow \phi\pi^0\pi^0$	(1.7 ± 0.7) × 10 ⁻⁴		DESIG=237
Γ ₅₉	$\eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-$	(3.2 ± 1.0) × 10 ⁻⁴		DESIG=229
Γ ₆₀	$\phi a_0(980)^0 \rightarrow \phi\eta\pi^0$	(5 ± 4) × 10 ⁻⁶		DESIG=258

Г ₆₁	$\Xi(1530)^0 \Xi^0$	(3.2 ±1.4) × 10 ⁻⁴		DESIG=108
Г ₆₂	$\Sigma(1385)^- \bar{\Sigma}^+$ (or c.c.)	[b] (3.1 ±0.5) × 10 ⁻⁴		DESIG=68
Г ₆₃	$\phi f_1(1285)$	(2.6 ±0.5) × 10 ⁻⁴	S=1.1	DESIG=106
Г ₆₄	$\eta \pi^+ \pi^-$	(4.0 ±1.7) × 10 ⁻⁴		DESIG=239
Г ₆₅	$\rho \eta$	(1.93 ±0.23) × 10 ⁻⁴		DESIG=22
Г ₆₆	$\omega \eta'(958)$	(1.82 ±0.21) × 10 ⁻⁴		DESIG=31
Г ₆₇	$\omega f_0(980)$	(1.4 ±0.5) × 10 ⁻⁴		DESIG=150
Г ₆₈	$\rho \eta'(958)$	(1.05 ±0.18) × 10 ⁻⁴		DESIG=23
Г ₆₉	$a_2(1320)^\pm \pi^\mp$	[b] < 4.3 × 10 ⁻³	CL=90%	DESIG=42
Г ₇₀	$K K_2^*(1430) + \text{c.c.}$	< 4.0 × 10 ⁻³	CL=90%	DESIG=45
Г ₇₁	$K_1(1270)^\pm K^\mp$	< 3.0 × 10 ⁻³	CL=90%	DESIG=131
Г ₇₂	$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	< 2.9 × 10 ⁻³	CL=90%	DESIG=47
Г ₇₃	$\phi \pi^0$	< 6.4 × 10 ⁻⁶	CL=90%	DESIG=33
Г ₇₄	$\phi \eta(1405) \rightarrow \phi \eta \pi \pi$	< 2.5 × 10 ⁻⁴	CL=90%	DESIG=128
Г ₇₅	$\omega f_2'(1525)$	< 2.2 × 10 ⁻⁴	CL=90%	DESIG=29
Г ₇₆	$\eta \phi(2170) \rightarrow$ $\eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 ⁻⁴	CL=90%	DESIG=253
Г ₇₇	$\Sigma(1385)^0 \bar{\Lambda}$	< 2 × 10 ⁻⁴	CL=90%	DESIG=111
Г ₇₈	$\Delta(1232)^+ \bar{p}$	< 1 × 10 ⁻⁴	CL=90%	DESIG=112
Г ₇₉	$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + \text{c.c.}$	< 1.1 × 10 ⁻⁵	CL=90%	DESIG=205
Г ₈₀	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	< 2.1 × 10 ⁻⁵	CL=90%	DESIG=206
Г ₈₁	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	< 1.6 × 10 ⁻⁵	CL=90%	DESIG=207
Г ₈₂	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	< 5.6 × 10 ⁻⁵	CL=90%	DESIG=208
Г ₈₃	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	< 1.1 × 10 ⁻⁵	CL=90%	DESIG=209
Г ₈₄	$\Sigma^0 \bar{\Lambda}$	< 9 × 10 ⁻⁵	CL=90%	DESIG=110

Decays into stable hadrons

Г ₈₅	$2(\pi^+ \pi^-) \pi^0$	(5.5 ±0.4) %		DESIG=9
Г ₈₆	$3(\pi^+ \pi^-) \pi^0$	(2.9 ±0.6) %		DESIG=11
Г ₈₇	$\pi^+ \pi^- \pi^0$	(2.07 ±0.12) %	S=1.6	DESIG=7
Г ₈₈	$\pi^+ \pi^- \pi^0 K^+ K^-$	(1.94 ±0.15) %		DESIG=18
Г ₈₉	$4(\pi^+ \pi^-) \pi^0$	(9.0 ±3.0) × 10 ⁻³		DESIG=12
Г ₉₀	$\pi^+ \pi^- K^+ K^-$	(6.6 ±0.5) × 10 ⁻³		DESIG=16
Г ₉₁	$\pi^+ \pi^- K^+ K^- \eta$	(1.84 ±0.28) × 10 ⁻³		DESIG=238
Г ₉₂	$\pi^0 \pi^0 K^+ K^-$	(2.45 ±0.31) × 10 ⁻³		DESIG=234
Г ₉₃	$K \bar{K} \pi$	(6.1 ±1.0) × 10 ⁻³		DESIG=15
Г ₉₄	$2(\pi^+ \pi^-)$	(3.55 ±0.23) × 10 ⁻³		DESIG=8
Г ₉₅	$3(\pi^+ \pi^-)$	(4.3 ±0.4) × 10 ⁻³		DESIG=10
Г ₉₆	$2(\pi^+ \pi^- \pi^0)$	(1.61 ±0.21) %		DESIG=210
Г ₉₇	$2(\pi^+ \pi^-) \eta$	(2.29 ±0.24) × 10 ⁻³		DESIG=201
Г ₉₈	$3(\pi^+ \pi^-) \eta$	(7.2 ±1.5) × 10 ⁻⁴		DESIG=202
Г ₉₉	$\rho \bar{p}$	(2.17 ±0.07) × 10 ⁻³		DESIG=50
Г ₁₀₀	$\rho \bar{p} \pi^0$	(1.19 ±0.08) × 10 ⁻³	S=1.1	DESIG=52
Г ₁₀₁	$\rho \bar{p} \pi^+ \pi^-$	(6.0 ±0.5) × 10 ⁻³	S=1.3	DESIG=54
Г ₁₀₂	$\rho \bar{p} \pi^+ \pi^- \pi^0$	[c] (2.3 ±0.9) × 10 ⁻³	S=1.9	DESIG=55
Г ₁₀₃	$\rho \bar{p} \eta$	(2.00 ±0.12) × 10 ⁻³		DESIG=56
Г ₁₀₄	$\rho \bar{p} \rho$	< 3.1 × 10 ⁻⁴	CL=90%	DESIG=57
Г ₁₀₅	$\rho \bar{p} \omega$	(1.10 ±0.15) × 10 ⁻³	S=1.3	DESIG=58
Г ₁₀₆	$\rho \bar{p} \eta'(958)$	(2.1 ±0.4) × 10 ⁻⁴		DESIG=59
Г ₁₀₇	$\rho \bar{p} \phi$	(4.5 ±1.5) × 10 ⁻⁵		DESIG=127
Г ₁₀₈	$n \bar{n}$	(2.2 ±0.4) × 10 ⁻³		DESIG=64
Г ₁₀₉	$n \bar{n} \pi^+ \pi^-$	(4 ±4) × 10 ⁻³		DESIG=65
Г ₁₁₀	$\Sigma^+ \bar{\Sigma}^-$	(1.50 ±0.24) × 10 ⁻³		DESIG=247
Г ₁₁₁	$\Sigma^0 \bar{\Sigma}^0$	(1.29 ±0.09) × 10 ⁻³		DESIG=63
Г ₁₁₂	$2(\pi^+ \pi^-) K^+ K^-$	(5.0 ±0.5) × 10 ⁻³		DESIG=17

NODE=M070;CLUMP=B

┐ ₁₁₃	$p\bar{n}\pi^-$	$(2.12 \pm 0.09) \times 10^{-3}$		DESIG=53
┐ ₁₁₄	$nN(1440)$	seen		DESIG=215; OUR EST; NOT CHECKED; ←
┐ ₁₁₅	$nN(1520)$	seen		DESIG=216; OUR EST; NOT CHECKED; ←
┐ ₁₁₆	$nN(1535)$	seen		DESIG=217; OUR EST; NOT CHECKED; ←
┐ ₁₁₇	$\Xi^- \Xi^+$	$(8.5 \pm 1.6) \times 10^{-4}$	S=1.5	DESIG=62
┐ ₁₁₈	$\Lambda\bar{\Lambda}$	$(1.61 \pm 0.15) \times 10^{-3}$	S=2.0	DESIG=60
┐ ₁₁₉	$\Lambda\bar{\Sigma}^- \pi^+$ (or c.c.)	[b] $(8.3 \pm 0.7) \times 10^{-4}$	S=1.2	DESIG=71
┐ ₁₂₀	$pK^- \bar{\Lambda}$	$(8.9 \pm 1.6) \times 10^{-4}$		DESIG=72
┐ ₁₂₁	$2(K^+ K^-)$	$(7.6 \pm 0.9) \times 10^{-4}$		DESIG=19
┐ ₁₂₂	$pK^- \bar{\Sigma}^0$	$(2.9 \pm 0.8) \times 10^{-4}$		DESIG=73
┐ ₁₂₃	$K^+ K^-$	$(2.37 \pm 0.31) \times 10^{-4}$		DESIG=13
┐ ₁₂₄	$K_S^0 K_L^0$	$(1.46 \pm 0.26) \times 10^{-4}$	S=2.7	DESIG=75
┐ ₁₂₅	$\Lambda\bar{\Lambda}\eta$	$(2.6 \pm 0.7) \times 10^{-4}$		DESIG=228
┐ ₁₂₆	$\Lambda\bar{\Lambda}\pi^0$	< 6.4 $\times 10^{-5}$	CL=90%	DESIG=109
┐ ₁₂₇	$\bar{\Lambda}nK_S^0 + \text{c.c.}$	$(6.5 \pm 1.1) \times 10^{-4}$		DESIG=225
┐ ₁₂₈	$\pi^+ \pi^-$	$(1.47 \pm 0.23) \times 10^{-4}$		DESIG=6
┐ ₁₂₉	$\Lambda\bar{\Sigma} + \text{c.c.}$	< 1.5 $\times 10^{-4}$	CL=90%	DESIG=61
┐ ₁₃₀	$K_S^0 K_S^0$	< 1 $\times 10^{-6}$	CL=95%	DESIG=14

Radiative decays

				NODE=M070; CLUMP=C
┐ ₁₃₁	3γ	$(1.2 \pm 0.4) \times 10^{-5}$		DESIG=81
┐ ₁₃₂	4γ	< 9 $\times 10^{-6}$	CL=90%	DESIG=244
┐ ₁₃₃	5γ	< 1.5 $\times 10^{-5}$	CL=90%	DESIG=245
┐ ₁₃₄	$\gamma\eta_c(1S)$	$(1.7 \pm 0.4) \%$	S=1.6	DESIG=85
┐ ₁₃₅	$\gamma\eta_c(1S) \rightarrow 3\gamma$	$(1.2 \pm 2.7 - 1.1) \times 10^{-6}$		DESIG=246
┐ ₁₃₆	$\gamma\pi^+ \pi^- 2\pi^0$	$(8.3 \pm 3.1) \times 10^{-3}$		DESIG=99
┐ ₁₃₇	$\gamma\eta\pi\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		DESIG=96
┐ ₁₃₈	$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+ \pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		DESIG=142
┐ ₁₃₉	$\gamma\eta(1405/1475) \rightarrow \gamma K \bar{K} \pi$	[d] $(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	DESIG=89
┐ ₁₄₀	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	DESIG=171
┐ ₁₄₁	$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+ \pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=170
┐ ₁₄₂	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	< 8.2 $\times 10^{-5}$	CL=95%	DESIG=212
┐ ₁₄₃	$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		DESIG=94
┐ ₁₄₄	$\gamma\rho\omega$	< 5.4 $\times 10^{-4}$	CL=90%	DESIG=226
┐ ₁₄₅	$\gamma\rho\phi$	< 8.8 $\times 10^{-5}$	CL=90%	DESIG=227
┐ ₁₄₆	$\gamma\eta'(958)$	$(5.16 \pm 0.15) \times 10^{-3}$	S=1.1	DESIG=84
┐ ₁₄₇	$\gamma 2\pi^+ 2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	DESIG=95
┐ ₁₄₈	$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
┐ ₁₄₉	$\gamma f_2(1270) f_2(1270)$ (non resonant)	$(8.2 \pm 1.9) \times 10^{-4}$		DESIG=204
┐ ₁₅₀	$\gamma K^+ K^- \pi^+ \pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		DESIG=143
┐ ₁₅₁	$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		DESIG=100
┐ ₁₅₂	$\gamma\omega\omega$	$(1.61 \pm 0.33) \times 10^{-3}$		DESIG=97
┐ ₁₅₃	$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0 \rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	DESIG=124
┐ ₁₅₄	$\gamma f_2(1270)$	$(1.43 \pm 0.11) \times 10^{-3}$		DESIG=86
┐ ₁₅₅	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(8.5 \pm 1.2 - 0.9) \times 10^{-4}$	S=1.2	DESIG=91
┐ ₁₅₆	$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(4.0 \pm 1.0) \times 10^{-4}$		DESIG=135
┐ ₁₅₇	$\gamma f_0(1710) \rightarrow \gamma\omega\omega$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=221
┐ ₁₅₈	$\gamma\eta$	$(1.104 \pm 0.034) \times 10^{-3}$		DESIG=83
┐ ₁₅₉	$\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi$	$(7.9 \pm 1.3) \times 10^{-4}$		DESIG=175
┐ ₁₆₀	$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		DESIG=88
┐ ₁₆₁	$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+ \pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		DESIG=141
┐ ₁₆₂	$\gamma f_2'(1525)$	$(4.5 \pm 0.7 - 0.4) \times 10^{-4}$		DESIG=87
┐ ₁₆₃	$\gamma f_2(1640) \rightarrow \gamma\omega\omega$	$(2.8 \pm 1.8) \times 10^{-4}$		DESIG=222
┐ ₁₆₄	$\gamma f_2(1910) \rightarrow \gamma\omega\omega$	$(2.0 \pm 1.4) \times 10^{-4}$		DESIG=223
┐ ₁₆₅	$\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		DESIG=144

Γ_{166}	$\gamma K^*(892) \bar{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		DESIG=145
Γ_{167}	$\gamma \phi \phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=98
Γ_{168}	$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		DESIG=90
Γ_{169}	$\gamma \eta(2225)$	$(3.3 \pm 0.5) \times 10^{-4}$		DESIG=126
Γ_{170}	$\gamma \eta(1760) \rightarrow \gamma \rho^0 \rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		DESIG=125
Γ_{171}	$\gamma \eta(1760) \rightarrow \gamma \omega \omega$	$(1.98 \pm 0.33) \times 10^{-3}$		DESIG=224
Γ_{172}	$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.6 \pm 0.4) \times 10^{-4}$		DESIG=213
Γ_{173}	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.5 \pm 1.9_{-0.9}^+) \times 10^{-5}$		DESIG=254
Γ_{174}	$\gamma (K \bar{K} \pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	DESIG=176
Γ_{175}	$\gamma \pi^0$	$(3.49 \pm 0.33_{-0.30}^+) \times 10^{-5}$		DESIG=82
Γ_{176}	$\gamma p \bar{p} \pi^+ \pi^-$	$< 7.9 \times 10^{-4}$	CL=90%	DESIG=93
Γ_{177}	$\gamma \Lambda \bar{\Lambda}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=200
Γ_{178}	$\gamma f_0(2200)$			DESIG=123
Γ_{179}	$\gamma f_J(2220)$	$> 2.50 \times 10^{-3}$	CL=99.9%	DESIG=92
Γ_{180}	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$(8 \pm 4) \times 10^{-5}$		DESIG=136
Γ_{181}	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 3.6 \times 10^{-5}$		DESIG=137
Γ_{182}	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		DESIG=138
Γ_{183}	$\gamma f_0(1500)$	$(1.01 \pm 0.32) \times 10^{-4}$		DESIG=172
Γ_{184}	$\gamma A \rightarrow \gamma \text{invisible}$	$[e] < 6.3 \times 10^{-6}$	CL=90%	DESIG=251

Weak decays

Γ_{185}	$D^- e^+ \nu_e + \text{c.c.}$	$< 1.2 \times 10^{-5}$	CL=90%	DESIG=218
Γ_{186}	$\bar{D}^0 e^+ e^- + \text{c.c.}$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=219
Γ_{187}	$D_s^- e^+ \nu_e + \text{c.c.}$	$< 3.6 \times 10^{-5}$	CL=90%	DESIG=220
Γ_{188}	$D^- \pi^+ + \text{c.c.}$	$< 7.5 \times 10^{-5}$	CL=90%	DESIG=241
Γ_{189}	$\bar{D}^0 K^0 + \text{c.c.}$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=242
Γ_{190}	$D_s^- \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=243

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

Γ_{191}	$\gamma \gamma$	C	$< 5 \times 10^{-6}$	CL=90%	DESIG=80
Γ_{192}	$e^\pm \mu^\mp$	LF	$< 1.1 \times 10^{-6}$	CL=90%	DESIG=177
Γ_{193}	$e^\pm \tau^\mp$	LF	$< 8.3 \times 10^{-6}$	CL=90%	DESIG=178
Γ_{194}	$\mu^\pm \tau^\mp$	LF	$< 2.0 \times 10^{-6}$	CL=90%	DESIG=179

Other decays

Γ_{195}	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.

 $J/\psi(1S)$ PARTIAL WIDTHS **$\Gamma(\text{hadrons})$** **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=M070220

NODE=M070W3
NODE=M070W3

LINKAGE=E

LINKAGE=EGM

LINKAGE=SG

LINKAGE=MF

LINKAGE=MG

LINKAGE=NSA

$\Gamma(e^+e^-)$ Γ_5

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

5.55±0.14±0.02 OUR EVALUATION

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

5.71±0.16	13k	⁹ ADAMS	06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.57±0.19	7.8k	⁹ AUBERT	04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.14±0.39		BAI	95B	BES	e^+e^-
5.36 ^{+0.29} _{-0.28}		¹⁰ HSUEH	92	RVUE	See Υ mini-review
4.72±0.35		ALEXANDER	89	RVUE	See Υ mini-review
4.4 ±0.6		¹⁰ BRANDELIK	79C	DASP	e^+e^-
4.6 ±0.8		¹¹ BALDINI-...	75	FRAG	e^+e^-
4.8 ±0.6		BOYARSKI	75	MRK1	e^+e^-
4.6 ±1.0		ESPOSITO	75B	FRAM	e^+e^-

⁹ Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.

¹⁰ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

¹¹ Assuming equal partial widths for e^+e^- and $\mu^+\mu^-$.

NODE=M070W1
NODE=M070W1

→ NOT CHECKED ←

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_{191}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<5.4 90 BRANDELIK 79C DASP e^+e^-

NODE=M070W70
NODE=M070W70

 $J/\psi(1S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel i in the e^+e^- annihilation.

NODE=M070225

NODE=M070225

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_5 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

4 ±0.8	¹² BALDINI-...	75	FRAG	e^+e^-
3.9±0.8	¹² ESPOSITO	75B	FRAM	e^+e^-

¹² 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	¹³ BALDINI-...	75	FRAG	e^+e^-
340 ± 90	¹³ ESPOSITO	75B	FRAM	e^+e^-
360 ±100	¹³ FORD	75	SPEC	e^+e^-

¹³ Data redundant with branching ratios or partial widths above.

NODE=M070G1
NODE=M070G1

NODE=M070G1;LINKAGE=S

 $\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_7 \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

334 ± 5 OUR AVERAGE

331.8± 5.2±6.3		ANASHIN	10	KEDR	3.097 $e^+e^- \rightarrow \mu^+\mu^-$
338.4± 5.8±7.1	13k	ADAMS	06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
330.1± 7.7±7.3	7.8k	AUBERT	04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$

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

510 ±90		DASP	75	DASP	e^+e^-
380 ±50		¹⁴ ESPOSITO	75B	FRAM	e^+e^-

¹⁴ Data redundant with branching ratios or partial widths above.

NODE=M070G2
NODE=M070G2

NODE=M070G2;LINKAGE=S

$$\Gamma(\omega\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.3±0.2	170	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ π ⁰ γ

NODE=M070G8
NODE=M070G8

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
53.6±5.0±0.4	788	15 AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ

NODE=M070G24
NODE=M070G24

¹⁵ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 47.8 \pm 3.1 \pm 3.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G24;LINKAGE=AU

$$\Gamma(K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
33±4±1	317 ± 23	^{16,17} AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G02
NODE=M070G02

¹⁶ Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3$.
¹⁷ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K\pi)] = 16.4 \pm 1.1 \pm 1.4$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K\pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G02;LINKAGE=AE

NODE=M070G02;LINKAGE=UB

$$\Gamma(K^*(892)^0\bar{K}_2(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0K^-\pi^+ + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{20}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.8±0.4±0.3	110 ± 14	¹⁸ AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G03
NODE=M070G03

¹⁸ Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3$.

NODE=M070G03;LINKAGE=AE

$$\Gamma(K^+\bar{K}^*(892)^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
29.0±1.7±1.3	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁺ K [*] (892) ⁻ γ

NODE=M070G18
NODE=M070G18

$$\Gamma(K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+K^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.96±0.85±0.70	155	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁰ γ

NODE=M070G20
NODE=M070G20

$$\Gamma(K^+\bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0K^\pm\pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.76±1.70±1.00	89	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K _S ⁰ K [±] π [∓] γ

NODE=M070G21
NODE=M070G21

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6±2.5±1.5	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K ⁰ $\bar{K}^*(892)^0$ γ

NODE=M070G19
NODE=M070G19

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0K^\pm\pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
17.70±1.70±1.00	94	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K _S ⁰ K [±] π [∓] γ

NODE=M070G22
NODE=M070G22

$$\Gamma(\omega K\bar{K}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{35}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.70±1.98±0.03	24	¹⁹ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → ωK ⁺ K ⁻ γ

NODE=M070G29
NODE=M070G29

¹⁹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega K\bar{K}) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 3.3 \pm 1.3 \pm 1.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G29;LINKAGE=AU

$$\Gamma(\phi 2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{37}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96±0.19±0.01	35	²⁰ AUBERT	06D BABR	10.6 e ⁺ e ⁻ → φ2(π ⁺ π ⁻)γ

NODE=M070G10
NODE=M070G10

²⁰ AUBERT 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi 2(\pi^+\pi^-)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = (0.47 \pm 0.09 \pm 0.03) \times 10^{-2}$ keV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G10;LINKAGE=AU

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{46}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.8 ± 0.4 OUR AVERAGE				
4.52 ± 0.48 ± 0.04	254 ± 23	21 SHEN	09 BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
5.33 ± 0.71 ± 0.05	103	22 AUBERT,BE 06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M070G14
NODE=M070G14

- ²¹ 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.
- ²² AUBERT,BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 2.61 \pm 0.30 \pm 0.18$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (48.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=SH

NODE=M070G14;LINKAGE=AU

$$\Gamma(\phi\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{47}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.15 ± 0.88 ± 0.03	23	23 AUBERT,BE 06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$
²³ 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

$$\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{50}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.1 ± 2.7 ± 0.4	6	24 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \phi\eta\gamma$
²⁴ 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

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{57}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.21 ± 0.23 OUR AVERAGE				Error includes scale factor of 1.2.
1.48 ± 0.27 ± 0.09	60 ± 11	25 SHEN	09 BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
1.02 ± 0.24 ± 0.01	20 ± 5	26 AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
²⁵ Multiplied by 2/3 to take into account the $\phi\pi^+\pi^-$ mode only. Using $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.6)\%$.				
²⁶ 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

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{58}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96 ± 0.40 ± 0.01	7.0 ± 2.8	27 AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$
²⁷ 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

$$\Gamma(\eta\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{64}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.24 ± 0.98 ± 0.03	9	28 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta\pi^+\pi^-\gamma$
²⁸ 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 $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (22.74 \pm 0.28) \times 10^{-2}$. 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	29 AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
²⁹ Dividing by $(2/3)^2$ to take twice into account that $B(K^{*0} \rightarrow K^+\pi^-) = 2/3$.				

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	^{30,31} AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G07
NODE=M070G07

³⁰ Using B(φ → (K⁺K⁻)) = (49.3 ± 0.6)%.

³¹ AUBERT 07AK reports [Γ(J/ψ(1S) → φ f₂(1270)) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(f₂(1270) → ππ)] = 3.41 ± 0.55 ± 0.28 eV which we divide by our best value B(f₂(1270) → ππ) = (84.8^{+2.4}_{-1.2}) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G07;LINKAGE=AE
NODE=M070G07;LINKAGE=UB

$$\Gamma(2(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{85}\Gamma_5/\Gamma$$

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

$$\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{87}\Gamma_5/\Gamma$$

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

$$\Gamma(\pi^+\pi^-\pi^0 K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{88}\Gamma_5/\Gamma$$

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

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{90}\Gamma_5/\Gamma$$

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 ³² AUBERT 05D BABR 10.6 e⁺e⁻ → K⁺K⁻π⁺π⁻γ

³² Superseded by AUBERT 07AK.

NODE=M070G12
NODE=M070G12

NODE=M070G12;LINKAGE=AU

$$\Gamma(\pi^+\pi^-K^+K^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{91}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.9±3.9±0.1	73	³³ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ ηγ

³³ 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) = (39.31 ± 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

$$\Gamma(\pi^0\pi^0 K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{92}\Gamma_5/\Gamma$$

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

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{94}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
19.5±1.4±1.3	270	AUBERT	05D BABR	10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)γ

NODE=M070G11
NODE=M070G11

$$\Gamma(3(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{95}\Gamma_5/\Gamma$$

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

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{96}\Gamma_5/\Gamma$$

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

$$\Gamma(2(\pi^+\pi^-\eta)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{97}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.1±2.4±0.1	85	³⁴ AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)ηγ

³⁴ AUBERT 07AU reports [Γ(J/ψ(1S) → 2(π⁺π⁻)η) × Γ(J/ψ(1S) → e⁺e⁻)/Γ_{total}] × [B(η → 2γ)] = 5.16 ± 0.85 ± 0.39 eV which we divide by our best value B(η → 2γ) = (39.31 ± 0.20) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G26
NODE=M070G26

NODE=M070G26;LINKAGE=AU

$$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{99}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
11.6±0.9 OUR AVERAGE	Error includes scale factor of 1.2.			
12.0±0.6±0.5	438	AUBERT	06B	$e^+e^- \rightarrow p\bar{p}\gamma$
9.7±1.7		³⁵ ARMSTRONG	93B E760	$\bar{p}p \rightarrow e^+e^-$
³⁵ Using $\Gamma_{\text{total}} = 85.5^{+6.1}_{-5.8}$ MeV.				

NODE=M070G4
NODE=M070G4

NODE=M070G;LINKAGE=A

$$\Gamma(\Sigma^0\bar{\Sigma}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{111}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
6.4±1.2±0.6	AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0\gamma$

NODE=M070G17
NODE=M070G17

$$\Gamma(2(\pi^+\pi^-)K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{112}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.75±0.23±0.17	205	AUBERT	06D BABR	10.6 $e^+e^- \rightarrow K^+K^-2(\pi^+\pi^-)\gamma$

NODE=M070G9
NODE=M070G9

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{118}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
10.7±0.9±0.7	AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M070G16
NODE=M070G16

$$\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{121}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
4.11±0.39±0.30	156 ± 15	AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.0 ±0.7 ±0.6	38	³⁶ AUBERT	05D BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$
³⁶ Superseded by AUBERT 07AK.				

NODE=M070G13
NODE=M070G13

NODE=M070G13;LINKAGE=AU

$J/\psi(1S)$ BRANCHING RATIOS

NODE=M070230

For the first four branching ratios, see also the partial widths, and (partial widths) $\times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ above.

NODE=M070300

$$\Gamma(\text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.877±0.005 OUR AVERAGE			
0.878±0.005	BAI	95B BES	e^+e^-
0.86 ±0.02	BOYARSKI	75 MRK1	e^+e^-

NODE=M070R3
NODE=M070R3

$$\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.135±0.003	^{37,38} SETH	04 RVUE	e^+e^-
0.17 ±0.02	³⁷ BOYARSKI	75 MRK1	e^+e^-

NODE=M070R4
NODE=M070R4

³⁷ Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.

³⁸ 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

$$\Gamma(ggg)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT
64.1±1.0	6 M	³⁹ BESSON	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^- + \text{hadrons}$

NODE=M070S65
NODE=M070S65

³⁹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the PDG 08 values of $B(\ell^+\ell^-)$, $B(\text{virtual } \gamma \rightarrow \text{hadrons})$, and $B(\gamma\eta_c)$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S65;LINKAGE=BE

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

VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT
8.79±1.05	200 k	⁴⁰ BESSON	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^-\gamma + \text{hadrons}$

NODE=M070S66
NODE=M070S66

⁴⁰ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the value of $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S66;LINKAGE=BE

$\Gamma(\gamma g g)/\Gamma(g g g)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
13.7±0.1±0.7	6 M	BESSION	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

 Γ_4/Γ_3

NODE=M070S67
 NODE=M070S67

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.94 ±0.06 OUR AVERAGE				
5.945±0.067±0.042	15k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.90 ±0.05 ±0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.09 ±0.33		BAI	95B	BES $e^+ e^-$
5.92 ±0.15 ±0.20		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75	MRK1 $e^+ e^-$

 Γ_5/Γ

NODE=M070R1
 NODE=M070R1

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.8±1.3±0.4	⁴¹ ARMSTRONG	96	E760 $\bar{p} p \rightarrow e^+ e^- \gamma$

⁴¹ For $E_\gamma > 100$ MeV.

 Γ_6/Γ

NODE=M070S33
 NODE=M070S33

NODE=M070S33;LINKAGE=A

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.93 ±0.06 OUR AVERAGE				
5.960±0.065±0.050	17k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.84 ±0.06 ±0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.08 ±0.33		BAI	95B	BES $e^+ e^-$
5.90 ±0.15 ±0.19		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75	MRK1 $e^+ e^-$

 Γ_7/Γ

NODE=M070R2
 NODE=M070R2

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.998±0.012 OUR AVERAGE			
1.002±0.021±0.013	⁴² ANASHIN	10	KEDR $3.097 e^+ e^- \rightarrow e^+ e^-, \mu^+ \mu^-$
0.997±0.012±0.006	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.00 ±0.07	BAI	95B	BES $e^+ e^-$
1.00 ±0.05	BOYARSKI	75	MRK1 $e^+ e^-$
0.91 ±0.15	ESPOSITO	75B	FRAM $e^+ e^-$
0.93 ±0.10	FORD	75	SPEC $e^+ e^-$

 Γ_5/Γ_7

NODE=M070R5
 NODE=M070R5

⁴² Not independent of the corresponding measurements of $\Gamma(e^+ e^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+ \mu^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$.

NODE=M070R5;LINKAGE=AN

HADRONIC DECAYS

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.69 ±0.15 OUR AVERAGE				Error includes scale factor of 2.4. See the ideogram below.
2.18 ±0.19		^{43,44} AUBERT,B	04N	BABR $10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$
2.184±0.005±0.201	220k	^{44,45} BAI	04H	BES $e^+ e^- \rightarrow J/\psi \rightarrow \pi^+ \pi^- \pi^0$
2.091±0.021±0.116		^{44,46} BAI	04H	BES $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
1.21 ±0.20		BAI	96D	BES $e^+ e^- \rightarrow \rho \pi$
1.42 ±0.01 ±0.19		COFFMAN	88	MRK3 $e^+ e^-$
1.3 ±0.3	150	FRANKLIN	83	MRK2 $e^+ e^-$
1.6 ±0.4	183	ALEXANDER	78	PLUT $e^+ e^-$
1.33 ±0.21		BRANDELIK	78B	DASP $e^+ e^-$
1.0 ±0.2	543	BARTEL	76	CNTR $e^+ e^-$
1.3 ±0.3	153	JEAN-MARIE	76	MRK1 $e^+ e^-$

 Γ_8/Γ

NODE=M070305

NODE=M070R20
 NODE=M070R20

OCCUR=2

⁴³ From the ratio of $\Gamma(e^+ e^-) B(\pi^+ \pi^- \pi^0)$ and $\Gamma(e^+ e^-) B(\mu^+ \mu^-)$ (AUBERT 04).

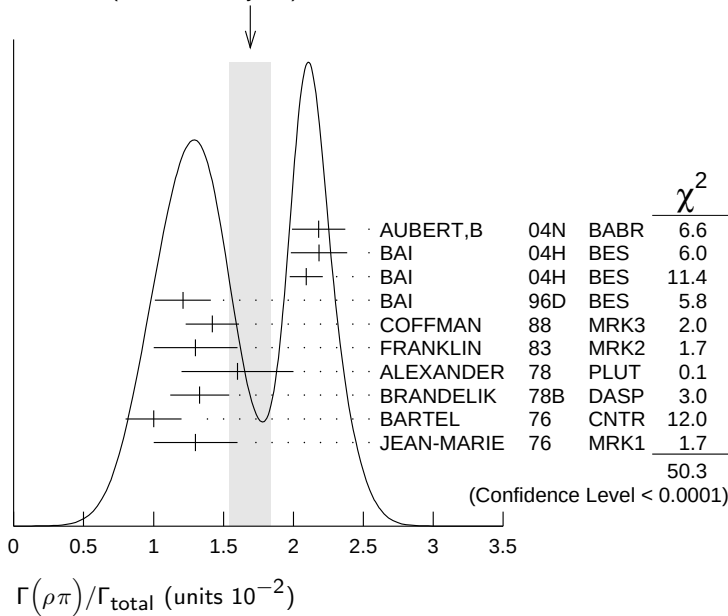
⁴⁴ Not independent of their $B(\pi^+ \pi^- \pi^0)$.

⁴⁵ From $J/\psi \rightarrow \pi^+ \pi^- \pi^0$ events directly.

⁴⁶ Obtained comparing the rates for $\pi^+ \pi^- \pi^0$ and $\mu^+ \mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$ and with $B(J/\psi \rightarrow \mu^+ \mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R20;LINKAGE=AU
 NODE=M070R20;LINKAGE=BU
 NODE=M070R20;LINKAGE=BA
 NODE=M070R20;LINKAGE=BI

WEIGHTED AVERAGE
1.69±0.15 (Error scaled by 2.4)



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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ_8
0.328±0.005±0.027	COFFMAN	88	MRK3 e^+e^-	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.35 ±0.08	ALEXANDER	78	PLUT e^+e^-	
0.32 ±0.08	BRANDELIK	78B	DASP e^+e^-	
0.39 ±0.11	BARTEL	76	CNTR e^+e^-	
0.37 ±0.09	JEAN-MARIE	76	MRK1 e^+e^-	

NODE=M070R21
NODE=M070R21

$\Gamma(a_2(1320)\rho)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{10}/Γ
10.9±2.2 OUR AVERAGE					
11.7±0.7±2.5	7584	AUGUSTIN	89	DM2 $J/\psi \rightarrow \rho^0 \rho^\pm \pi^\mp$	
8.4±4.5	36	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$	

NODE=M070R43
NODE=M070R43

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ
85±34	140	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 3(\pi^+\pi^-)\pi^0$	

NODE=M070R26
NODE=M070R26

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ
0.40±0.06±0.04	170	47 AUBERT	06D	BABR 10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\pi^0\gamma$	
47 Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.					

NODE=M070R76
NODE=M070R76

NODE=M070R76;LINKAGE=EE

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ
8.6±0.7 OUR AVERAGE				Error includes scale factor of 1.1.	
9.7±0.6±0.6	788	48 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 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$	

48 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
NODE=M070R24

NODE=M070R24;LINKAGE=AU

$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{14}/Γ
4.3±0.6 OUR AVERAGE					
4.3±0.2±0.6	5860	AUGUSTIN	89	DM2 e^+e^-	
4.0±1.6	70	BURMESTER	77D	PLUT e^+e^-	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.9±0.8	81	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$	

NODE=M070R28
NODE=M070R28

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.3±0.7±0.1	25 ± 8	49	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M070R46
 NODE=M070R46

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

<5	90	VANNUCCI	77	MRK1	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$
49	AUBERT	07AK	reports	$[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (1.28 \pm 0.40 \pm 0.11) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.	

NODE=M070R46;LINKAGE=BE

 $\Gamma(K^*(892)^\pm \bar{K}^*(892)^\mp)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.00±0.19^{+0.11}_{-0.32}	323	ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M070S73
 NODE=M070S73

 $\Gamma(K^*(892)^\pm \bar{K}^*(800)^\mp)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09±0.18^{+0.94}_{-0.54}	655	ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M070S74
 NODE=M070S74

 $\Gamma(\eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.15±0.13±0.22	209	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$

NODE=M070S69
 NODE=M070S69

 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±0.6 OUR AVERAGE				

NODE=M070R48
 NODE=M070R48

5.9±0.6±0.2	317 ± 23	50,51	AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
6.7±2.6	40	VANNUCCI	77	MRK1	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

⁵⁰ Using $B(K_2^*(1430)^0 \rightarrow K \pi) = (49.9 \pm 1.2)\%$.

⁵¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (32.9 \pm 2.3 \pm 2.7) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R48;LINKAGE=AU
 NODE=M070R48;LINKAGE=BE

 $\Gamma(\omega K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
61 ± 9 OUR AVERAGE				
62.0± 6.8±10.6	899 ± 98	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^\pm \pi^\mp$
65.3±10.2±13.5	176 ± 28	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
53 ±14 ±14	530 ± 140	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S2
 NODE=M070S2

OCCUR=2

 $\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.12±0.30 OUR AVERAGE				
5.2 ±0.4 ±0.1	52	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	$J/\psi \rightarrow K^\pm X$

⁵² AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ \bar{K}^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (29.0 \pm 1.7 \pm 1.3) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S15;LINKAGE=AU

$$\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{23}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.97±0.20±0.05	155	⁵³ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$
⁵³ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (10.96 \pm 0.85 \pm 0.70) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070R09
NODE=M070R09

NODE=M070R09;LINKAGE=AU

$$\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{24}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.0±0.4±0.1	89	⁵⁴ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$
⁵⁴ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^+ \bar{K}^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (16.76 \pm 1.70 \pm 1.00) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070S58
NODE=M070S58

NODE=M070S58;LINKAGE=AU

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{25}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
4.39±0.31 OUR AVERAGE				
4.8 ±0.5 ±0.1		⁵⁵ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K^0 \bar{K}^*(892)^0 \gamma$
3.96±0.15±0.60	1192	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
4.33±0.12±0.45		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.7 ±0.6	45	VANNUCCI	77 MRK1	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
⁵⁵ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^0 \bar{K}^*(892)^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (26.6 \pm 2.5 \pm 1.5) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070S16
NODE=M070S16

NODE=M070S16;LINKAGE=AU

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.}) / \Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.}) \quad \Gamma_{25}/\Gamma_{22}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.82±0.05±0.09	COFFMAN	88 MRK3	$J/\psi \rightarrow K \bar{K}^*(892) + \text{c.c.}$

NODE=M070S17
NODE=M070S17

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{26}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.2±0.4±0.1	94	⁵⁶ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$
⁵⁶ AUBERT 08S reports $[\Gamma(J/\psi(1S) \rightarrow K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (17.70 \pm 1.70 \pm 1.00) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070S59
NODE=M070S59

NODE=M070S59;LINKAGE=AU

$$\Gamma(K_1(1400)^\pm K^\mp) / \Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.8±0.8±1.2	⁵⁷ BAI	99C BES	$e^+ e^-$
⁵⁷ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$			

NODE=M070S35
NODE=M070S35

NODE=M070S35;LINKAGE=M3

$$\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{28}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	⁵⁸ ABLIKIM	06C BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
⁵⁸ A $K_0^*(800)$ is observed by ABLIKIM 06C in the $K^+ \pi^-$ mass spectrum of the $\bar{K}^*(892)^0 K^+ \pi^-$ final state against the $\bar{K}^*(892)$. A corresponding branching fraction of the $J/\psi(1S)$ is not presented.			

NODE=M070S52
NODE=M070S52

NODE=M070S52;LINKAGE=AB

$$\Gamma(\omega \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{29}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.4±0.3±0.7	509	AUGUSTIN	89 DM2	$J/\psi \rightarrow \pi^+ \pi^- 3\pi^0$

NODE=M070S26
NODE=M070S26

$$\Gamma(b_1(1235)^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{30}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
30±5 OUR AVERAGE				
31±6	4600	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
29±7	87	BURMESTER	77D PLUT	$e^+ e^-$

NODE=M070R49
NODE=M070R49

$\Gamma(\omega K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

34 ± 5 OUR AVERAGE37.7 $\pm 0.8 \pm 5.8$ 1972 ± 41 ABLIKIM 08E BES2 $e^+ e^- \rightarrow J/\psi$ 29.5 $\pm 1.4 \pm 7.0$ 879 ± 41 BECKER 87 MRK3 $e^+ e^- \rightarrow \text{hadrons}$ NODE=M070S1
NODE=M070S1 $\Gamma(b_1(1235)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

23 $\pm 3 \pm 5$

229

AUGUSTIN 89 DM2 $e^+ e^-$ NODE=M070S28
NODE=M070S28 $\Gamma(\eta K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{33}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

21.8 $\pm 2.2 \pm 3.4$ 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 AVERAGE20.8 $\pm 2.7 \pm 3.9$ 195 ± 25 ABLIKIM 08E BES2 $J/\psi \rightarrow \phi K_S^0 K^\pm \pi^\mp$ 29.6 $\pm 3.7 \pm 4.7$ 238 ± 30 ABLIKIM 08E BES2 $J/\psi \rightarrow \phi K^+ K^- \pi^0$ 20.7 $\pm 2.4 \pm 3.0$ FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ 20 $\pm 3 \pm 3$ 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[(1.6 ± 0.5) $\times 10^{-4}$ OUR 2011 AVERAGE]13.6 $\pm 5.0 \pm 1.0$ 24⁵⁹ AUBERT 07AU BABR 10.6 $e^+ e^- \rightarrow \omega K^+ K^- \gamma$ 19.8 $\pm 2.1 \pm 3.9$ ⁶⁰ FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ 16 ± 10 22FELDMAN 77 MRK1 $e^+ e^-$ ⁵⁹ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \omega K^+ K^-) \cdot B(\eta \rightarrow 3\pi) = 3.3 \pm 1.3 \pm 0.2 \text{ eV}$.⁶⁰ Addition of $\omega K^+ K^-$ and $\omega K^0 \bar{K}^0$ branching ratios.NODE=M070R27
NODE=M070R27

NEW

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}) EVTS

DOCUMENT ID TECN COMMENT

4.8 $\pm 1.1 \pm 0.3$

61,62

FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ NODE=M070S25
NODE=M070S25⁶¹ Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.⁶² Addition of $f_0(1710) \rightarrow K^+ K^-$ and $f_0(1710) \rightarrow K^0 \bar{K}^0$ branching ratios.NODE=M070S25;LINKAGE=F
NODE=M070S25;LINKAGE=G $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{37}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

16.6 ± 2.3 OUR AVERAGE17.3 $\pm 3.3 \pm 1.2$ 35⁶³ AUBERT 06D BABR 10.6 $e^+ e^- \rightarrow \phi 2(\pi^+ \pi^-) \gamma$ 16.0 $\pm 1.0 \pm 3.0$ FALVARD 88 DM2 $J/\psi \rightarrow \text{hadrons}$ ⁶³ 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 $\pm 0.23 \pm 0.40$

332

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

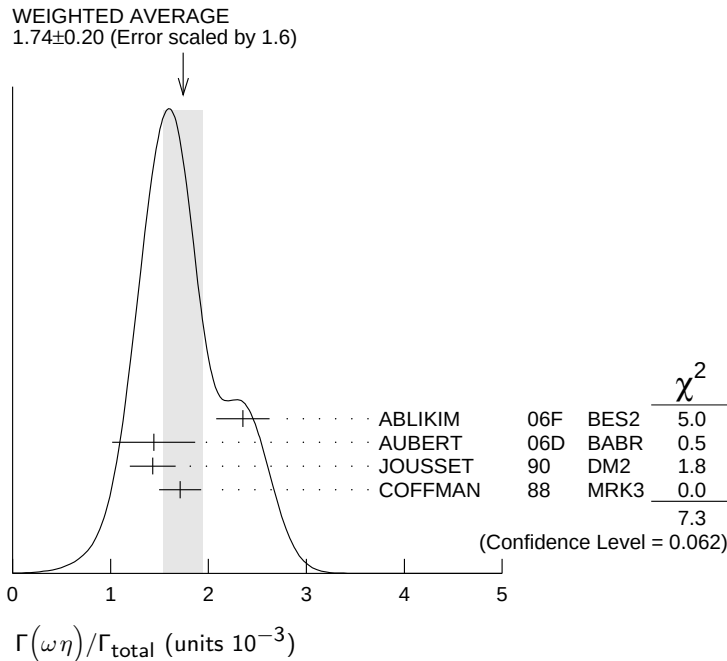
Error includes scale factor of 1.6. See the ideogram below.

2.352 ± 0.273 5k⁶⁴ ABLIKIM 06F BES2 $J/\psi \rightarrow \omega \eta$ 1.44 $\pm 0.40 \pm 0.14$ 13⁶⁵ AUBERT 06D BABR 10.6 $e^+ e^- \rightarrow \omega \eta \gamma$ 1.43 $\pm 0.10 \pm 0.21$ 378JOUSSET 90 DM2 $J/\psi \rightarrow \text{hadrons}$ 1.71 $\pm 0.08 \pm 0.20$ COFFMAN 88 MRK3 $e^+ e^- \rightarrow 3\pi \eta$ NODE=M070R30
NODE=M070R30

64 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 $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.
65 Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.

NODE=M070R30;LINKAGE=BL

NODE=M070R30;LINKAGE=EE

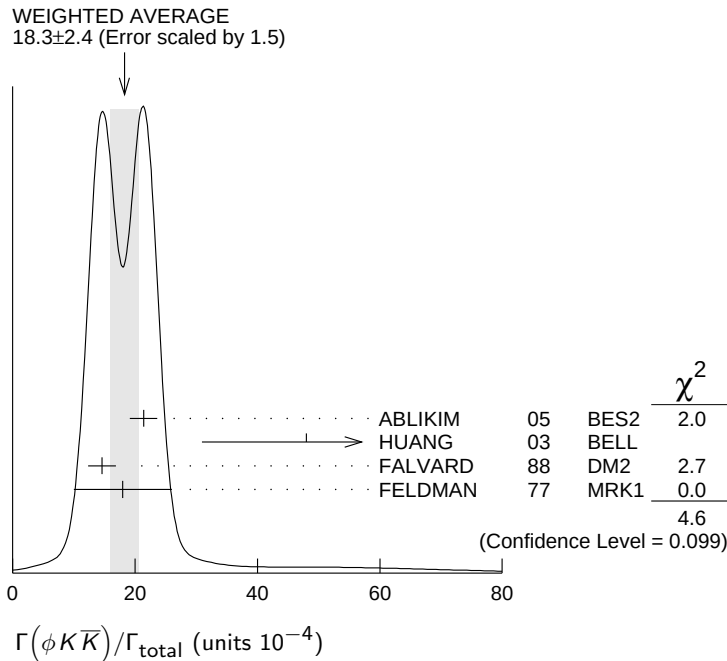


$\Gamma(\phi K \bar{K})/\Gamma_{\text{total}}$					Γ_{40}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
18.3± 2.4 OUR AVERAGE					Error includes scale factor of 1.5. See the ideogram below.
21.4± 0.4±2.2		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$	
48 $\begin{smallmatrix} +20 \\ -16 \end{smallmatrix}$ ±6	9.0 $\begin{smallmatrix} +3.7 \\ -3.0 \end{smallmatrix}$	66,67 HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$	
14.6± 0.8±2.1		68 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$	
18 ± 8	14	FELDMAN	77 MRK1	$e^+ e^-$	

NODE=M070R36
NODE=M070R36

66 We have multiplied K^+K^- measurement by 2 to obtain $K\bar{K}$.
67 Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.
68 Addition of $\phi K^+ K^-$ and $\phi K^0 \bar{K}^0$ branching ratios.

NODE=M070R36;LINKAGE=AA
NODE=M070R36;LINKAGE=CC
NODE=M070R36;LINKAGE=A



$\Gamma(\phi f_0(1710) \rightarrow \phi K \bar{K})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.6$\pm$0.2$\pm$0.6	69,70 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

⁶⁹ Including interference with $f_2'(1525)$.⁷⁰ Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.NODE=M070S24
NODE=M070S24NODE=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$\pm$0.13$\pm$0.02	44 $\pm$ 7	71,72	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 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-$ ⁷¹ Using $B(f_2(1270) \rightarrow \pi\pi) = (84.8^{+2.4}_{-1.2})\%$ ⁷² 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=M070R39NODE=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$\pm$0.09$\pm$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
1.03$\pm$0.13 OUR AVERAGE				
1.00 $\pm$ 0.04 $\pm$ 0.21	631 $\pm$ 25	HENRARD	87 DM2	$e^+e^- \rightarrow \Sigma^{*-}$
1.19 $\pm$ 0.04 $\pm$ 0.25	754 $\pm$ 27	HENRARD	87 DM2	$e^+e^- \rightarrow \Sigma^{*+}$
0.86 $\pm$ 0.18 $\pm$ 0.22	56	EATON	84 MRK2	$e^+e^- \rightarrow \Sigma^{*-}$
1.03 $\pm$ 0.24 $\pm$ 0.25	68	EATON	84 MRK2	$e^+e^- \rightarrow \Sigma^{*+}$

NODE=M070R67
NODE=M070R67

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 $\pm$ 4 OUR AVERAGE				Error includes scale factor of 2.7.
12.3 $\pm$ 0.6 $\pm$ 2.0	73,74	FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
4.8 $\pm$ 1.8	46	GIDAL	81 MRK2	$J/\psi \rightarrow K^+K^-K^+K^-$

⁷³ Re-evaluated using $B(f_2'(1525) \rightarrow K \bar{K}) = 0.713$.⁷⁴ 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$\pm$0.09 OUR AVERAGE				Error includes scale factor of 1.2.
0.96 $\pm$ 0.13	103	⁷⁵ AUBERT,BE 06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
1.09 $\pm$ 0.02 $\pm$ 0.13		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
0.78 $\pm$ 0.03 $\pm$ 0.12		FALVARD 88	DM2	$J/\psi \rightarrow \text{hadrons}$
2.1 $\pm$ 0.9	23	FELDMAN 77	MRK1	e^+e^-

⁷⁵ Derived by us. AUBERT,BE 06D measures $\Gamma(J/\psi \rightarrow e^+e^-) \times B(J/\psi \rightarrow \phi\pi^+\pi^-) \times B(\phi \rightarrow K^+K^-) = (2.61 \pm 0.30 \pm 0.18)$ eVNODE=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$\pm$0.16	23	⁷⁶ AUBERT,BE 06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$

⁷⁶ Derived by us. AUBERT,BE 06D measures $\Gamma(J/\psi \rightarrow e^+e^-) \times B(J/\psi \rightarrow \phi\pi^0\pi^0) \times B(\phi \rightarrow K^+K^-) = (1.54 \pm 0.40 \pm 0.16)$ eVNODE=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$\pm$0.8 OUR AVERAGE				
7.4 $\pm$ 0.6 $\pm$ 1.4	227 $\pm$ 19	ABLIKIM	08E BES2	$e^+e^- \rightarrow J/\psi$
7.4 $\pm$ 0.9 $\pm$ 1.1		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
7 $\pm$ 0.6 $\pm$ 1.0	163 $\pm$ 15	BECKER	87 MRK3	$e^+e^- \rightarrow \text{hadrons}$

NODE=M070S3
NODE=M070S3

$\Gamma(\omega f_1(1420))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.8^{+1.9}_{-1.6} \pm 1.7$	111^{+31}_{-26}	BECKER	87 MRK3	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{49}/Γ

NODE=M070S5
 NODE=M070S5

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.75 ± 0.08 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
$1.4 \pm 0.6 \pm 0.1$	6	⁷⁷ AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \phi\eta\gamma$
$0.898 \pm 0.024 \pm 0.089$		ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadr}$
$0.64 \pm 0.04 \pm 0.11$	346	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
$0.661 \pm 0.045 \pm 0.078$		COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+K^-\eta$

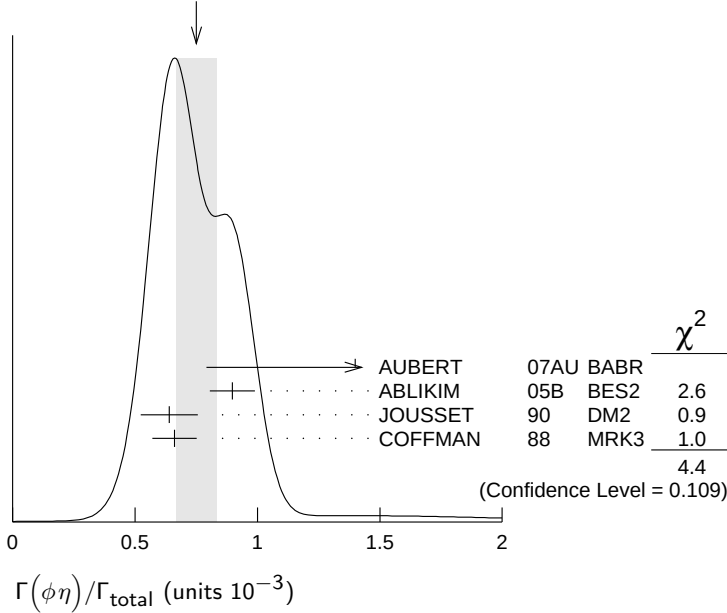
 Γ_{50}/Γ

NODE=M070R37
 NODE=M070R37

⁷⁷ 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;LINKAGE=AU

WEIGHTED AVERAGE
 0.75 ± 0.08 (Error scaled by 1.5)

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.20 \pm 0.12 \pm 0.21$	206	ABLIKIM	080 BES2	$e^+e^- \rightarrow J/\psi$

 Γ_{51}/Γ

NODE=M070S64
 NODE=M070S64

 $\Gamma(\Xi(1530)^-\Xi^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.59 \pm 0.09 \pm 0.12$	75 ± 11	HENRARD	87 DM2	e^+e^-

 Γ_{52}/Γ

NODE=M070S9
 NODE=M070S9

 $\Gamma(\rho K^- \bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.51 \pm 0.26 \pm 0.18$	89	EATON	84 MRK2	e^+e^-

 Γ_{53}/Γ

NODE=M070R74
 NODE=M070R74

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

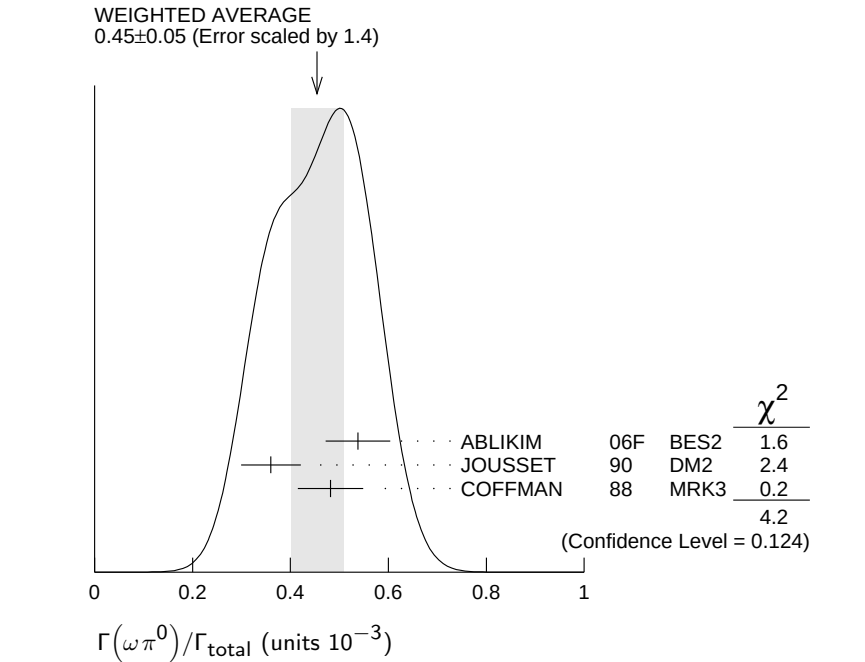
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.45 ± 0.05 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
$0.538 \pm 0.012 \pm 0.065$	2090	⁷⁸ ABLIKIM	06F BES2	$J/\psi \rightarrow \omega\pi^0$
$0.360 \pm 0.028 \pm 0.054$	222	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
$0.482 \pm 0.019 \pm 0.064$		COFFMAN	88 MRK3	$e^+e^- \rightarrow \pi^0\pi^+\pi^-\pi^0$

 Γ_{54}/Γ

NODE=M070R32
 NODE=M070R32

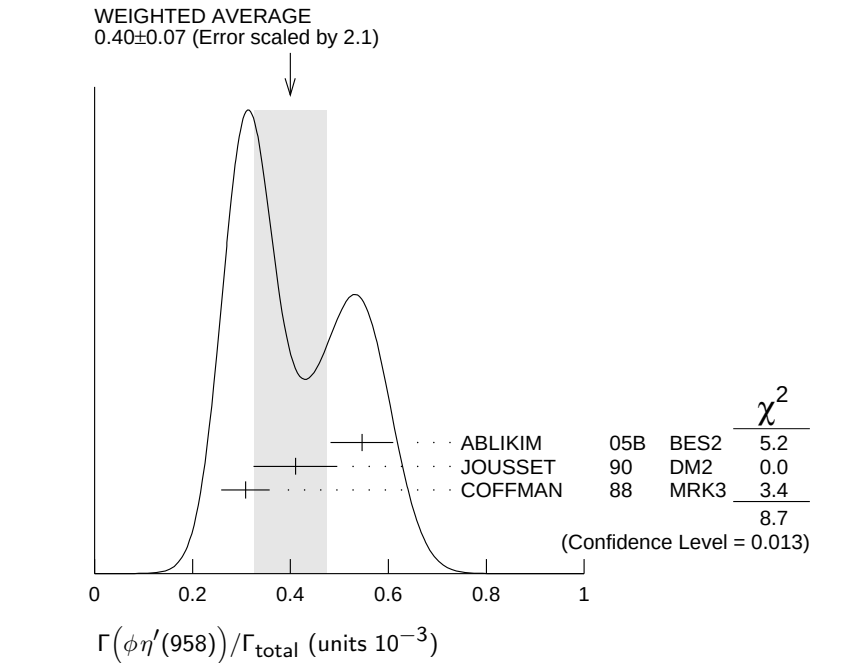
⁷⁸ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R32;LINKAGE=BL



$\Gamma(\phi\eta'(958))/\Gamma_{\text{total}}$					Γ_{55}/Γ
VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.40 ±0.07 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.					
0.546±0.031±0.056			ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadr}$
0.41 ±0.03 ±0.08	167		JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.308±0.034±0.036			COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+K^-\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.3	90		VANNUCCI	77 MRK1	e^+e^-

NODE=M070R38
NODE=M070R38



$\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$					Γ_{56}/Γ
VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT	
3.2±0.9 OUR AVERAGE Error includes scale factor of 1.9.					
4.6±0.4±0.8	79	FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$	
2.6±0.6	50	79 GIDAL	81 MRK2	$J/\psi \rightarrow K^+K^-K^+K^-$	
79 Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.					

NODE=M070R41
NODE=M070R41

NODE=M070R41;LINKAGE=A

$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.182±0.042±0.005	19.5 ± 4.5	^{80,81} AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

⁸⁰ Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

⁸¹ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (1.01 \pm 0.22 \pm 0.08) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S02
NODE=M070S02

NODE=M070S02;LINKAGE=AU
NODE=M070S02;LINKAGE=BE

 $\Gamma(\phi f_0(980) \rightarrow \phi \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.171±0.073±0.004	7.0 ± 2.8	^{82,83} AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

⁸² Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

⁸³ AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^0 \pi^0) / \Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (0.95 \pm 0.39 \pm 0.10) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S03
NODE=M070S03

NODE=M070S03;LINKAGE=AU
NODE=M070S03;LINKAGE=BE

 $\Gamma(\eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.23±0.75±0.73	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$

NODE=M070R08
NODE=M070R08

 $\Gamma(\phi a_0(980)^0 \rightarrow \phi \eta \pi^0) / \Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
5.0±2.7±2.5	⁸⁴ ABLIKIM	11D BES3	$J/\psi \rightarrow \phi \eta \pi^0$

⁸⁴ 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	⁸⁵ JOUSSET	90 DM2	$J/\psi \rightarrow \phi \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.6±0.2±0.1	16 ± 6	BECKER	87 MRK3	$J/\psi \rightarrow \phi K \bar{K} \pi$

NODE=M070S6
NODE=M070S6

OCCUR=2

⁸⁵ We attribute to the $f_1(1285)$ the signal observed in the $\pi^+ \pi^- \eta$ invariant mass distribution at 1297 MeV.

NODE=M070S6;LINKAGE=Q

 $\Gamma(\eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.40±0.17±0.03	9	⁸⁶ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \eta \pi^+ \pi^- \gamma$

⁸⁶ AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \eta \pi^+ \pi^-) \cdot B(\eta \rightarrow 3\pi) = 0.51 \pm 0.22 \pm 0.03$ eV.

NODE=M070S05
NODE=M070S05

NODE=M070S05;LINKAGE=AU

 $\Gamma(\rho \eta) / \Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.193±0.023 OUR AVERAGE				
0.194±0.017±0.029	299	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.193±0.013±0.029		COFFMAN	88 MRK3	$e^+ e^- \rightarrow \pi^+ \pi^- \eta$

NODE=M070R22
NODE=M070R22

$\Gamma(\omega\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.182±0.021 OUR AVERAGE				
0.226±0.043	218	⁸⁷ ABLIKIM	06F BES2	$J/\psi \rightarrow \omega\eta'$
0.18 $^{+0.10}_{-0.08}$ ±0.03	6	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.166±0.017±0.019		COFFMAN	88 MRK3	$e^+e^- \rightarrow 3\pi\eta'$

⁸⁷ Using $B(\eta' \rightarrow \pi^+\pi^-\eta) = (44.3 \pm 1.5)\%$, $B(\eta' \rightarrow \pi^+\pi^-\gamma) = 29.5 \pm 1.0\%$, $B(\eta \rightarrow 2\gamma) = 39.43 \pm 0.26\%$, and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R31
NODE=M070R31

NODE=M070R31;LINKAGE=BL

 $\Gamma(\omega f_0(980))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.41±0.27±0.47	⁸⁸ AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$

⁸⁸ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.

NODE=M070S27
NODE=M070S27

NODE=M070S27;LINKAGE=K

 $\Gamma(\rho\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.105±0.018 OUR AVERAGE				
0.083±0.030±0.012	19	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.114±0.014±0.016		COFFMAN	88 MRK3	$J/\psi \rightarrow \pi^+\pi^-\eta'$

NODE=M070R23
NODE=M070R23

 $\Gamma(a_2(1320)^\pm\pi^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	BRAUNSCH...	76 DASP	e^+e^-

NODE=M070R42
NODE=M070R42

 $\Gamma(K\bar{K}_2^*(1430)+\text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<40	90	VANNUCCI	77 MRK1	$e^+e^- \rightarrow K^0\bar{K}_2^{*0}$

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

<66	90	BRAUNSCH...	76 DASP	$e^+e^- \rightarrow K^\pm\bar{K}_2^{*\mp}$

NODE=M070R45
NODE=M070R45

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	⁸⁹ BAI	99C BES	e^+e^-

⁸⁹ Assuming $B(K_1(1270) \rightarrow K\rho) = 0.42 \pm 0.06$

NODE=M070S34
NODE=M070S34

NODE=M070S34;LINKAGE=M2

 $\Gamma(K_2^*(1430)^0\bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<29	90	VANNUCCI	77 MRK1	$e^+e^- \rightarrow \pi^+\pi^-\bar{K}^+K^-$

NODE=M070R47
NODE=M070R47

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

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.4	90	ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \phi\gamma\gamma$

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

<6.8	90	COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+K^-\pi^0$

NODE=M070R33
NODE=M070R33

 $\Gamma(\phi\eta(1405) \rightarrow \phi\eta\pi\pi)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	⁹⁰ FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

⁹⁰ Includes unknown branching fraction $\eta(1405) \rightarrow \eta\pi\pi$.

NODE=M070S23
NODE=M070S23

NODE=M070S23;LINKAGE=A

 $\Gamma(\omega f'_2(1525))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	⁹¹ 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	⁹¹ FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

⁹¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.713$.

NODE=M070R29
NODE=M070R29

NODE=M070R29;LINKAGE=C

 $\Gamma(\eta\phi(2170) \rightarrow \eta K^*(892)^0\bar{K}^*(892)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.52	90	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+\pi^- K^-\pi^+$

NODE=M070S70
NODE=M070S70

$$\Gamma(\Sigma(1385)^0 \bar{\Lambda})/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.2	90	HENRARD	87 DM2	$e^+ e^-$

$$\Gamma_{\pi\pi}/\Gamma$$

NODE=M070S13
NODE=M070S13

$$\Gamma(\Delta(1232)^+ \bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	90	HENRARD	87 DM2	$e^+ e^-$

$$\Gamma_{78}/\Gamma$$

NODE=M070S14
NODE=M070S14

$$\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	BAI	04G BES2	$e^+ e^-$

$$\Gamma_{79}/\Gamma$$

NODE=M070S47
NODE=M070S47

$$\Gamma(\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	BAI	04G BES2	$e^+ e^-$

$$\Gamma_{80}/\Gamma$$

NODE=M070S48
NODE=M070S48

$$\Gamma(\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	BAI	04G BES2	$e^+ e^-$

$$\Gamma_{81}/\Gamma$$

NODE=M070S49
NODE=M070S49

$$\Gamma(\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.6	90	BAI	04G BES2	$e^+ e^-$

$$\Gamma_{82}/\Gamma$$

NODE=M070S50
NODE=M070S50

$$\Gamma(\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	BAI	04G BES2	$e^+ e^-$

$$\Gamma_{83}/\Gamma$$

NODE=M070S51
NODE=M070S51

$$\Gamma(\Sigma^0 \bar{\Lambda})/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	HENRARD	87 DM2	$e^+ e^-$

$$\Gamma_{84}/\Gamma$$

NODE=M070S12
NODE=M070S12

STABLE HADRONS

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

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

$$\Gamma_{85}/\Gamma$$

NODE=M070R9
NODE=M070R9

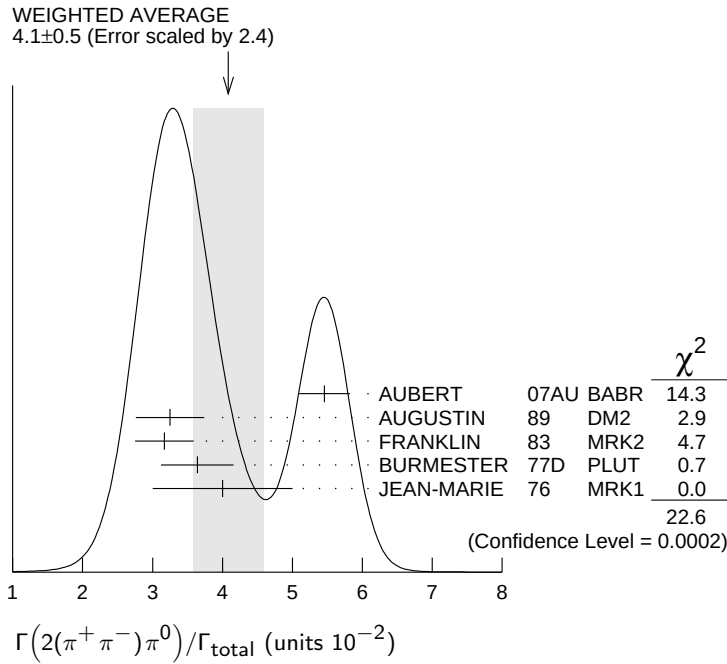
4.1 ± 0.5 OUR AVERAGE Error includes scale factor of 2.4. See the ideogram below.

5.46 ± 0.34 ± 0.14	4990	⁹² 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	$e^+ e^-$

⁹² 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=M070307

NODE=M070R9;LINKAGE=AU



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

Γ_{13}/Γ_{85}

VALUE DOCUMENT ID TECN COMMENT

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

0.3 ⁹³ JEAN-MARIE 76 MRK1 e^+e^-

⁹³ Final state $(\pi^+\pi^-\pi^0)$ under the assumption that $\pi\pi$ is isospin 0.

NODE=M070R25
NODE=M070R25

NODE=M070R25;LINKAGE=J

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

Γ_{86}/Γ

VALUE EVTS DOCUMENT ID TECN COMMENT

0.029±0.006 OUR AVERAGE

0.028±0.009 11 FRANKLIN 83 MRK2 $e^+e^- \rightarrow$ hadrons

0.029±0.007 181 JEAN-MARIE 76 MRK1 e^+e^-

NODE=M070R11
NODE=M070R11

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

Γ_{87}/Γ

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

20.7 ±1.2 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

23.6 ±2.1 ±0.5 256 ⁹⁴ AUBERT 07AU BABR 10.6 $e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$

21.8 ±1.9 ^{95,96} AUBERT,B 04N BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

21.84±0.05±2.01 220k ^{96,97} BAI 04H BES e^+e^-

20.91±0.21±1.16 ^{96,98} BAI 04H BES e^+e^-

15 ±2 168 FRANKLIN 83 MRK2 e^+e^-

NODE=M070R7
NODE=M070R7

OCCUR=2

⁹⁴ 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 $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}} = 0.789 \pm 0.015$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁹⁵ From the ratio of $\Gamma(e^+e^-)B(\pi^+\pi^-\pi^0)$ and $\Gamma(e^+e^-)B(\mu^+\mu^-)$ (AUBERT 04).

⁹⁶ Mostly $\rho\pi$, see also $\rho\pi$ subsection.

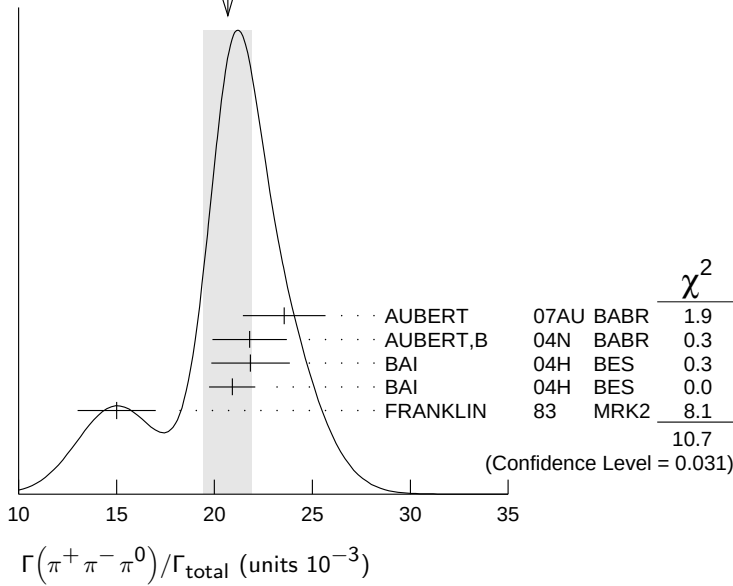
⁹⁷ From $J/\psi \rightarrow \pi^+\pi^-\pi^0$ events directly.

⁹⁸ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^-J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R7;LINKAGE=AU

NODE=M070R;LINKAGE=AU
NODE=M070R;LINKAGE=BU
NODE=M070R;LINKAGE=BA
NODE=M070R;LINKAGE=BI

WEIGHTED AVERAGE
20.7±1.2 (Error scaled by 1.6)



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

Γ_{88}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.79±0.29 OUR AVERAGE		Error includes scale factor of 2.2.		
1.93±0.14±0.05	768	⁹⁹ 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^-
⁹⁹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0 K^+K^-)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] = 0.1070 \pm 0.0043 \pm 0.0064$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070R18
NODE=M070R18

NODE=M070R18;LINKAGE=AU

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

Γ_{89}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
90±30	13	JEAN-MARIE	76 MRK1	e^+e^-

NODE=M070R12
NODE=M070R12

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

Γ_{90}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.6±0.5 OUR AVERAGE				
6.5±0.4±0.2	1.6k	¹⁰⁰ 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	¹⁰¹ AUBERT	05D BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
¹⁰⁰ 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.				
¹⁰¹ 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_{91}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.84±0.28±0.05	73	¹⁰² AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$
¹⁰² 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_{92}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.45±0.31±0.06	203 ± 16	¹⁰³ AUBERT 07AK BABR	10.6	$e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$
¹⁰³ 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_{93}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
61 ± 10 OUR AVERAGE				
55.2±12.0	25	FRANKLIN	83	MRK2 $e^+e^- \rightarrow K^+K^-\pi^0$
78.0±21.0	126	VANNUCCI	77	MRK1 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M070R15
 NODE=M070R15

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.55±0.23 OUR AVERAGE				
3.53±0.12±0.29	1107	¹⁰⁴ ABLIKIM 05H BES2		$e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi \pi^+\pi^-, J/\psi \rightarrow 2(\pi^+\pi^-)$
3.51±0.34±0.09	270	¹⁰⁵ AUBERT 05D BABR	10.6	$e^+e^- \rightarrow 2(\pi^+\pi^-)\gamma$
4.0 ± 1.0	76	JEAN-MARIE 76	MRK1	e^+e^-
¹⁰⁴ Computed using $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.				
¹⁰⁵ 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.				

NODE=M070R8
 NODE=M070R8

NODE=M070R8;LINKAGE=AB
 NODE=M070R8;LINKAGE=AU

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
43 ± 4 OUR AVERAGE				
43.0± 2.9±2.8	496	¹⁰⁶ AUBERT 06D BABR	10.6	$e^+e^- \rightarrow 3(\pi^+\pi^-)\gamma$
40 ± 20	32	JEAN-MARIE 76	MRK1	e^+e^-
¹⁰⁶ 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_{96}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.62±0.09±0.19	761	¹⁰⁷ AUBERT 06D BABR	10.6	$e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$
¹⁰⁷ 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_{97}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.29±0.24 OUR AVERAGE				
2.35±0.39±0.20	85	¹⁰⁸ AUBERT 07AU BABR	10.6	$e^+e^- \rightarrow 2(\pi^+\pi^-)\eta\gamma$
2.26±0.08±0.27	4839	ABLIKIM 05C BES2		$e^+e^- \rightarrow 2(\pi^+\pi^-)\eta$
¹⁰⁸ 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_{98}/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_{99}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.17±0.07 OUR AVERAGE				
2.18±0.16±0.07	317	¹⁰⁹ 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	¹¹⁰ 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^-

NODE=M070R50
 NODE=M070R50

¹⁰⁹WU 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 $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.013 \pm 0.034) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹¹⁰Assuming angular distribution $(1+\cos^2\theta)$.

NODE=M070R50;LINKAGE=WU

NODE=M070R50;LINKAGE=A

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

Γ_{100}/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

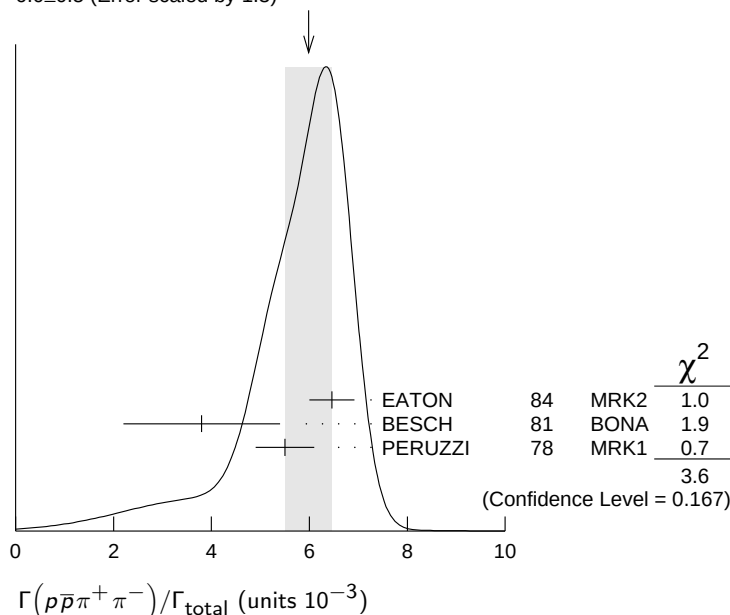
$\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_{101}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0 ±0.5 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
6.46±0.17±0.43	1435	EATON	84 MRK2	e^+e^-
3.8 ±1.6	48	BESCH	81 BONA	e^+e^-
5.5 ±0.6	533	PERUZZI	78 MRK1	e^+e^-

NODE=M070R54
NODE=M070R54

WEIGHTED AVERAGE
6.0±0.5 (Error scaled by 1.3)



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

Γ_{102}/Γ

Including $p\bar{p}\pi^+\pi^-\gamma$ and excluding ω, η, η'

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ±0.9 OUR AVERAGE	Error includes scale factor of 1.9.			
3.36±0.65±0.28	364	EATON	84 MRK2	e^+e^-
1.6 ±0.6	39	PERUZZI	78 MRK1	e^+e^-

NODE=M070R55
NODE=M070R55
NODE=M070R55

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

Γ_{103}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00±0.12 OUR AVERAGE				
1.91±0.02±0.17	13k	¹¹¹ ABLIKIM	09 BES2	e^+e^-
2.03±0.13±0.15	826	EATON	84 MRK2	e^+e^-
2.5 ±1.2		BRANDELIK	79C DASP	e^+e^-
2.3 ±0.4	197	PERUZZI	78 MRK1	e^+e^-

NODE=M070R56
NODE=M070R56

¹¹¹From the combination of $p\bar{p}\eta \rightarrow p\bar{p}\gamma\gamma$ and $p\bar{p}\eta \rightarrow p\bar{p}\pi^+\pi^-\pi^0$ channels.

NODE=M070R56;LINKAGE=AB

$\Gamma(p\bar{p}\rho)/\Gamma_{\text{total}}$

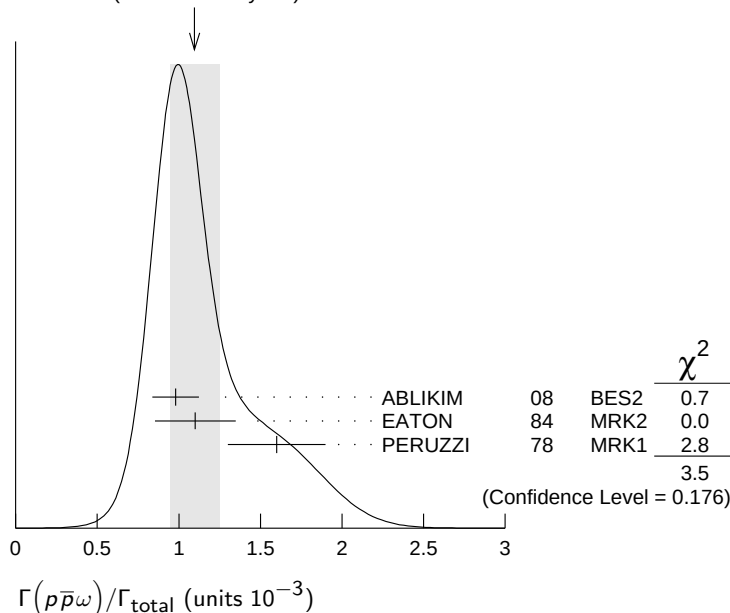
Γ_{104}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	90	EATON	84 MRK2	$e^+e^- \rightarrow \text{hadrons}\gamma$

NODE=M070R57
NODE=M070R57

$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{105}/Γ NODE=M070R58
NODE=M070R58

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.10 ± 0.15 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
$0.98 \pm 0.03 \pm 0.14$	2449	ABLIKIM	08	BES2 e^+e^-
$1.10 \pm 0.17 \pm 0.18$	486	EATON	84	MRK2 e^+e^-
1.6 ± 0.3	77	PERUZZI	78	MRK1 e^+e^-

WEIGHTED AVERAGE
 1.10 ± 0.15 (Error scaled by 1.3) $\Gamma(p\bar{p}\eta'(958))/\Gamma_{\text{total}}$ Γ_{106}/Γ NODE=M070R59
NODE=M070R59

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.21 ± 0.04 OUR AVERAGE				
$0.200 \pm 0.023 \pm 0.028$	265 ± 31	¹¹² ABLIKIM	09	BES2 e^+e^-
$0.68 \pm 0.23 \pm 0.17$	19	EATON	84	MRK2 e^+e^-
1.8 ± 0.6	19	PERUZZI	78	MRK1 e^+e^-

¹¹² From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\gamma\rho^0$ channels.

NODE=M070R59;LINKAGE=AB

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{107}/Γ NODE=M070S22
NODE=M070S22

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.45 \pm 0.13 \pm 0.07$	FALVARD	88	DM2 $J/\psi \rightarrow \text{hadrons}$

 $\Gamma(n\bar{n})/\Gamma_{\text{total}}$ Γ_{108}/Γ NODE=M070R64
NODE=M070R64

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.22 ± 0.04 OUR AVERAGE				
0.231 ± 0.049	79	BALDINI	98	FENI e^+e^-
0.18 ± 0.09		BESCH	78	BONA e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.190 ± 0.055	40	ANTONELLI	93	SPEC e^+e^-

 $\Gamma(n\bar{n}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{109}/Γ NODE=M070R65
NODE=M070R65

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 3.6	5	BESCH	81	BONA e^+e^-

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{110}/Γ NODE=M070S09
NODE=M070S09

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.50 \pm 0.10 \pm 0.22$	399	ABLIKIM	080	BES2 $e^+e^- \rightarrow J/\psi$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.29±0.09 OUR AVERAGE				
1.15±0.24±0.03	113	AUBERT	07BD BABR	$10.6 e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0 \gamma$
1.33±0.04±0.11	1779	ABLIKIM	06 BES2	$J/\psi \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.06±0.04±0.23	884 ± 30	PALLIN	87 DM2	$e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.58±0.16±0.25	90	EATON	84 MRK2	$e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.3 ±0.4	52	PERUZZI	78 MRK1	$e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$

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

2.4 ±2.6 3 BESCH 81 BONA $e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$
 113 AUBERT 07BD reports $[\Gamma(J/\psi(1S) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+ e^-)] = (6.4 \pm 1.2 \pm 0.6) \times 10^{-3}$ keV which we divide by our best value $\Gamma(J/\psi(1S) \rightarrow e^+ e^-) = 5.55 \pm 0.14 \pm 0.02$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R63
 NODE=M070R63

NODE=M070R63;LINKAGE=AU

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

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	114 AUBERT	06D BABR	$10.6 e^+ e^- \rightarrow \omega K^+ K^- 2(\pi^+ \pi^-) \gamma$
31 ±13	30	VANNUCCI	77 MRK1	$e^+ e^-$

114 Using $\Gamma(J/\psi \rightarrow e^+ e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.

NODE=M070R17
 NODE=M070R17

NODE=M070R17;LINKAGE=EE

 $\Gamma(p \bar{n} \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.12±0.09 OUR AVERAGE				
2.36±0.02±0.21	59k	ABLIKIM	06K BES2	$J/\psi \rightarrow p \pi^- \bar{n}$
2.47±0.02±0.24	55k	ABLIKIM	06K BES2	$J/\psi \rightarrow \bar{p} \pi^+ n$
2.02±0.07±0.16	1288	EATON	84 MRK2	$e^+ e^- \rightarrow p \pi^-$
1.93±0.07±0.16	1191	EATON	84 MRK2	$e^+ e^- \rightarrow \bar{p} \pi^+$
1.7 ±0.7	32	BESCH	81 BONA	$e^+ e^- \rightarrow p \pi^-$
1.6 ±1.2	5	BESCH	81 BONA	$e^+ e^- \rightarrow \bar{p} \pi^+$
2.16±0.29	194	PERUZZI	78 MRK1	$e^+ e^- \rightarrow p \pi^-$
2.04±0.27	204	PERUZZI	78 MRK1	$e^+ e^- \rightarrow \bar{p} \pi^+$

NODE=M070R53
 NODE=M070R53

OCCUR=2

OCCUR=2

OCCUR=2

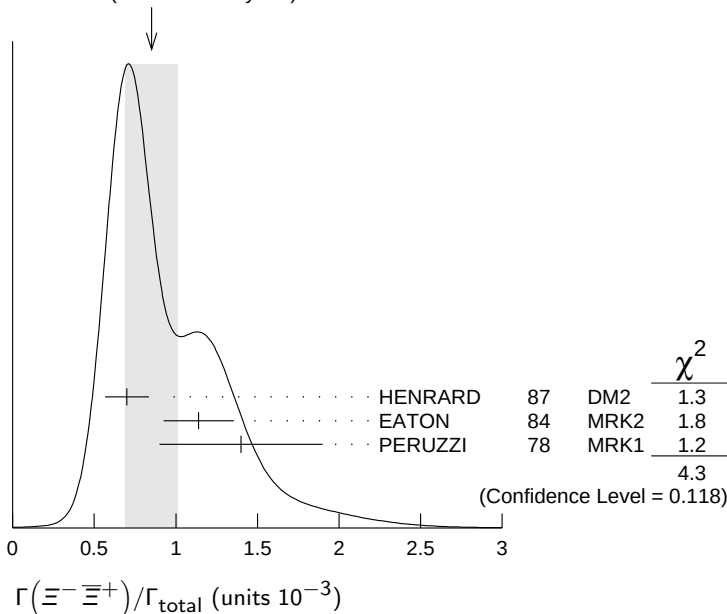
OCCUR=2

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.85±0.16 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.				
0.70±0.06±0.12	132 ± 11	HENRARD	87 DM2	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$
1.14±0.08±0.20	194	EATON	84 MRK2	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$
1.4 ±0.5	51	PERUZZI	78 MRK1	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$

NODE=M070R62
 NODE=M070R62

WEIGHTED AVERAGE
 0.85±0.16 (Error scaled by 1.5)



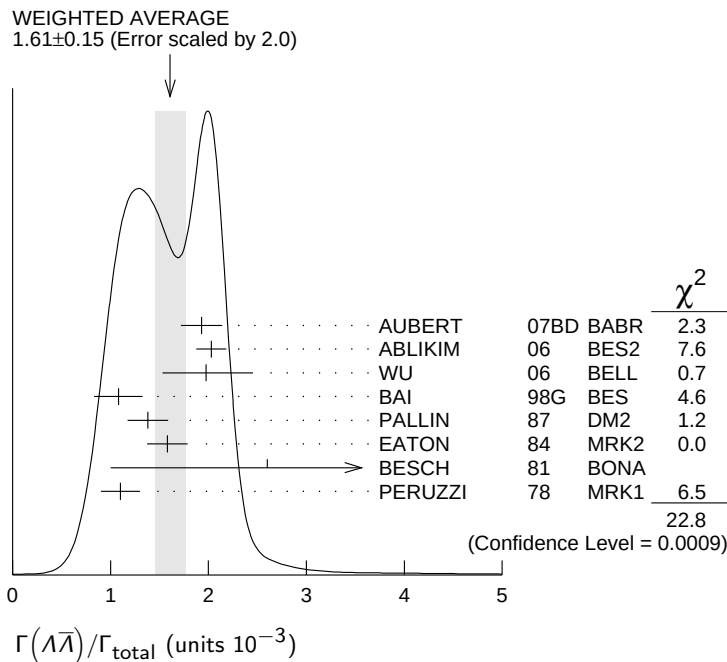
$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$					Γ_{118}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.61 ± 0.15 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.			
$1.93 \pm 0.21 \pm 0.05$	115	AUBERT	07BD BABR	$10.6 e^+ e^- \rightarrow \Lambda\bar{\Lambda}\gamma$	
$2.03 \pm 0.03 \pm 0.15$	8887	ABLIKIM	06 BES2	$J/\psi \rightarrow \Lambda\bar{\Lambda}$	
$2.0^{+0.5}_{-0.4} \pm 0.1$	46	116 WU	06 BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$	
$1.08 \pm 0.06 \pm 0.24$	631	BAI	98G BES	$e^+ e^-$	
$1.38 \pm 0.05 \pm 0.20$	1847	PALLIN	87 DM2	$e^+ e^-$	
$1.58 \pm 0.08 \pm 0.19$	365	EATON	84 MRK2	$e^+ e^-$	
2.6 ± 1.6	5	BESCH	81 BONA	$e^+ e^-$	
1.1 ± 0.2	196	PERUZZI	78 MRK1	$e^+ e^-$	

NODE=M070R60
NODE=M070R60

- ¹¹⁵ 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.
- ¹¹⁶ WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)] = (2.00^{+0.34}_{-0.29} \pm 0.34) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.013 \pm 0.034) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R60;LINKAGE=AU

NODE=M070R60;LINKAGE=WU



$\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$					Γ_{118}/Γ_{99}
VALUE	DOCUMENT ID	TECN	COMMENT		
$0.90^{+0.15}_{-0.14} \pm 0.10$	117 WU	06 BELL	$B^+ \rightarrow p\bar{p}K^+, \Lambda\bar{\Lambda}K^+$		

NODE=M070R79
NODE=M070R79

- ¹¹⁷ Not independent of other $J/\psi \rightarrow \Lambda\bar{\Lambda}, p\bar{p}$ branching ratios reported by WU 06.

NODE=M070R79;LINKAGE=WU

$\Gamma(\Lambda\bar{\Sigma}^- \pi^+ (\text{or c.c.}))/\Gamma_{\text{total}}$					Γ_{119}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.83 ± 0.07 OUR AVERAGE		Error includes scale factor of 1.2.			
$0.770 \pm 0.051 \pm 0.083$	335	118 ABLIKIM	07H BES2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^+ \pi^-$	
$0.747 \pm 0.056 \pm 0.076$	254	118 ABLIKIM	07H BES2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^- \pi^+$	
$0.90 \pm 0.06 \pm 0.16$	225 ± 15	HENRARD	87 DM2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^+ \pi^-$	
$1.11 \pm 0.06 \pm 0.20$	342 ± 18	HENRARD	87 DM2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^- \pi^+$	
$1.53 \pm 0.17 \pm 0.38$	135	EATON	84 MRK2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^+ \pi^-$	
$1.38 \pm 0.21 \pm 0.35$	118	EATON	84 MRK2	$e^+ e^- \rightarrow \Lambda\bar{\Sigma}^- \pi^+$	

NODE=M070R71
NODE=M070R71

OCCUR=2

OCCUR=2

OCCUR=2

- ¹¹⁸ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\Sigma^+ \rightarrow \pi^0 p) = 51.6\%$.

NODE=M070R71;LINKAGE=AB

$\Gamma(pK^-\bar{\Lambda})/\Gamma_{\text{total}}$					Γ_{120}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.89 \pm 0.07 \pm 0.14$	307	EATON	84 MRK2	$e^+ e^-$	

NODE=M070R72
NODE=M070R72

$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{121}/Γ

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

0.76±0.09 OUR AVERAGE

0.74±0.09±0.02	156 ± 15	119 AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow 2(K^+ K^-)\gamma$

1.4 $^{+0.5}_{-0.4}$ ±0.2	11.0 $^{+4.3}_{-3.5}$	120 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	121 AUBERT	05D BABR	10.6 $e^+ e^- \rightarrow 2(K^+ K^-)\gamma$

119 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.

120 Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

121 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_{122}/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_{123}/Γ

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

2.37±0.31 OUR AVERAGE

2.39±0.24±0.22	107	BALTRUSAIT..85D	MRK3	$e^+ e^-$

6

BRANDELIK

79C

DASP

 $e^+ e^-$

NODE=M070R13
NODE=M070R13

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{124}/Γ

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

1.46±0.26 OUR AVERAGE Error includes scale factor of 2.7. See the ideogram below.

1.82±0.04±0.13	2155 ± 45	122 BAI	04A BES2	$J/\psi \rightarrow K_S^0 K_L^0 \rightarrow$

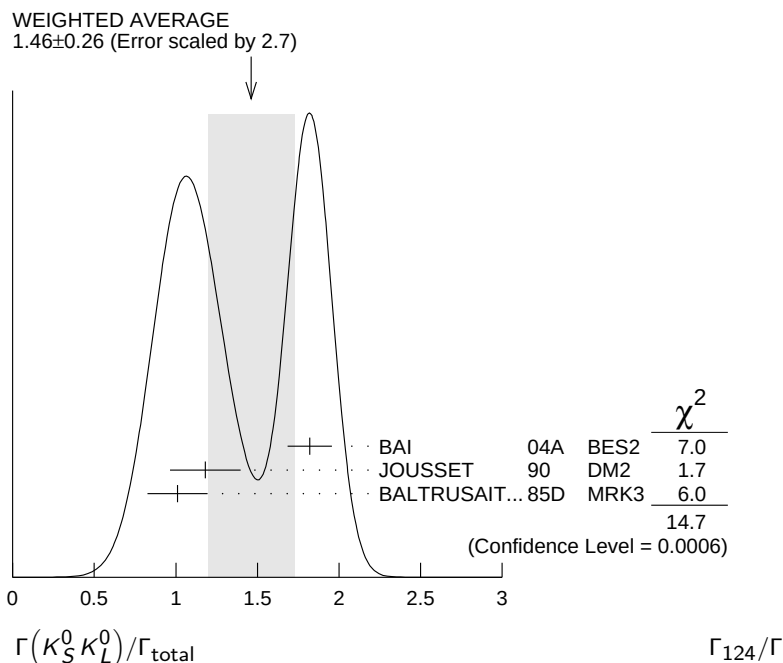
1.18±0.12±0.18		JOUSSET	90 DM2	$J/\psi \rightarrow \pi^+ \pi^- X$

1.01±0.16±0.09	74	BALTRUSAIT..85D	MRK3	$e^+ e^-$

122 Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6868 \pm 0.0027$.

NODE=M070R75
NODE=M070R75

NODE=M070R;LINKAGE=HZ



$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{125}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.62 \pm 0.60 \pm 0.44$	90	44	123 ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$

¹²³ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.

NODE=M070R07
NODE=M070R07

NODE=M070R07;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{126}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.64	90	124	ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$

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

$2.3 \pm 0.7 \pm 0.8$	11	BAI	98G BES	e^+e^-
$2.2 \pm 0.5 \pm 0.5$	19 ± 4	HENRARD	87 DM2	e^+e^-

¹²⁴ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.

NODE=M070S11
NODE=M070S11

NODE=M070S11;LINKAGE=AB

 $\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{127}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$6.46 \pm 0.20 \pm 1.07$	1058	125	ABLIKIM	08C BES2	$e^+e^- \rightarrow J/\psi$

¹²⁵ 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_{128}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.47 ± 0.23 OUR AVERAGE					
$1.58 \pm 0.20 \pm 0.15$	84		BALTRUSAIT..85D	MRK3	e^+e^-
1.0 ± 0.5	5		BRANDELIK 78B	DASP	e^+e^-
1.6 ± 1.6	1		VANNUCCI 77	MRK1	e^+e^-

NODE=M070R6
NODE=M070R6

 $\Gamma(\Lambda\bar{\Sigma} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{129}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.15	90	PERUZZI 78	MRK1	$e^+e^- \rightarrow \Lambda X$

NODE=M070R61
NODE=M070R61

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{130}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	126 BAI 04D	BES	e^+e^-

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

<0.052	90	126 BALTRUSAIT..85C	MRK3	e^+e^-

¹²⁶ Forbidden by CP.

NODE=M070R14
NODE=M070R14

NODE=M070R14;LINKAGE=C

NODE=M070310

RADIATIVE DECAYS

 $\Gamma(3\gamma)/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$12 \pm 3 \pm 2$	$24.2^{+7.2}_{-6.0}$		ADAMS 08	CLEO	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

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

<55	90	PARTRIDGE 80	CBAL	e^+e^-

NODE=M070R81
NODE=M070R81

 $\Gamma(4\gamma)/\Gamma_{\text{total}}$ Γ_{132}/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_{133}/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_{134}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.4 OUR AVERAGE					Error includes scale factor of 1.6.

$2.06 \pm 0.32 \pm 0.03$		127 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	128 AUBERT 06E	BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$

seen	16	BALTRUSAIT..84	MRK3	$J/\psi \rightarrow 2\phi\gamma$

NODE=M070R85
NODE=M070R85

127 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 $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (33.6 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

128 Calculated by the authors using an average of $B(J/\psi \rightarrow \gamma\eta_c) \times B(\eta_c \rightarrow K\bar{K}\pi)$ from BALTRUSAITIS 86, BISELLO 91, BAI 04 and $B(\eta_c \rightarrow K\bar{K}\pi) = (8.5 \pm 1.8)\%$ from AUBERT 06E.

NODE=M070R85;LINKAGE=MI

NODE=M070R85;LINKAGE=AU

$\Gamma(\gamma\eta_c(1S) \rightarrow 3\gamma)/\Gamma_{\text{total}}$		Γ_{135}/Γ		
VALUE (units 10^{-6})	EVT5	DOCUMENT ID	TECN	COMMENT
$1.2^{+2.7}_{-1.1} \pm 0.3$	$1.2^{+2.8}_{-1.1}$	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S08
NODE=M070S08

$\Gamma(\gamma\pi^+\pi^- 2\pi^0)/\Gamma_{\text{total}}$		Γ_{136}/Γ		
VALUE (units 10^{-3})		DOCUMENT ID	TECN	COMMENT
$8.3 \pm 0.2 \pm 3.1$	129	BALTRUSAITIS 86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$

NODE=M070R99
NODE=M070R99

129 4π mass less than 2.0 GeV.

NODE=M070R99;LINKAGE=M

$\Gamma(\gamma\eta\pi\pi)/\Gamma_{\text{total}}$		Γ_{137}/Γ		
VALUE (units 10^{-3})		DOCUMENT ID	TECN	COMMENT
6.1 ± 1.0 OUR AVERAGE				
$5.85 \pm 0.3 \pm 1.05$	130	EDWARDS	83B	CBAL $J/\psi \rightarrow \eta\pi^+\pi^-$
$7.8 \pm 1.2 \pm 2.4$	130	EDWARDS	83B	CBAL $J/\psi \rightarrow \eta 2\pi^0$

NODE=M070R96
NODE=M070R96

OCCUR=2

NODE=M070R96;LINKAGE=M

130 Broad enhancement at 1700 MeV.

$\Gamma(\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$		Γ_{138}/Γ		
VALUE (units 10^{-4})		DOCUMENT ID	TECN	COMMENT
6.2 $\pm 2.2 \pm 0.9$		BAI	99	BES $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M070S37
NODE=M070S37

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma K\bar{K}\pi)/\Gamma_{\text{total}}$		Γ_{139}/Γ		
VALUE (units 10^{-3})		DOCUMENT ID	TECN	COMMENT
2.8 ± 0.6 OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.			

NODE=M070R89
NODE=M070R89

$1.66 \pm 0.1 \pm 0.58$	131,132	BAI	00D	BES $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
$3.8 \pm 0.3 \pm 0.6$	133	AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma K\bar{K}\pi$
$4.0 \pm 0.7 \pm 1.0$	133	EDWARDS	82E	CBAL $J/\psi \rightarrow K^+ K^- \pi^0 \gamma$
4.3 ± 1.7	133,134	SCHARRE	80	MRK2 e^+e^-

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

$1.78 \pm 0.21 \pm 0.33$	133,135,136	AUGUSTIN	92	DM2 $J/\psi \rightarrow \gamma K\bar{K}\pi$
$0.83 \pm 0.13 \pm 0.18$	133,137,138	AUGUSTIN	92	DM2 $J/\psi \rightarrow \gamma K\bar{K}\pi$
$0.66^{+0.17+0.24}_{-0.16-0.15}$	133,136,139	BAI	90C	MRK3 $J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$1.03^{+0.21+0.26}_{-0.18-0.19}$	133,138,140	BAI	90C	MRK3 $J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

OCCUR=2

OCCUR=2

131 Interference with the $J/\psi(1S)$ radiative transition to the broad $K\bar{K}\pi$ pseudoscalar state around 1800 is $(0.15 \pm 0.01 \pm 0.05) \times 10^{-3}$.

NODE=M070R89;LINKAGE=BD

132 Interference with $J/\psi \rightarrow \gamma f_1(1420)$ is $(-0.03 \pm 0.01 \pm 0.01) \times 10^{-3}$.

NODE=M070R89;LINKAGE=BE

133 Includes unknown branching fraction $\eta(1405) \rightarrow K\bar{K}\pi$.

NODE=M070R89;LINKAGE=B

134 Corrected for spin-zero hypothesis for $\eta(1405)$.

NODE=M070R89;LINKAGE=C

135 From fit to the $a_0(980)\pi 0^-+$ partial wave.

NODE=M070R89;LINKAGE=H

136 $a_0(980)\pi$ mode.

NODE=M070R89;LINKAGE=K9

137 From fit to the $K^*(892)K 0^-+$ partial wave.

NODE=M070R89;LINKAGE=J

138 K^*K mode.

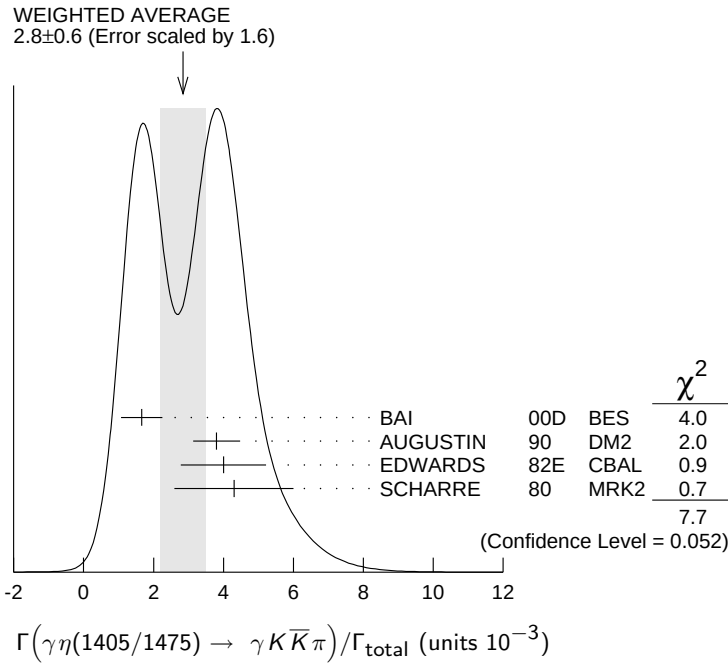
NODE=M070R89;LINKAGE=K8

139 From $a_0(980)\pi$ final state.

NODE=M070R89;LINKAGE=D

140 From $K^*(890)K$ final state.

NODE=M070R89;LINKAGE=E



$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0) / \Gamma_{\text{total}}$

Γ_{140}/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	¹⁴¹ BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
0.64 ± 0.12 ± 0.07	¹⁴¹ COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$

¹⁴¹ 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_{141}/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	¹⁴²	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	261 ¹⁴³	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

¹⁴² Via $a_0(980)\pi$.

¹⁴³ Includes unknown branching fraction to $\eta\pi^+\pi^-$.

NODE=M070S29
NODE=M070S29

NODE=M070S29;LINKAGE=RR
NODE=M070S29;LINKAGE=R

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi) / \Gamma_{\text{total}}$

Γ_{142}/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_{143}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
4.5 ± 0.8 OUR AVERAGE				
4.7 ± 0.3 ± 0.9		¹⁴⁴ BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
3.75 ± 1.05 ± 1.20		¹⁴⁵ BURKE	82 MRK2	$J/\psi \rightarrow 4\pi\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.09	90	¹⁴⁶ BISELLO	89B	$J/\psi \rightarrow 4\pi\gamma$

¹⁴⁴ 4π mass less than 2.0 GeV.

¹⁴⁵ 4π mass less than 2.0 GeV. We have multiplied $2\rho^0$ measurement by 3 to obtain 2ρ .

¹⁴⁶ 4π mass in the range 2.0–25 GeV.

NODE=M070R94
NODE=M070R94

NODE=M070R94;LINKAGE=N
NODE=M070R94;LINKAGE=M
NODE=M070R94;LINKAGE=A

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

Γ_{144}/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_{145}/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_{146}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.16±0.15 OUR AVERAGE		Error includes scale factor of 1.1.		
4.86±0.23±0.08		147 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	$e^+e^- \rightarrow 2\gamma\rho$

147 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 $B(\eta'(958) \rightarrow \pi^+\pi^-\eta) = (43.4 \pm 0.7) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$. 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

 $\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ Γ_{147}/Γ

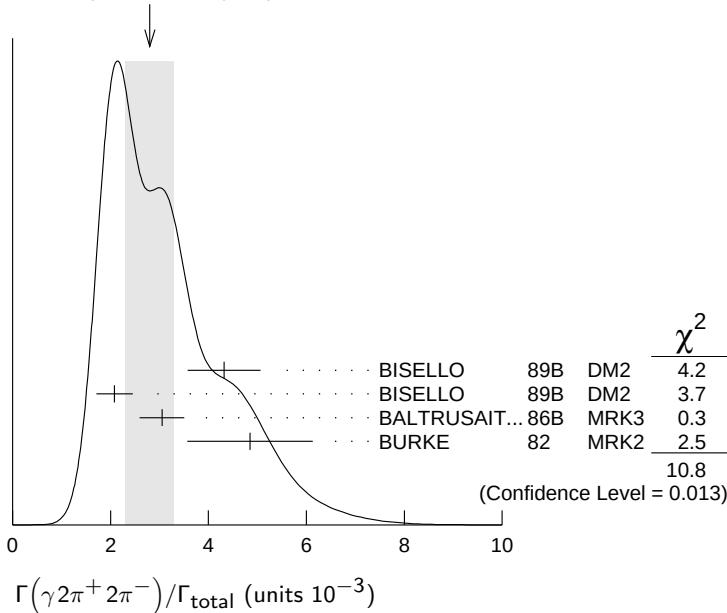
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.8 ±0.5 OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.		
4.32±0.14±0.73	148 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$
2.08±0.13±0.35	149 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$
3.05±0.08±0.45	149 BALTRUSAIT..	86B MRK3	$J/\psi \rightarrow 4\pi\gamma$
4.85±0.45±1.20	150 BURKE	82 MRK2	e^+e^-
148 4π mass less than 3.0 GeV.			
149 4π mass less than 2.0 GeV.			
150 4π mass less than 2.5 GeV.			

NODE=M070R95
NODE=M070R95

OCCUR=2

NODE=M070R95;LINKAGE=A
NODE=M070R95;LINKAGE=B
NODE=M070R95;LINKAGE=M

WEIGHTED AVERAGE
2.8±0.5 (Error scaled by 1.9)

 $\Gamma(\gamma f_2(1270) f_2(1270))/\Gamma_{\text{total}}$ Γ_{148}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.5±0.7±1.6	646 ± 45	ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M070S45
NODE=M070S45

 $\Gamma(\gamma f_2(1270) f_2(1270) (\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{149}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.2±0.8±1.7	151 ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M070S46
NODE=M070S46

151 Subtracting contribution from intermediate $\eta_c(1S)$ decays.

NODE=M070S46;LINKAGE=AB

$$\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{150}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1±0.1±0.6	1516	BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

NODE=M070B05
NODE=M070B05

$$\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}} \quad \Gamma_{151}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.7±0.5±0.5	152 BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M070S7
NODE=M070S7

152 Assuming branching fraction $f_4(2050) \rightarrow \pi\pi/\text{total} = 0.167$.

NODE=M070S7;LINKAGE=V

$$\Gamma(\gamma \omega \omega)/\Gamma_{\text{total}} \quad \Gamma_{152}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.61±0.33 OUR AVERAGE				
6.0 ±4.8 ±1.8		ABLIKIM	08A BES2	$J/\psi \rightarrow \gamma \omega \pi^+ \pi^-$
1.41±0.2 ±0.42	120 ± 17	BISELLO	87 SPEC	$e^+ e^-$, hadrons γ
1.76±0.09±0.45		BALTRUSAIT..85C	MRK3	$e^+ e^- \rightarrow \text{hadrons } \gamma$

NODE=M070R97
NODE=M070R97

$$\Gamma(\gamma \eta(1405/1475) \rightarrow \gamma \rho^0 \rho^0)/\Gamma_{\text{total}} \quad \Gamma_{153}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.7 ±0.4 OUR AVERAGE	Error includes scale factor of 1.3.		
2.1 ±0.4	BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1.36±0.38	153,154 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi \gamma$

NODE=M070S19
NODE=M070S19

153 Estimated by us from various fits.

154 Includes unknown branching fraction to $\rho^0 \rho^0$.

NODE=M070S19;LINKAGE=A
NODE=M070S19;LINKAGE=B

$$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}} \quad \Gamma_{154}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.43±0.11 OUR AVERAGE				
1.62±0.26 ^{+0.02} _{-0.05}	155	ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
1.42±0.21 ^{+0.02} _{-0.04}	156	ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$
1.33±0.05±0.20	157	AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1.36±0.09±0.23	157	BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1.48±0.25±0.30	178	EDWARDS	82B CBAL	$e^+ e^- \rightarrow 2\pi^0 \gamma$
2.0 ±0.7	35	ALEXANDER	78 PLUT	$e^+ e^-$
1.2 ±0.6	30	158 BRANDELIK	78B DASP	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$

NODE=M070R86
NODE=M070R86

155 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.

OCCUR=2

156 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.

NODE=M070R86;LINKAGE=AL

157 Estimated using $B(f_2(1270) \rightarrow \pi\pi)=0.843 \pm 0.012$. The errors do not contain the uncertainty in the $f_2(1270)$ decay.

NODE=M070R86;LINKAGE=X

158 Restated by us to take account of spread of E1, M2, E3 transitions.

NODE=M070R86;LINKAGE=T

$$\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}} \quad \Gamma_{155}/\Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
8.5 ± 1.2 0.9 OUR AVERAGE		Error includes scale factor of 1.2.		

NODE=M070R91
NODE=M070R91

9.62±0.29 ^{+3.51} _{-1.86}	159	BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
5.0 ± 0.8 ^{+1.8} _{-0.4}	160,161	BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
9.2 ± 1.4±1.4	161	AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
10.4 ± 1.2±1.6	161	AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
9.6 ± 1.2±1.8	161	BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=2

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

1.6 ± 0.2 ^{+0.6} _{-0.2}	161,162	BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
< 0.8	90	163 BISELLO	89B	$J/\psi \rightarrow 4\pi \gamma$
1.6 ± 0.4±0.3	164	BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
3.8 ± 1.6	165	EDWARDS	82D CBAL	$e^+ e^- \rightarrow \eta \eta \gamma$

OCCUR=2

OCCUR=2

159 Includes unknown branching ratio to $K^+ K^-$ or $K_S^0 K_S^0$.

160 Assuming $J^P = 2^+$ for $f_0(1710)$.

161 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.

162 Assuming $J^P = 0^+$ for $f_0(1710)$.

163 Includes unknown branching fraction to $\rho^0 \rho^0$.

164 Includes unknown branching fraction to $\pi^+ \pi^-$.

165 Includes unknown branching fraction to $\eta \eta$.

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_{156} / Γ

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

4.0 ± 1.0 OUR AVERAGE

3.96 $\pm 0.06 \pm 1.12$	166 ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$

3.99 $\pm 0.15 \pm 2.64$	166 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	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

166 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_{157} / 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_{158} / 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_{159} / 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 $\pm 0.15 \pm 0.21$

167,168

AUGUSTIN

92

DM2

$J/\psi \rightarrow \gamma K \bar{K} \pi$

0.87 $\pm 0.14^{+0.14}_{-0.11}$

167

BAI

90C

MRK3

$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M070S31

NODE=M070S31

OCCUR=2

167 Included unknown branching fraction $f_1(1420) \rightarrow K \bar{K} \pi$.

168 From fit to the $K^*(892) K 1^+ 1^+$ partial wave.

NODE=M070S31;LINKAGE=A

NODE=M070S31;LINKAGE=D

$\Gamma(\gamma f_1(1285)) / \Gamma_{\text{total}}$

Γ_{160} / Γ

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

0.61 ± 0.08 OUR AVERAGE

0.69 $\pm 0.16 \pm 0.20$

169

BAI

04J

BES2

$J/\psi \rightarrow \gamma \gamma \rho^0$

0.61 $\pm 0.04 \pm 0.21$

170

BAI

00D

BES

$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

0.45 $\pm 0.09 \pm 0.17$

171

BAI

99

BES

$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

0.625 $\pm 0.063 \pm 0.103$

172

BOLTON

92

MRK3

$J/\psi \rightarrow \gamma f_1(1285)$

0.70 $\pm 0.08 \pm 0.16$

173

BOLTON

92B

MRK3

$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

169 Assuming $B(f_1(1285) \rightarrow \rho^0 \gamma) = 0.055 \pm 0.013$.

170 Assuming $\Gamma(f_1(1285) \rightarrow K \bar{K} \pi) / \Gamma_{\text{total}} = 0.090 \pm 0.004$.

171 Assuming $\Gamma(f_1(1285) \rightarrow \eta \pi \pi) / \Gamma_{\text{total}} = 0.5 \pm 0.18$.

172 Obtained summing the sequential decay channels

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \pi \pi \pi \pi) = (1.44 \pm 0.39 \pm 0.27) \times 10^{-4}$;

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow \eta \pi) = (3.90 \pm 0.42 \pm 0.87) \times 10^{-4}$;

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow K \bar{K}) = (0.66 \pm 0.26 \pm 0.29) \times 10^{-4}$;

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \gamma \rho^0) = (0.25 \pm 0.07 \pm 0.03) \times 10^{-4}$.

173 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

NODE=M070R88

NODE=M070R88;LINKAGE=BI

NODE=M070R88;LINKAGE=BD

NODE=M070R88;LINKAGE=BA

NODE=M070R88;LINKAGE=B

NODE=M070R88;LINKAGE=A

$\Gamma(\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{161}/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_{162}/Γ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID

TECN

COMMENT

 $4.5^{+0.7}_{-0.4}$ OUR AVERAGE $3.85 \pm 0.17^{+1.91}_{-0.73}$

174 BAI

03G

BES

 $J/\psi \rightarrow \gamma K \bar{K}$ $3.6 \pm 0.4^{+1.4}_{-0.4}$

174 BAI

96C

BES

 $J/\psi \rightarrow \gamma K^+ K^-$ $5.6 \pm 1.4 \pm 0.9$

174 AUGUSTIN

88

DM2

 $J/\psi \rightarrow \gamma K^+ K^-$ $4.5 \pm 0.4 \pm 0.9$

174 AUGUSTIN

88

DM2

 $J/\psi \rightarrow \gamma K_S^0 K_S^0$ $6.8 \pm 1.6 \pm 1.4$

174 BALTRUSAIT..87

MRK3

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

OCCUR=3

OCCUR=4

OCCUR=2

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

<3.4 90 4 175 BRANDELIK 79C DASP $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$ <2.3 90 3 ALEXANDER 78 PLUT $e^+ e^- \rightarrow K^+ K^- \gamma$ 174 Using $B(f'_2(1525) \rightarrow K \bar{K}) = 0.888$.175 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_{163}/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_{164}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $0.20 \pm 0.04 \pm 0.13$

151

ABLIKIM

06H

BES

 $J/\psi \rightarrow \gamma \omega \omega$ NODE=M070R03
NODE=M070R03 $\Gamma(\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{165}/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_{166}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $4.0 \pm 0.3 \pm 1.3$

320

176 BAI

00B

BES

 $J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$ NODE=M070B07
NODE=M070B07

176 Summed over all charges.

NODE=M070R;LINKAGE=B7

 $\Gamma(\gamma \phi \phi)/\Gamma_{\text{total}}$ Γ_{167}/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

177 BISELLO

90

DM2

 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$ $3.1 \pm 0.7 \pm 0.4$

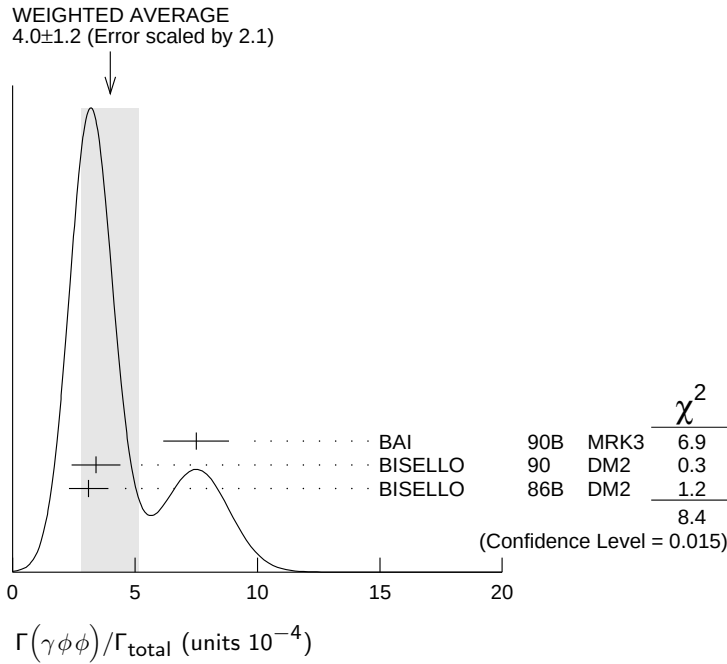
177 BISELLO

86B

DM2

 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$ 177 $\phi \phi$ mass less than 2.9 GeV, η_c excluded.

NODE=M070R98;LINKAGE=C



$\Gamma(\gamma\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{168}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.38±0.07±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_{169}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.33±0.05 OUR AVERAGE				
0.44±0.04±0.08	196 ± 19	178 ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
0.33±0.08±0.05		178 BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
0.27±0.06±0.06		178 BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
0.24 ^{+0.15} _{-0.10}	179,180	BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M070S21
NODE=M070S21

OCCUR=2

178 Includes unknown branching fraction to $\phi\phi$.

179 Estimated by us from various fits.

180 Includes unknown branching fraction to $\rho^0\rho^0$.

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_{170}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.13±0.09	181,182 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M070S20
NODE=M070S20

181 Estimated by us from various fits.

182 Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S20;LINKAGE=A
NODE=M070S20;LINKAGE=B

$\Gamma(\gamma\eta(1760) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}}$ Γ_{171}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.98±0.08±0.32	1045	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$

NODE=M070R04
NODE=M070R04

$\Gamma(\gamma X(1835) \rightarrow \gamma\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{172}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.6 ±0.4 OUR AVERAGE				

NODE=M070R78
NODE=M070R78

2.87±0.09^{+0.49}_{-0.52} 4265 183 ABLIKIM 11C BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

2.2 ±0.4 ±0.4 264 ABLIKIM 05R BES2 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

183 From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two unconfirmed states $\gamma X(2120)$, and $\gamma X(2370)$, for $M(p\bar{p}) < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.

NODE=M070R78;LINKAGE=AI

$\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{173}/Γ

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

NODE=M070S71
NODE=M070S71

0.75^{+0.19}_{-0.09} OUR AVERAGE

1.14 ^{+0.43+0.42} _{-0.30-0.26}	231	184 ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma p \bar{p}$
0.70 $\pm$ 0.04 ^{+0.19} _{-0.08}		BAI	03F BES2	$J/\psi \rightarrow \gamma p \bar{p}$

184 From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M070S71;LINKAGE=AL

 $\Gamma(\gamma(K\bar{K}\pi)[J^{PC}=0^{-+}])/\Gamma_{\text{total}}$ Γ_{174}/Γ

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

NODE=M070S38
NODE=M070S38

0.7 $\pm$ 0.4 OUR AVERAGE Error includes scale factor of 2.1.

0.58 $\pm$ 0.03 $\pm$ 0.20	185 BAI	00D BES	$J/\psi \rightarrow \gamma K^{\pm} K_S^0 \pi^{\mp}$
2.1 $\pm$ 0.1 $\pm$ 0.7	186 BAI	00D BES	$J/\psi \rightarrow \gamma K^{\pm} K_S^0 \pi^{\mp}$

OCCUR=2

185 For a broad structure around 1800 MeV.

NODE=M070S38;LINKAGE=BD
NODE=M070S38;LINKAGE=BE

186 For a broad structure around 2040 MeV.

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{175}/Γ

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

NODE=M070R82
NODE=M070R82

3.49^{+0.33}_{-0.30} OUR AVERAGE

3.63 $\pm$ 0.36 $\pm$ 0.13		PEDLAR	09 CLE3	$J/\psi \rightarrow \pi^0 \gamma$
3.13 ^{+0.65} _{-0.47}	586	ABLIKIM	06E BES2	$J/\psi \rightarrow \pi^0 \gamma$

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

3.6 $\pm$ 1.1 $\pm$ 0.7		BLOOM	83 CBAL	$e^+ e^-$
7.3 $\pm$ 4.7	10	BRANDELIK	79C DASP	$e^+ e^-$

 $\Gamma(\gamma p \bar{p} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{176}/Γ

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

NODE=M070R93
NODE=M070R93

<0.79	90	EATON	84 MRK2	$e^+ e^-$

 $\Gamma(\gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{177}/Γ

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

NODE=M070S8
NODE=M070S8

<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	$e^+ e^-$

 $\Gamma(\gamma f_0(2200))/\Gamma_{\text{total}}$ Γ_{178}/Γ

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

NODE=M070S18
NODE=M070S18

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

1.5	187 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

187 Includes unknown branching fraction to $K_S^0 K_S^0$.

NODE=M070S18;LINKAGE=A

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{179}/Γ

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

NODE=M070R92
NODE=M070R92

>250	99.9	188 HASAN	96 SPEC	$\bar{p} p \rightarrow \pi^+ \pi^-$

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

>300		189 BAI	96B BES	$e^+ e^- \rightarrow \gamma \bar{p} p, K \bar{K}$
< 2.3	95	190 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
< 1.6	95	190 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
12.4 ^{+6.4} _{-5.2} $\pm$ 2.8	23	190 BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
8.4 ^{+3.4} _{-2.8} $\pm$ 1.6	93	190 BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=2

OCCUR=2

188 Using BAI 96B.

NODE=M070R92;LINKAGE=M

189 Using BARNES 93.

NODE=M070R92;LINKAGE=A

190 Includes unknown branching fraction to $K^+ K^-$ or $K_S^0 K_S^0$.

NODE=M070R92;LINKAGE=W

$\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{180} / 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_{181} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
< 3.6	191 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	191 DEL-AMO-SA..100	BABR	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
$6.6 \pm 2.9 \pm 2.4$	BAI	96B BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
$10.8 \pm 4.0 \pm 3.2$	BAI	96B BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070B03
NODE=M070B03

OCCUR=2

OCCUR=2

191 For spin 2 and helicity 0; other combinations lead to more stringent upper limits.

NODE=M070B03;LINKAGE=DE

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \rho \bar{\rho}) / \Gamma_{\text{total}}$ Γ_{182} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.6 \pm 0.5$	BAI	96B BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \rho \bar{\rho}$

NODE=M070B04
NODE=M070B04

 $\Gamma(\gamma f_0(1500)) / \Gamma_{\text{total}}$ Γ_{183} / Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.01 ± 0.32 OUR AVERAGE			
$1.00 \pm 0.03 \pm 0.45$	192 ABLIKIM	06v BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$1.02 \pm 0.09 \pm 0.45$	192 ABLIKIM	06v BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$

NODE=M070S32
NODE=M070S32

OCCUR=2

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

>5.7 ± 0.8 193,194 BUGG 95 MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$

192 Including unknown branching fraction to $\pi \pi$.

193 Including unknown branching ratio for $f_0(1500) \rightarrow \pi^+ \pi^- \pi^+ \pi^-$.

194 Assuming that $f_0(1500)$ decays only to two S -wave dipions.

NODE=M070S32;LINKAGE=AB
NODE=M070S32;LINKAGE=A
NODE=M070S32;LINKAGE=B

 $\Gamma(\gamma A \rightarrow \gamma \text{invisible}) / \Gamma_{\text{total}}$ Γ_{184} / Γ
(narrow state A with $m_A < 960$ MeV)

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	195 INSLEER	10 CLEO	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070S68
NODE=M070S68

195 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;LINKAGE=IN

WEAK DECAYS

 $\Gamma(D^- e^+ \nu_e + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{185} / 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_{186} / 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_{187} / Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.6	90	196 ABLIKIM	06M BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S55
NODE=M070S55

196 Using $B(D_s^- \rightarrow \phi \pi^-) = 4.4 \pm 0.5 \%$.

NODE=M070S55;LINKAGE=AB

 $\Gamma(D^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{188} / 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_{189} / 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_{190}/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_{191}/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	¹⁹⁷ 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	$e^+ e^-$

NODE=M070R80
NODE=M070R80

¹⁹⁷ 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 $B(B^+ \rightarrow J/\psi(1S) K^+) = 1.013 \times 10^{-3}$.

NODE=M070R80;LINKAGE=WI

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

$\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$					Γ_{192}/Γ
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.1	90	BAI	03D	BES	$e^+ e^- \rightarrow J/\psi$

NODE=M070315

NODE=M070S39
NODE=M070S39

$\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$					Γ_{193}/Γ
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	
<8.3	90	ABLIKIM	04	BES	$e^+ e^- \rightarrow J/\psi$

NODE=M070S40
NODE=M070S40

$\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$					Γ_{194}/Γ
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	
<2.0	90	ABLIKIM	04	BES	$e^+ e^- \rightarrow J/\psi$

NODE=M070S41
NODE=M070S41

OTHER DECAYS

$\Gamma(\text{invisible})/\Gamma(\mu^+ \mu^-)$					Γ_{195}/Γ_7
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<1.2 \times 10^{-2}$	90	ABLIKIM	08G	BES2	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070325

NODE=M070S60
NODE=M070S60

$J/\psi(1S)$ REFERENCES

NODE=M070

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 091101R	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 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 031101R	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	06K	PRL 97 062001	M. Ablikim <i>et al.</i>	(BES 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 051103R	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 091103R	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05B	PR D71 032003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50496
ABLIKIM	05C	PL B610 192	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50507
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50985
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
LI	05C	PR D71 111103	Z. Li <i>et al.</i>	(CLEO Collab.)	REFID=50802
ABLIKIM	04	PL B598 172	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49739
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
AUBERT	04	PR D69 011103	B. Aubert <i>et al.</i>	(BaBar Collab.)	REFID=49611
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49620
BAI	04A	PR D69 012003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49607
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04E	PL B591 42	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49751
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04H	PR D70 012005	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49754
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
SETH	04	PR D69 097503	K.K. Seth		REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03D	PL B561 49	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49403
BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)	REFID=49473
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REFID=49621
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	00B	PL B472 200	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47427
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47954
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46606
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98G	PL B424 213	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46341
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46342
BALDINI	98	PL B444 111	R. Baldini <i>et al.</i>	(FENICE Collab.)	REFID=46608
ARMSTRONG	96	PR D54 7067	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45146
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44736
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
BAI	96D	PR D54 1221	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45198
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 Collab., E706 Collab.)	REFID=44739
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)	REFID=45197
BAI	95B	PL B355 374	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44434
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ANTONELLI	93	PL B301 317	A. Antonelli <i>et al.</i>	(FENICE Collab.)	REFID=43314
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)	REFID=43601
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42175
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42176
COFFMAN	92	PRL 68 282	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41866
HSUEH	92	PR D45 R2181	S. Hsueh, S. Palestini	(FNAL, TORI)	REFID=41899
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41668
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41354
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
BISELLO	90	PL B241 617	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41359
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
JOUSSET	90	PR D41 1389	J. Jousset <i>et al.</i>	(DM2 Collab.)	REFID=41349
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REFID=40345
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
COFFMAN	88	PR D38 2695	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=40346
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BAGLIN	87	NP B286 592	C. Baglin <i>et al.</i>	(LAPP, CERN, GENO, LYON+)	REFID=40002
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40012
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
HENRARD	87	NP B292 670	P. Henrard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40261
PALLIN	87	NP B292 653	D. Pallin <i>et al.</i>	(CLER, FRAS, LALO, PADO)	REFID=40243
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
BALTRUSAIT...	86B	PL B339 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)	REFID=21865
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=22101
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
BALTRUSAIT...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095
BALTRUSAIT...	85D	PR D32 566	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22097
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22006
EATON	84	PR D29 804	M.W. Eaton <i>et al.</i>	(LBL, SLAC)	REFID=22092
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21318
FRANKLIN	83	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REFID=22216
BURKE	82	PRL 49 632	D.L. Burke <i>et al.</i>	(LBL, SLAC)	REFID=21676
EDWARDS	82B	PR D25 3065	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22080
EDWARDS	82D	PRL 48 458	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21677
Also		ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
BESCH	81	ZPHY C8 1	H.J. Besch <i>et al.</i>	(BONN, DESY, MANZ)	REFID=22077
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
PARTRIDGE	80	PRL 44 712	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22073
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
Translated from YAF 34 1471.					

BRANDELIK	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)
ALEXANDER	78	PL 72B 493	G. Alexander <i>et al.</i>	(DESY, HAMB, SIEG+)
BESCH	78	PL 78B 347	H.J. Besch <i>et al.</i>	(BONN, DESY, MANZ)
BRANDELIK	78B	PL 74B 292	R. Brandelik <i>et al.</i>	(DASP Collab.)
PERUZZI	78	PR D17 2901	I. Peruzzi <i>et al.</i>	(SLAC, LBL)
BARTEL	77	PL 66B 489	W. Bartel <i>et al.</i>	(DESY, HEIDP)
BURMESTER	77D	PL 72B 135	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
VANNUCCI	77	PR D15 1814	F. Vannucci <i>et al.</i>	(SLAC, LBL)
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)
BRAUNSCH...	76	PL 63B 487	W. Braunschweig <i>et al.</i>	(DASP Collab.)
JEAN-MARIE	76	PRL 36 291	B. Jean-Marie <i>et al.</i>	(SLAC, LBL) IG
BALDINI-...	75	PL 58B 471	R. Baldini-Celio <i>et al.</i>	(FRAS, ROMA)
BOYARSKI	75	PRL 34 1357	A.M. Boyarski <i>et al.</i>	(SLAC, LBL) JPC
DASP	75	PL 56B 491	W. Braunschweig <i>et al.</i>	(DASP Collab.)
ESPOSITO	75B	LNC 14 73	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)
FORD	75	PRL 34 604	R.L. Ford <i>et al.</i>	(SLAC, PENN)

REFID=22114
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REFID=22039

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NODE=M870

NODE=M056

$$\chi_{c0}(1P) \quad I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M056M

NODE=M056M

$\chi_{c0}(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3414.75 ± 0.31 OUR AVERAGE				
3414.2 ± 0.5 ± 2.3	5.4k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow \text{hadrons}$
3406 ± 7 ± 6	230	¹ ABE	07	BELL $e^+e^- \rightarrow J/\psi(c\bar{c})$
3414.21 ± 0.39 ± 0.27		ABLIKIM	05G	BES2 $\psi(2S) \rightarrow \gamma\chi_{c0}$
3414.7 $^{+0.7}_{-0.6}$ ± 0.2		² ANDREOTTI	03	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
3415.5 ± 0.4 ± 0.4	392	³ BAGNASCO	02	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
3417.4 $^{+1.8}_{-1.9}$ ± 0.2		² AMBROGIANI	99B	E835 $\bar{p}p \rightarrow e^+e^-\gamma$
3414.1 ± 0.6 ± 0.8		BAI	99B	BES $\psi(2S) \rightarrow \gamma X$
3417.8 ± 0.4 ± 4		² GAISER	86	CBAL $\psi(2S) \rightarrow \gamma X$
3416 ± 3 ± 4		⁴ TANENBAUM	78	MRK1 e^+e^-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3416.5 ± 3.0		EISENSTEIN	01	CLE2 $e^+e^- \rightarrow e^+e^-\chi_{c0}$
3422 ± 10		⁴ BARTEL	78B	CNTR $e^+e^- \rightarrow J/\psi 2\gamma$
3415 ± 9		⁴ BIDDICK	77	CNTR $e^+e^- \rightarrow \gamma X$

¹ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

² Using mass of $\psi(2S) = 3686.0$ MeV.

³ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

⁴ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

NODE=M056M;LINKAGE=EB
NODE=M056M;LINKAGE=C
NODE=M056M;LINKAGE=NW
NODE=M056M;LINKAGE=D

$\chi_{c0}(1P)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.4 ± 0.6 OUR FIT				
10.5 ± 0.8 OUR AVERAGE Error includes scale factor of 1.1.				
10.6 ± 1.9 ± 2.6	5.4k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow \text{hadrons}$
12.6 $^{+1.5+0.9}_{-1.6-1.1}$		ABLIKIM	05G	BES2 $\psi(2S) \rightarrow \gamma\chi_{c0}$
8.6 $^{+1.7}_{-1.3}$ ± 0.1		ANDREOTTI	03	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
9.7 ± 1.0	392	⁵ BAGNASCO	02	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
16.6 $^{+5.2}_{-3.7}$ ± 0.1		AMBROGIANI	99B	E835 $\bar{p}p \rightarrow e^+e^-\gamma$
14.3 ± 2.0 ± 3.0		BAI	98I	BES $\psi(2S) \rightarrow \gamma\pi^+\pi^-$
13.5 ± 3.3 ± 4.2		GAISER	86	CBAL $\psi(2S) \rightarrow \gamma X, \gamma\pi^0\pi^0$

⁵ Recalculated by ANDREOTTI 05A.

NODE=M056W

NODE=M056W

NODE=M056W;LINKAGE=AN

$\chi_{c0}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level

NODE=M056215;NODE=M056

Hadronic decays

NODE=M056;CLUMP=A

Γ_1	$2(\pi^+\pi^-)$	$(2.26 \pm 0.19) \%$		DESIG=3
Γ_2	$\rho^0 \pi^+\pi^-$	$(8.8 \pm 2.8) \times 10^{-3}$		DESIG=9
Γ_3	$\rho^0 \rho^0$			DESIG=54
Γ_4	$f_0(980) f_0(980)$	$(6.7 \pm 2.1) \times 10^{-4}$		DESIG=20
Γ_5	$\pi^+\pi^-\pi^0\pi^0$	$(3.4 \pm 0.4) \%$		DESIG=61
Γ_6	$\rho^+\pi^-\pi^0 + \text{c.c.}$	$(2.9 \pm 0.4) \%$		DESIG=62
Γ_7	$4\pi^0$	$(3.3 \pm 0.4) \times 10^{-3}$		DESIG=70
Γ_8	$\pi^+\pi^-K^+K^-$	$(1.79 \pm 0.15) \%$		DESIG=5
Γ_9	$K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-$	$(9.9 \pm 4.0 \pm 2.9) \times 10^{-4}$		DESIG=31
Γ_{10}	$K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	$(8.1 \pm 2.0 \pm 2.4) \times 10^{-4}$		DESIG=32
Γ_{11}	$K_1(1270)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	$(6.3 \pm 1.9) \times 10^{-3}$		DESIG=33
Γ_{12}	$K_1(1400)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	$< 2.7 \times 10^{-3}$	CL=90%	DESIG=34
Γ_{13}	$f_0(980) f_0(980)$	$(1.6 \pm 1.1 \pm 0.9) \times 10^{-4}$		DESIG=23
Γ_{14}	$f_0(980) f_0(2200)$	$(8.0 \pm 2.0 \pm 2.5) \times 10^{-4}$		DESIG=24
Γ_{15}	$f_0(1370) f_0(1370)$	$< 2.8 \times 10^{-4}$	CL=90%	DESIG=25
Γ_{16}	$f_0(1370) f_0(1500)$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=26
Γ_{17}	$f_0(1370) f_0(1710)$	$(6.8 \pm 4.0 \pm 2.4) \times 10^{-4}$		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}	$K^+K^-\pi^+\pi^-\pi^0$	$(1.13 \pm 0.27) \%$		DESIG=75
Γ_{22}	$K^+K^-\pi^0\pi^0$	$(5.6 \pm 0.9) \times 10^{-3}$		DESIG=63
Γ_{23}	$K^+\pi^-K^0\pi^0 + \text{c.c.}$	$(2.52 \pm 0.34) \%$		DESIG=65
Γ_{24}	$\rho^+K^-K^0 + \text{c.c.}$	$(1.22 \pm 0.21) \%$		DESIG=66
Γ_{25}	$K^*(892)^-K^+\pi^0 \rightarrow K^+\pi^-K^0\pi^0 + \text{c.c.}$	$(4.7 \pm 1.2) \times 10^{-3}$		DESIG=67
Γ_{26}	$K_S^0 K_S^0 \pi^+\pi^-$	$(5.8 \pm 1.1) \times 10^{-3}$		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}	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(7.3 \pm 1.6) \times 10^{-3}$		DESIG=10
Γ_{30}	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=21
Γ_{31}	$\pi\pi$	$(8.5 \pm 0.4) \times 10^{-3}$		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}	$\eta\eta$	$(3.03 \pm 0.21) \times 10^{-3}$		DESIG=13
Γ_{35}	$\eta\eta'$	$< 2.4 \times 10^{-4}$	CL=90%	DESIG=37
Γ_{36}	$\eta'\eta'$	$(2.02 \pm 0.22) \times 10^{-3}$		DESIG=46
Γ_{37}	$\omega\omega$	$(9.8 \pm 1.1) \times 10^{-4}$		DESIG=22
Γ_{38}	$\omega\phi$	$(1.19 \pm 0.22) \times 10^{-4}$		DESIG=76
Γ_{39}	K^+K^-	$(6.06 \pm 0.35) \times 10^{-3}$		DESIG=2
Γ_{40}	$K_S^0 K_S^0$	$(3.14 \pm 0.18) \times 10^{-3}$		DESIG=15
Γ_{41}	$\pi^+\pi^-\eta$	$< 2.0 \times 10^{-4}$	CL=90%	DESIG=50
Γ_{42}	$\pi^+\pi^-\eta'$	$< 4 \times 10^{-4}$	CL=90%	DESIG=53
Γ_{43}	$\bar{K}^0 K^+\pi^- + \text{c.c.}$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=17
Γ_{44}	$K^+K^-\pi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=47
Γ_{45}	$K^+K^-\eta$	$< 2.3 \times 10^{-4}$	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}	$K^+K^-K^+K^-$	$(2.79 \pm 0.29) \times 10^{-3}$		DESIG=14
Γ_{48}	$K^+K^-\phi$	$(9.8 \pm 2.5) \times 10^{-4}$		DESIG=44
Γ_{49}	$\phi\phi$	$(8.1 \pm 0.8) \times 10^{-4}$		DESIG=16
Γ_{50}	$p\bar{p}$	$(2.23 \pm 0.13) \times 10^{-4}$		DESIG=11

Γ_{51}	$p\bar{p}\pi^0$	$(7.0 \pm 0.7) \times 10^{-4}$	S=1.2	DESIG=48
Γ_{52}	$p\bar{p}\eta$	$(3.6 \pm 0.4) \times 10^{-4}$		DESIG=52
Γ_{53}	$p\bar{p}\omega$	$(5.3 \pm 0.6) \times 10^{-4}$		DESIG=69
Γ_{54}	$p\bar{p}\phi$	$(6.1 \pm 1.5) \times 10^{-5}$		DESIG=74
Γ_{55}	$p\bar{p}\pi^+\pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	DESIG=8
Γ_{56}	$p\bar{p}\pi^0\pi^0$	$(1.05 \pm 0.28) \times 10^{-3}$		DESIG=64
Γ_{57}	$p\bar{p}K^+K^-$ (non-resonant)	$(1.23 \pm 0.27) \times 10^{-4}$		DESIG=71
Γ_{58}	$p\bar{p}K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	DESIG=40
Γ_{59}	$p\bar{n}\pi^-$	$(1.14 \pm 0.31) \times 10^{-3}$		DESIG=43
Γ_{60}	$\Lambda\bar{\Lambda}$	$(3.3 \pm 0.4) \times 10^{-4}$		DESIG=19
Γ_{61}	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$< 4.0 \times 10^{-3}$	CL=90%	DESIG=38
Γ_{62}	$K^+\bar{p}\Lambda + \text{c.c.}$	$(1.02 \pm 0.19) \times 10^{-3}$		DESIG=49
Γ_{63}	$K^+p\Lambda(1520) + \text{c.c.}$	$(3.0 \pm 0.8) \times 10^{-4}$		DESIG=72
Γ_{64}	$\Lambda(1520)\bar{\Lambda}(1520)$	$(3.2 \pm 1.2) \times 10^{-4}$		DESIG=73
Γ_{65}	$\Sigma^0\bar{\Sigma}^0$	$(4.2 \pm 0.7) \times 10^{-4}$		DESIG=58
Γ_{66}	$\Sigma^+\bar{\Sigma}^-$	$(3.1 \pm 0.7) \times 10^{-4}$		DESIG=59
Γ_{67}	$\Xi^0\bar{\Xi}^0$	$(3.2 \pm 0.8) \times 10^{-4}$		DESIG=60
Γ_{68}	$\Xi^-\bar{\Xi}^+$	$(4.9 \pm 0.7) \times 10^{-4}$		DESIG=39
Radiative decays				
Γ_{69}	$\gamma J/\psi(1S)$	$(1.17 \pm 0.08) \%$		NODE=M056;CLUMP=B DESIG=6
Γ_{70}	$\gamma\rho^0$	$< 9 \times 10^{-6}$	CL=90%	DESIG=55
Γ_{71}	$\gamma\omega$	$< 8 \times 10^{-6}$	CL=90%	DESIG=56
Γ_{72}	$\gamma\phi$	$< 6 \times 10^{-6}$	CL=90%	DESIG=57
Γ_{73}	$\gamma\gamma$	$(2.23 \pm 0.17) \times 10^{-4}$		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 223 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 312.2$ for 174 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	26									
x_8	20	5								
x_{29}	9	2	30							
x_{31}	22	6	23	8						
x_{34}	13	3	14	5	28					
x_{39}	20	5	20	7	36	23				
x_{40}	22	6	22	8	35	22	30			
x_{47}	13	3	12	5	19	12	16	17		
x_{49}	11	3	12	4	22	14	18	18	10	
x_{50}	2	1	2	1	-6	-7	2	2	1	1
x_{60}	8	2	9	3	17	11	15	14	8	9
x_{69}	2	1	3	1	13	10	8	6	4	5
x_{73}	-26	-7	-18	-10	-9	-4	-10	-15	-9	-5
Γ	-14	-4	-12	-6	-12	-8	-11	-13	-7	-6
	x_1	x_2	x_8	x_{29}	x_{31}	x_{34}	x_{39}	x_{40}	x_{47}	x_{49}
x_{60}	1									
x_{69}	-46	4								
x_{73}	-6	-3	11							
Γ	3	-5	-10	-57						
	x_{50}	x_{60}	x_{69}	x_{73}						

$\chi_{c0}(1P)$ PARTIAL WIDTHS

NODE=M056217

 $\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S))/\Gamma(\text{total})$

NODE=M056223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}} \quad \Gamma_{50} \Gamma_{69}/\Gamma$$

NODE=M056G1
NODE=M056G1

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

27.1± 2.4 OUR FIT

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

26.6± 2.6±1.4 392 6,7 BAGNASCO 02 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$ 48.7^{+11.3}_{-8.9}±2.4 6,7 AMBROGIANI 99B E835 $\bar{p}p \rightarrow \gamma J/\psi$ ⁶ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056G;LINKAGE=7A

⁷ Values in $(\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ and $(\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ are not independent. The latter is used in the fit since it is less correlated to the total width.

NODE=M056G;LINKAGE=KS

 $\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M056224

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{31} \Gamma_{73}/\Gamma$$

NODE=M056G3
NODE=M056G3

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

19.7± 1.4 OUR FIT**23 ± 5 OUR AVERAGE**29.7^{+17.4}_{-12.0}±4.8 103⁺⁶⁰₋₄₂ 8 UEHARA 09 BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$ 22.7± 3.2±3.5 129 ± 18 9 NAKAZAWA 05 BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$ ⁸ We multiplied the measurement by 3 to convert from $\pi^0 \pi^0$ to $\pi\pi$. Interference with the continuum included.

NODE=M056G3;LINKAGE=UE

⁹ We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M056G;LINKAGE=NA

$$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{34} \Gamma_{73}/\Gamma$$

NODE=M056G06
NODE=M056G06

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

9.4±2.3±1.2 22 10 UEHARA 10A BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \eta\eta$ ¹⁰ Interference with the continuum not included.

NODE=M056G06;LINKAGE=UE

$$\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{39} \Gamma_{73}/\Gamma$$

NODE=M056G4
NODE=M056G4

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

14.0±1.1 OUR FIT**14.3±1.6±2.3** 153 ± 17 NAKAZAWA 05 BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

$$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{40} \Gamma_{73}/\Gamma$$

NODE=M056G5
NODE=M056G5

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

7.3 ±0.5 OUR FIT**7.00±0.65±0.71** 134 ± 12 CHEN 07B BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$

$$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_1 \Gamma_{73}/\Gamma$$

NODE=M056G2
NODE=M056G2

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

52 ± 4 OUR FIT**49 ±10 OUR AVERAGE** Error includes scale factor of 1.8.44.7± 3.6±4.9 3.6k UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+ \pi^-)$ 75 ±13 ±8 EISENSTEIN 01 CLE2 $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$

$$\Gamma(\rho^0 \rho^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_3 \Gamma_{73}/\Gamma$$

NODE=M056G07
NODE=M056G07

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

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

<12 90 <252 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+ \pi^-)$

$$\Gamma(\pi^+ \pi^- K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_8 \Gamma_{73}/\Gamma$$

NODE=M056G08
NODE=M056G08

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

41 ±4 OUR FIT**38.8±3.7±4.7** 1.7k UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+ K^- \pi^+ \pi^-$

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{21} \Gamma_{73}/\Gamma$$

NODE=M056G01
NODE=M056G01

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

26±4±4 1094 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{29} \Gamma_{73}/\Gamma$$

NODE=M056G09
NODE=M056G09

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

17 ±4 OUR FIT**16.7±6.1±3.0** 495 ± 182 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+ K^- \pi^+ \pi^-$

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{30}\Gamma_{73}/\Gamma$$

VALUE (eV) CL% EVTS DOCUMENT ID TECN COMMENT

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

<6 90 <148 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M056G10
NODE=M056G10

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

$$\Gamma_{47}\Gamma_{73}/\Gamma$$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

6.4±0.7 OUR FIT

7.9±1.3±1.1 215 ± 36 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+ K^-)$

NODE=M056G11
NODE=M056G11

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

$$\Gamma_{49}\Gamma_{73}/\Gamma$$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

1.88±0.21 OUR FIT

[2.1 ± 0.5 eV OUR 2011 FIT]

2.3 ±0.9 ±0.4 23.6 ± 9.6 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+ K^-)$

NODE=M056G12
NODE=M056G12
NEW

$\chi_{c0}(1P)$ BRANCHING RATIOS

NODE=M056220

HADRONIC DECAYS

NODE=M056305

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

$$\Gamma_1/\Gamma$$

VALUE DOCUMENT ID

0.0226±0.0019 OUR FIT

NODE=M056R2
NODE=M056R2

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

$$\Gamma_2/\Gamma_1$$

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

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

$$\Gamma_2/\Gamma$$

VALUE DOCUMENT ID

0.0088±0.0028 OUR FIT

NODE=M056R9
NODE=M056R9

$$\Gamma(f_0(980) f_0(980))/\Gamma_{\text{total}}$$

$$\Gamma_4/\Gamma$$

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

6.7±2.1±0.2 36 ± 9 11 ABLIKIM 04G BES $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

11 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R24
NODE=M056R24

NODE=M056R24;LINKAGE=AB

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

$$\Gamma_5/\Gamma$$

VALUE (%) EVTS DOCUMENT ID TECN COMMENT

3.4±0.4 OUR AVERAGE [(3.4 ± 0.4)% OUR 2011 AVERAGE]

3.4±0.4±0.1 1751.4 12 HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

12 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R62
NODE=M056R62

NEW

NODE=M056R62;LINKAGE=HE

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

$$\Gamma_6/\Gamma$$

VALUE (%) EVTS DOCUMENT ID TECN COMMENT

2.9±0.4 OUR AVERAGE [(2.9 ± 0.4)% OUR 2011 AVERAGE]

2.9±0.4±0.1 1358.5 13,14 HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

13 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R63
NODE=M056R63

NEW

NODE=M056R63;LINKAGE=HE

14 Calculated by us. We have added the values from HE 08B for $\rho^+ \pi^- \pi^0$ and $\rho^- \pi^+ \pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M056R63;LINKAGE=OC

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±0.4±0.1	3296	¹⁵ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

$$\Gamma_7/\Gamma$$

NODE=M056R71
NODE=M056R71

¹⁵ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R71;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID
17.9±1.5 OUR FIT	

$$\Gamma_8/\Gamma$$

NODE=M056R3
NODE=M056R3

$$\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.})/\Gamma(\pi^+\pi^-K^+K^-)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.41±0.09 OUR FIT			
0.41±0.10	TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

$$\Gamma_{29}/\Gamma_8$$

NODE=M056R55
NODE=M056R55

$$\Gamma(K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.9^{+3.6}_{-2.8}±0.3	83	¹⁶ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

$$\Gamma_9/\Gamma$$

NODE=M056R36
NODE=M056R36

¹⁶ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R36;LINKAGE=AB

$$\Gamma(K_0^*(1430)^0\bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.1^{+2.0}_{-2.4}±0.3	62	¹⁷ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

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

NODE=M056R37
NODE=M056R37

¹⁷ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R37;LINKAGE=AB

$$\Gamma(K_1(1270)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.3±1.9±0.2	68	¹⁸ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

$$\Gamma_{11}/\Gamma$$

NODE=M056R38
NODE=M056R38

¹⁸ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The measurement assumes $B(K_1(1270) \rightarrow K\rho(770)) = 42 \pm 6\%$.

NODE=M056R38;LINKAGE=AB

$$\Gamma(K_1(1400)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹⁹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

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

NODE=M056R39
NODE=M056R39

¹⁹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$. The measurement assumes $B(K_1(1400) \rightarrow K^*(892)\pi) = 94 \pm 6\%$.

NODE=M056R39;LINKAGE=AB

$\Gamma(f_0(980)f_0(980))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$16^{+11}_{-9} \pm 1$	28	20 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R28
 NODE=M056R28

20 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. One of the $f_0(980)$ mesons is identified via decay to $\pi^+ \pi^-$ while the other via $K^+ K^-$ decay.

NODE=M056R28;LINKAGE=AB

 $\Gamma(f_0(980)f_0(2200))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.0^{+2.0}_{-2.5} \pm 0.3$	77	21 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R29
 NODE=M056R29

21 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(980) \rightarrow \pi^+ \pi^-$ and $f_0(2200) \rightarrow K^+ K^-$ decays.

NODE=M056R29;LINKAGE=AB

 $\Gamma(f_0(1370)f_0(1370))/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.8	90	22 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R30
 NODE=M056R30

22 ABLIKIM 05Q reports $< 2.9 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370)f_0(1370))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$. 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	23 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R31
 NODE=M056R31

23 ABLIKIM 05Q reports $< 1.8 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370)f_0(1500))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+ \pi^-$ and $f_0(1500) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R31;LINKAGE=AB

 $\Gamma(f_0(1370)f_0(1710))/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.8^{+3.6}_{-2.4} \pm 0.2$	61	24 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R32
 NODE=M056R32

24 ABLIKIM 05Q reports $(7.12 \pm 1.85^{+3.28}_{-1.68}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370)f_0(1710))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+ \pi^-$ and $f_0(1710) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R32;LINKAGE=AB

 $\Gamma(f_0(1500)f_0(1370))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.3	90	25 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R33
 NODE=M056R33

25 ABLIKIM 05Q reports $< 1.4 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500)f_0(1370))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+ \pi^-$ and $f_0(1370) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R33;LINKAGE=AB

$\Gamma(f_0(1500) f_0(1500))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	26 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
26 ABLIKIM 05Q reports $< 0.55 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500) f_0(1500))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$. 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	27 ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
27 ABLIKIM 05Q reports $< 0.73 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500) f_0(1710))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+ \pi^-$ and $f_0(1710) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.				

NODE=M056R35
 NODE=M056R35

NODE=M056R35;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.56±0.09 OUR AVERAGE		[(0.56 ± 0.09)% OUR 2011 AVERAGE]		
0.56±0.09±0.02	213.5	28 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
28 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R64
 NODE=M056R64

NEW

NODE=M056R64;LINKAGE=HE

 $\Gamma(K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.52±0.34 OUR AVERAGE		[(2.52 ± 0.34)% OUR 2011 AVERAGE]		
2.52±0.33±0.08	401.7	29 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
29 HE 08B reports $2.64 \pm 0.15 \pm 0.31 \pm 0.14$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R66
 NODE=M056R66

NEW

NODE=M056R66;LINKAGE=HE

 $\Gamma(\rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.22±0.21 OUR AVERAGE		[(1.22 ± 0.21)% OUR 2011 AVERAGE]		
1.22±0.21±0.04	179.7	30 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
30 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R67
 NODE=M056R67

NEW

NODE=M056R67;LINKAGE=HE

 $\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.47±0.12 OUR AVERAGE		[(0.47 ± 0.12)% OUR 2011 AVERAGE]		
0.47±0.12±0.01	64.1	31 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
31 HE 08B reports $0.49 \pm 0.10 \pm 0.07 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R68
 NODE=M056R68

NEW

NODE=M056R68;LINKAGE=HE

$$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{26} / \Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.8 ± 1.1 ± 0.2	152 ± 14	³² ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R47
NODE=M056R47

³² ABLIKIM 050 reports $[\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (0.558 \pm 0.051 \pm 0.089) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R47;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 OUR AVERAGE		[(0.30 ± 0.07)% OUR 2011 AVERAGE]		
0.30 ± 0.07 ± 0.01	56.4	³³ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R69
NODE=M056R69

NEW

³³ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R69;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			

NODE=M056R4
NODE=M056R4

→ NOT CHECKED ←

11.7 ± 1.0 ± 1.9	³⁴ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
12.5 ± 2.9 ± 0.5	³⁴ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$

³⁴ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R;LINKAGE=X1

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{29} / \Gamma$$

VALUE	DOCUMENT ID
0.0073 ± 0.0016 OUR FIT	

NODE=M056R10
NODE=M056R10

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}} \quad \Gamma_{30} / \Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7^{+0.6}_{-0.5} ± 0.1	64	³⁵ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R26
NODE=M056R26

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

1.6 ± 0.4 ± 0.1	30.1 ± 5.7	^{36,37} ABLIKIM	04H BES	Repl. by ABLIKIM 05Q

³⁵ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R26;LINKAGE=AI

³⁶ Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

³⁷ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R;LINKAGE=AL

NODE=M056R26;LINKAGE=AB

$$\Gamma(\pi \pi) / \Gamma_{\text{total}} \quad \Gamma_{31} / \Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
8.5 ± 0.4 OUR FIT	

NODE=M056R22
NODE=M056R22

$$\Gamma(\eta \eta) / \Gamma_{\text{total}} \quad \Gamma_{34} / \Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
3.03 ± 0.21 OUR FIT	

NODE=M056R13
NODE=M056R13

$$\Gamma(\eta \eta) / \Gamma(\pi \pi) \quad \Gamma_{34} / \Gamma_{31}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.356 ± 0.025 OUR FIT			

NODE=M056R20
NODE=M056R20

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

0.26 ± 0.09 ^{+0.03} _{-0.02}	³⁸ ANDREOTTI	05C E835	$\bar{p} p \rightarrow 2 \text{ mesons}$
0.24 ± 0.10 ± 0.08	³⁸ BAI	03C BES	$\psi(2S) \rightarrow 5\gamma$

³⁸ We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

NODE=M056R;LINKAGE=D1

$\Gamma(\eta\eta')/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.24	90	35 $\pm$ 13	39 ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\eta'\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.5	90		40 ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma\chi_{c0}$
39 ASNER 09 reports $< 0.25 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.					
40 Superseded by ASNER 09. ADAMS 07 reports $< 0.5 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.					

NODE=M056R03
NODE=M056R03

NODE=M056R03;LINKAGE=AS

NODE=M056R03;LINKAGE=AD

$\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.02$\pm$0.21$\pm$0.06	0.4k	41 ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\eta'\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.6 $\pm$ 0.4 $\pm$ 0.1	23	42 ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma\chi_{c0}$
41 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
42 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R04
NODE=M056R04

NODE=M056R04;LINKAGE=AS

NODE=M056R04;LINKAGE=AD

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.98$\pm$0.11 OUR AVERAGE				
[(2.2 $\pm$ 0.7) $\times 10^{-3}$ OUR 2011 AVERAGE]				
0.94 $\pm$ 0.11 $\pm$ 0.03	991	43 ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons
2.2 $\pm$ 0.7 $\pm$ 0.1	38.1 $\pm$ 9.6	44 ABLIKIM	05N BES2	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma 6\pi$
43 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
44 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R27
NODE=M056R27
NEW

NODE=M056R27;LINKAGE=AL

NODE=M056R27;LINKAGE=AB

$\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.19$\pm$0.22$\pm$0.04	76	45 ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons
45 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R76
NODE=M056R76

NODE=M056R76;LINKAGE=AL

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
6.06$\pm$0.35 OUR FIT	

NODE=M056R6
NODE=M056R6

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
3.14$\pm$0.18 OUR FIT	
[(3.15 $\pm$ 0.18) $\times 10^{-3}$ OUR 2011 FIT]	

NODE=M056R15
NODE=M056R15
NEW

$\Gamma(K_S^0 K_S^0)/\Gamma(\pi\pi)$ Γ_{40}/Γ_{31}

VALUE	DOCUMENT ID	TECN	COMMENT

0.369±0.022 OUR FIT

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

0.31 ±0.05 ±0.05 46,47 CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c0}$ 46 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 $\pi\pi$.

47 Not independent from other measurements.

NODE=M056R53
NODE=M056R53

NODE=M056R53;LINKAGE=CH

NODE=M056R53;LINKAGE=NI

 $\Gamma(K_S^0 K_S^0)/\Gamma(K^+K^-)$ Γ_{40}/Γ_{39}

VALUE	DOCUMENT ID	TECN	COMMENT

0.519±0.035 OUR FIT

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

0.49 ±0.07 ±0.08 48,49 CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c0}$ 48 Using $\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.

49 Not independent from other measurements.

NODE=M056R52
NODE=M056R52

NODE=M056R52;LINKAGE=CH

NODE=M056R52;LINKAGE=NI

 $\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{41}/Γ

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

<0.20 90 50 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 51 ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma\chi_{c0}$ 50 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.51 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.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

<0.4 90 52 ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ 52 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.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

<0.10 90 53 ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

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

<0.7 90 54,55 ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma\chi_{c0}$ <0.7 90 55,56 BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c0}$ 53 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.54 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.55 We have multiplied the $K_S^0 K^+ \pi^-$ measurement by a factor of 2 to convert to $\bar{K}^0 K^+ \pi^-$.56 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 57 ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ 57 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.68 \times 10^{-2}$.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
<0.23	90	58 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
58 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$.				

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
$1.43 \pm 0.48 \pm 0.05$	16.8 ± 4.8	59 ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$
59 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R48
 NODE=M056R48

NODE=M056R48;LINKAGE=AB

 $\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
2.79 ± 0.29 OUR FIT	

NODE=M056R14
 NODE=M056R14

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.98 \pm 0.25 \pm 0.03$	38	60 ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
60 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R01
 NODE=M056R01

NODE=M056R01;LINKAGE=AB

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
0.81 ± 0.08 OUR FIT	
[(0.91 ± 0.19) $\times 10^{-3}$ OUR 2011 FIT]	

NODE=M056R16
 NODE=M056R16
 NEW

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
2.23 ± 0.13 OUR FIT	

NODE=M056R11
 NODE=M056R11

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.70 ± 0.07 OUR AVERAGE	Error includes scale factor of 1.2.		
$0.74 \pm 0.06 \pm 0.02$	61 ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
$0.56 \pm 0.12 \pm 0.02$	62 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
61 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			
62 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

NODE=M056R06
 NODE=M056R06

NODE=M056R06;LINKAGE=ON

NODE=M056R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.36 ± 0.04 OUR AVERAGE			
$0.36 \pm 0.04 \pm 0.01$	63 ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
$0.37 \pm 0.11 \pm 0.01$	64 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M056R50
 NODE=M056R50

⁶³ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50;LINKAGE=ON

⁶⁴ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50;LINKAGE=AT

$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$				Γ_{53}/Γ
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT	
0.53±0.06±0.02	⁶⁵ ONYISI	10	CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$	NODE=M056R70 NODE=M056R70

⁶⁵ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R70;LINKAGE=ON

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$				Γ_{54}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±1.4±0.2	42 ± 8	⁶⁶ ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$

NODE=M056R75
NODE=M056R75

⁶⁶ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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.			

NODE=M056R7
NODE=M056R7

→ NOT CHECKED ←

2.1 ±1.0 OUR AVERAGE	Error includes scale factor of 2.0.			
1.57±0.21±0.53	⁶⁷ BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$
4.20±1.15±0.18	⁶⁷ TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

⁶⁷ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R7;LINKAGE=X1

$\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$				Γ_{56}/Γ
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.105±0.028 OUR AVERAGE	[(0.105 ± 0.028)% OUR 2011 AVERAGE]			

NODE=M056R65
NODE=M056R65

NEW

0.105±0.028±0.003	39.5	⁶⁸ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+h^-h^0h^0$

⁶⁸ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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
1.23±0.26±0.04	48 ± 8	⁶⁹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$

NODE=M056R72
NODE=M056R72

⁶⁹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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	⁷⁰ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$

NODE=M056R46
NODE=M056R46

⁷⁰ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R;LINKAGE=AB

$\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 Γ_{59}/Γ NODE=M056R49
NODE=M056R49**11.4±3.1±0.4**⁷¹ ABLIKIM 06I BES2 $\psi(2S) \rightarrow \gamma p \pi^- X$

⁷¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R49;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

 Γ_{60}/Γ NODE=M056R23
NODE=M056R23**3.3±0.4 OUR FIT** $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{61}/Γ NODE=M056R44
NODE=M056R44**<4.0**

90

⁷² ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c0}\gamma$

⁷² Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R44;LINKAGE=AB

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{62}/Γ NODE=M056R07
NODE=M056R07**1.02±0.19±0.03**⁷³ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

⁷³ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R07;LINKAGE=AT

 $\Gamma(K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{63}/Γ NODE=M056R73
NODE=M056R73**3.0±0.8±0.1**

62 ± 12

⁷⁴ ABLIKIM 11F BES3 $\psi(2S) \rightarrow p\bar{p}K^+K^-$

⁷⁴ ABLIKIM 11F reports $(3.00 \pm 0.58 \pm 0.50) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R73;LINKAGE=AB

 $\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{64}/Γ NODE=M056R74
NODE=M056R74**3.2±1.2±0.1**

28 ± 10

⁷⁵ ABLIKIM 11F BES3 $\psi(2S) \rightarrow p\bar{p}K^+K^-$

⁷⁵ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R74;LINKAGE=AB

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

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{65}/Γ NODE=M056R59
NODE=M056R59**4.2±0.7±0.1**

78 ± 10

⁷⁶ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Sigma^0\bar{\Sigma}^0$

⁷⁶ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R59;LINKAGE=NA

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

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{66}/Γ NODE=M056R60
NODE=M056R60**3.1±0.7±0.1**

39 ± 7

⁷⁷ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Sigma^+\bar{\Sigma}^-$

⁷⁷ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R60;LINKAGE=NA

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.2 \pm 0.8 \pm 0.1$	23.3 ± 4.9	⁷⁸ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$

⁷⁸ NAIK 08 reports $(3.34 \pm 0.70 \pm 0.48) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R61
NODE=M056R61

NODE=M056R61;LINKAGE=NA

 $\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{68}/Γ

<i>VALUE (units 10⁻⁴)</i>	<i>CL%</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
4.9±0.7±0.2	95 ± 11	⁷⁹ NAIK	08	CLEO	$\psi(2S) \rightarrow \gamma \Xi^+ \Xi^-$

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

< 10.3	90	⁸⁰ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0} \gamma$

⁷⁹ NAIK 08 reports $(5.14 \pm 0.60 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁸⁰ Using $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.2 \pm 0.5)\%$

NODE=M056R45
NODE=M056R45

NODE=M056R45;LINKAGE=NA

NODE=M056R45;LINKAGE=AB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi\pi)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{31}/\Gamma$

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

 19.0 ± 1.4 OUR FIT **$15.3 \pm 2.4 \pm 0.8$**

⁸¹ ANDREOTTI 03 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0 \pi^0$

⁸¹ We have multiplied $B(p\bar{p}) \cdot B(\pi^0 \pi^0)$ measurement by 3 to obtain $B(p\bar{p}) \cdot B(\pi\pi)$.

NODE=M056R21
NODE=M056R21

NODE=M056R;LINKAGE=AD

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0 \eta)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{32}/\Gamma$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
< 0.4	ANDREOTTI 05C	E835	$\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R41
NODE=M056R41

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0 \eta')/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{33}/\Gamma$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
< 2.5	ANDREOTTI 05C	E835	$\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R42
NODE=M056R42

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta)/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{34}/\Gamma$

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

 6.8 ± 0.6 OUR FIT **$4.0 \pm 1.2^{+0.5}_{-0.3}$**

ANDREOTTI 05C E835 $\bar{p}p \rightarrow \eta\eta$

NODE=M056R40
NODE=M056R40

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta')/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{35}/\Gamma$

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

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

$2.1^{+2.3}_{-1.5}$	ANDREOTTI 05C	E835	$\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R43
NODE=M056R43

———— RADIATIVE DECAYS ————

NODE=M056310

 $\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{69}/Γ

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

 117 ± 8 OUR FIT

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

$200 \pm 20 \pm 20$	⁸² ADAM	05A CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

⁸² Uses $B(\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \gamma J/\psi)$ from ADAM 05A and $B(\psi(2S) \rightarrow \gamma \chi_{c0})$ from ATHAR 04.

NODE=M056R8
NODE=M056R8

NODE=M056R8;LINKAGE=AD

 $\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

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

< 9 90 1.2 ± 4.5 ⁸³ 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	⁸⁴ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \rho^0$

NODE=M056R56
NODE=M056R56

- ⁸³ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$.
- ⁸⁴ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$.

NODE=M056R56;LINKAGE=BE

NODE=M056R56;LINKAGE=AB

 $\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 8	90	0.0 ± 2.8	⁸⁵ BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \omega$

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

<13	90	5 ± 11	⁸⁶ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \omega$

- ⁸⁵ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$.

NODE=M056R57;LINKAGE=BE

- ⁸⁶ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$.

NODE=M056R57;LINKAGE=AB

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 6	90	0.1 ± 1.6	⁸⁷ 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	⁸⁸ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \phi$

- ⁸⁷ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$.

NODE=M056R58;LINKAGE=BE

- ⁸⁸ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.68 \times 10^{-2}$.

NODE=M056R58;LINKAGE=AB

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
2.23 ± 0.17 OUR FIT				

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

<8	90	⁸⁹ WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$

- ⁸⁹ WICHT 08 reports $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma \gamma) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c0}(1P) K^+)] < 0.11 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c0}(1P) K^+) = 1.34 \times 10^{-4}$.

NODE=M056R1;LINKAGE=WI

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{73}/Γ_{69}

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

1.90 ± 0.19 OUR FIT**2.0 ± 0.4 OUR AVERAGE**

$2.2 \pm 0.4^{+0.1}_{-0.2}$	⁹⁰ ANDREOTTI	04 E835	$p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma \gamma$

1.45 ± 0.74	⁹¹ AMBROGIANI	00B E835	$\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma \gamma, \gamma J/\psi$

- ⁹⁰ 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=M056R;LINKAGE=AN

- ⁹¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056R;LINKAGE=7A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma \times \Gamma_{69}/\Gamma$

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

26.2 ± 1.7 OUR FIT**28.2 ± 2.1 OUR AVERAGE**

$28.0 \pm 1.9 \pm 1.3$	392	^{92,93,94} BAGNASCO	02 E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$

$29.3^{+5.7}_{-4.7} \pm 1.5$	89	^{92,93} AMBROGIANI	99B	$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$

- ⁹² 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=M056R;LINKAGE=KS

- ⁹³ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056R19;LINKAGE=7A

- ⁹⁴ Recalculated by ANDREOTTI 05A.

NODE=M056R19;LINKAGE=AN

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

$$\Gamma_{50}/\Gamma \times \Gamma_{73}/\Gamma$$

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

5.0 ± 0.5 OUR FIT

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

$6.52 \pm 1.18^{+0.48}_{-0.72}$

⁹⁵ ANDREOTTI 04 E835 $p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$

⁹⁵ The values of $B(p\bar{p})B(\gamma\gamma)$ and $B(\gamma\gamma)B(\gamma J/\psi)$ measured by ANDREOTTI 04 are not independent. The latter is used in the fit because of smaller systematics.

NODE=M056R25
NODE=M056R25

NODE=M056R25;LINKAGE=AN

$\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M056230

$$\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{50}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

21.6 ± 1.4 OUR FIT

23.7 ± 1.8 OUR AVERAGE

$23.7 \pm 1.4 \pm 1.4$

⁹⁶ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$

$23.6^{+3.7}_{-3.4} \pm 3.4$

BAI 04F BES $\psi(2S) \rightarrow \gamma\chi_{c0}(1P) \rightarrow \gamma p\bar{p}$

⁹⁶ Calculated by us. NAIK 08 reports $B(\chi_c^0 \rightarrow p\bar{p}) = (25.7 \pm 1.5 \pm 1.5 \pm 1.3) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_c^0) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B6
NODE=M056B6

NODE=M056B6;LINKAGE=NA

$$\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{50}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

6.4 ± 0.4 OUR FIT

4.6 ± 1.9

⁹⁷ BAI 98I BES $\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma p\bar{p}$

⁹⁷ Calculated by us. The value for $B(\chi_{c0} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B1
NODE=M056B1

NODE=M056B;LINKAGE=B1

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{60}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

32 ± 4 OUR FIT

31.2 ± 3.3 ± 2.0

131 ± 12 ⁹⁸ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

⁹⁸ Calculated by us. NAIK 08 reports $B(\chi_c^0 \rightarrow \Lambda\bar{\Lambda}) = (33.8 \pm 3.6 \pm 2.2 \pm 1.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_c^0) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B20
NODE=M056B20

NODE=M056B20;LINKAGE=NA

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{60}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

9.5 ± 1.1 OUR FIT

13.0 ± 3.6 ± 2.5

15.2 ± 4.2 ⁹⁹ BAI 03E BES $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

⁹⁹ BAI 03E reports $[B(\chi_c^0 \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_c^0) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p\bar{p})] = (2.45^{+0.68}_{-0.65} \pm 0.46)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M056B21
NODE=M056B21

NODE=M056B21;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{69}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

0.113 ± 0.008 OUR FIT

0.073 ± 0.018 OUR AVERAGE

0.069 ± 0.018

¹⁰⁰ OREGLIA 82 CBAL $\psi(2S) \rightarrow \gamma\chi_{c0}$

0.4 ± 0.3

¹⁰¹ BRANDELIK 79B DASP $\psi(2S) \rightarrow \gamma\chi_{c0}$

0.16 ± 0.11

¹⁰¹ BARTEL 78B CNTR $\psi(2S) \rightarrow \gamma\chi_{c0}$

3.3 ± 1.7

¹⁰² 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

560 ¹⁰³ MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma\chi_{c0}$

0.18 ± 0.01 ± 0.02

172 ¹⁰⁴ ADAM 05A CLEO Repl. by MENDEZ 08

NODE=M056B2
NODE=M056B2

- 100 Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.
 101 Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.
 102 Assumes isotropic gamma distribution.
 103 Not independent from other measurements of MENDEZ 08.
 104 Not independent from other values reported by ADAM 05A.

NODE=M056B;LINKAGE=3Q
 NODE=M056B;LINKAGE=2Q
 NODE=M056B;LINKAGE=EA
 NODE=M056B2;LINKAGE=ME
 NODE=M056B2;LINKAGE=AD

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})} = \frac{\Gamma_{69}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{\Gamma_{69}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_9^{\psi(2S)} + \Gamma_{11}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.344\Gamma_{110}^{\psi(2S)} + 0.195\Gamma_{111}^{\psi(2S)}}$$

NODE=M056B7
 NODE=M056B7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.191±0.014 OUR FIT				

NODE=M056B7

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

0.201±0.011±0.021	560	105 MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.31 ±0.02 ±0.03	172	ADAM	05A	CLEO	Repl. by MENDEZ 08

105 Not independent from other measurements of MENDEZ 08.

NODE=M056B7;LINKAGE=ME

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} = \frac{\Gamma_{69}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{69}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{11}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.344\Gamma_{110}^{\psi(2S)} + 0.195\Gamma_{111}^{\psi(2S)}}$$

NODE=M056B8
 NODE=M056B8

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.338±0.024 OUR FIT				

0.358±0.020±0.037 560 MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$

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

0.55 ±0.04 ±0.06	172	106 ADAM	05A	CLEO	Repl. by MENDEZ 08

106 Not independent from other values reported by ADAM 05A.

NODE=M056B;LINKAGE=AD

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma \gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} = \frac{\Gamma_{73}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{109}^{\psi(2S)}}{\Gamma_{73}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{109}^{\psi(2S)} + \Gamma_{11}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.344\Gamma_{110}^{\psi(2S)} + 0.195\Gamma_{111}^{\psi(2S)}}$$

NODE=M056B3
 NODE=M056B3

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.16±0.19 OUR FIT				

2.21±0.33 OUR AVERAGE

2.17±0.32±0.10	207 ± 31	ECKLUND	08A	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow 3\gamma$
3.7 ±1.8 ±1.0		LEE	85	CBAL	$\psi(2S) \rightarrow \gamma \chi_{c0}$

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} = \frac{\Gamma_{31}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{109}^{\psi(2S)}}{\Gamma_{31}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{109}^{\psi(2S)} + \Gamma_{11}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.344\Gamma_{110}^{\psi(2S)} + 0.195\Gamma_{111}^{\psi(2S)}}$$

NODE=M056B22
 NODE=M056B22

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.25±0.29 OUR FIT				

8.80±0.34 OUR AVERAGE

9.11±0.08±0.65	17k	107 ABLIKIM	10A	BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$
8.81±0.11±0.43	8.9k	108 ASNER	09	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
8.13±0.19±0.89	2.8k	109 ASNER	09	CLEO	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

OCCUR=2

107 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 $\pi \pi$.

NODE=M056B22;LINKAGE=AB

108 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 $\pi \pi$.

NODE=M056B22;LINKAGE=AS

109 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;LINKAGE=AN

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} = \frac{\Gamma_{31}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{31}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{11}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.344\Gamma_{110}^{\psi(2S)} + 0.195\Gamma_{111}^{\psi(2S)}}$$

NODE=M056B5
 NODE=M056B5

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
24.5±0.9 OUR FIT				

20.7±1.7 OUR AVERAGE

23.9±2.7±4.1	97 ± 11	110 BAI	03C	BES	$\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^0 \pi^0$
20.2±1.1±1.5	720 ± 32	111 BAI	98I	BES	$\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^+ \pi^-$

110 We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

NODE=M056B;LINKAGE=D1

111 Calculated by us. The value for $B(\chi_{c0} \rightarrow \pi^+ \pi^-)$ reported in BAI 98I is derived using $B(\psi' \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi' \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.

NODE=M056B;LINKAGE=D2

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{34} / \Gamma \times \Gamma_{109}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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

2.93±0.18 OUR FIT**3.12±0.19 OUR AVERAGE**3.23±0.09±0.23 2132 ¹¹² ABLIKIM 10A BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$ 2.93±0.12±0.29 0.9k ¹¹³ 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 48 ¹¹⁴ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma\chi_{c0}$ ¹¹² 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$.¹¹³ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.¹¹⁴ 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

NODE=M056B11;LINKAGE=AB

NODE=M056B11;LINKAGE=AS

NODE=M056B11;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{34} / \Gamma \times \Gamma_{109}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

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

0.87 ±0.05 OUR FIT**0.578±0.241±0.158**BAI 03C BES $\psi(2S) \rightarrow \gamma\eta\eta$ NODE=M056B10
NODE=M056B10

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{39} / \Gamma \times \Gamma_{109}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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

5.87±0.28 OUR FIT**5.97±0.07±0.32** 8.1k ¹¹⁵ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K^+K^-$ ¹¹⁵ 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

NODE=M056B23;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{39} / \Gamma \times \Gamma_{109}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

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

1.75±0.09 OUR FIT**1.63±0.10±0.15** 774 ± 38 ¹¹⁶ BAI 98I BES $\psi(2S) \rightarrow \gamma K^+K^-$ ¹¹⁶ 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

NODE=M056B9;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{40} / \Gamma \times \Gamma_{109}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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

3.04±0.15 OUR FIT**3.18±0.17 OUR AVERAGE**3.22±0.07±0.17 2.1k ¹¹⁷ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$ 3.02±0.19±0.33 322 ABLIKIM 05O BES2 $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$ ¹¹⁷ 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

NODE=M056B12;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{40} / \Gamma \times \Gamma_{109}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

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

9.1±0.5 OUR FIT**5.6±0.8±1.3**¹¹⁸ BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$ ¹¹⁸ 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

NODE=M056B13;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+ \pi^-))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_1}{\Gamma} \times \frac{\Gamma_{109}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

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 ¹¹⁹BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c0}$ 9.3±0.9 ¹²⁰TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹¹⁹ 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

¹²⁰ 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

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_8}{\Gamma} \times \frac{\Gamma_{109}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

NODE=M056B18
NODE=M056B18**1.73±0.13 OUR FIT**[(1.73 ± 0.14) × 10^{-3} OUR 2011 FIT]**1.64±0.05±0.2** ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \chi_{c0}$

NEW

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_8}{\Gamma} \times \frac{\Gamma_{109}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

NODE=M056B19
NODE=M056B19**5.2 ±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 ¹²¹TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹²¹ 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

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{47}}{\Gamma} \times \frac{\Gamma_{109}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M056B14
NODE=M056B14**2.70±0.27 OUR FIT****3.20±0.11±0.41** 278 ¹²²ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹²² 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

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{47}}{\Gamma} \times \frac{\Gamma_{109}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

NODE=M056B15
NODE=M056B15**8.0±0.8 OUR FIT****6.1±0.8±0.9** ¹²³BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹²³ 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

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi \phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{49}}{\Gamma} \times \frac{\Gamma_{109}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M056B16
NODE=M056B16**0.79±0.07 OUR FIT**[(0.88 ± 0.18) × 10^{-4} OUR 2011 FIT]**0.78±0.07 OUR AVERAGE**[(0.86 ± 0.22) × 10^{-4} OUR 2011 AVERAGE]0.77±0.03±0.07 612 ¹²⁴ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons0.86±0.19±0.12 26 ¹²⁵ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹²⁴ 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

¹²⁵ 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

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{49}/\Gamma \times \Gamma_{109}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.34±0.21 OUR FIT[(2.6 ± 0.5) × 10⁻⁴ OUR 2011 FIT]**2.6 ±1.0 ±1.1**¹²⁶ BAI

99B BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ ¹²⁶ 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	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	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 011103R	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 091501R	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 011102R	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101R	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 071101R	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51651
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
CHEN	07B	PL B651 15	W.T. Chen <i>et al.</i>	(BELLE Collab.)	REFID=51710
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05N	PL B630 7	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50847
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
ANDREOTTI	05C	PR D72 112002	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50991
NAKAZAWA	05	PL B615 39	H. Nakazawa <i>et al.</i>	(BELLE Collab.)	REFID=50807
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50187
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
ANDREOTTI	04	PL B584 16	M. Andreotti <i>et al.</i>	(E835 Collab.)	REFID=49744
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
ANDREOTTI	03	PRL 91 091801	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=49578
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
BAGNASCO	02	PL B533 237	S. Bagnasco <i>et al.</i>	(FNAL E835 Collab.)	REFID=48833
EISENSTEIN	01	PRL 87 061801	B.I. Eisenstein <i>et al.</i>	(CLEO Collab.)	REFID=48344
AMBROGIANI	00B	PR D62 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47940
AMBROGIANI	99B	PRL 83 2902	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47389
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059

$\chi_{c1}(1P)$

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

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M055

NODE=M055

NODE=M055M

NODE=M055M

OCCUR=2

NODE=M055M;LINKAGE=NW

NODE=M055M;LINKAGE=C

NODE=M055M;LINKAGE=P

NODE=M055M;LINKAGE=D

NODE=M055M;LINKAGE=M

 $\chi_{c1}(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3510.66 ± 0.07 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
3510.30 ± 0.14 ± 0.16		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3510.719 ± 0.051 ± 0.019		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
3509.4 ± 0.9		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3510.60 ± 0.087 ± 0.019	513	¹ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+ e^- \gamma$
3511.3 ± 0.4 ± 0.4	30	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+ e^- X$
3512.3 ± 0.3 ± 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

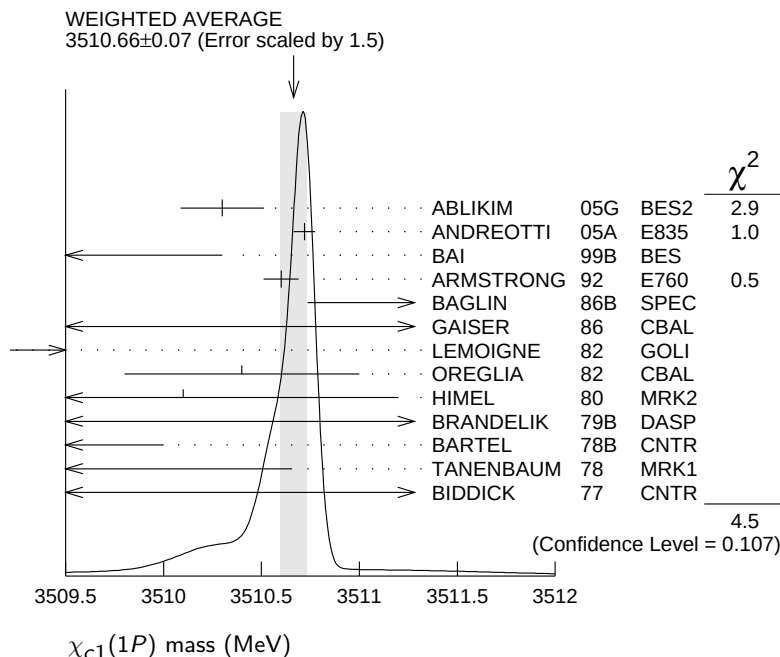
¹ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

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**

NODE=M055W

NODE=M055W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.86 ±0.05 OUR FIT					
0.88 ±0.05 OUR AVERAGE					
1.39 +0.40 +0.26 -0.38 -0.77			ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
0.876 ±0.045 ±0.026			ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
0.87 ±0.11 ±0.08	513	⁶ ARMSTRONG	92 E760		$\bar{p}p \rightarrow e^+ e^- \gamma$

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

<1.3 95 BAGLIN 86B SPEC $\bar{p}p \rightarrow e^+e^-X$
 <3.8 90 GAISER 86 CBAL $\psi(2S) \rightarrow \gamma X$

⁶Recalculated 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 $\pi^+\pi^-\pi^0\pi^0$	$(1.26 \pm 0.17) \%$	
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	$(1.53 \pm 0.26) \%$	
Γ_5 $\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$	
Γ_6 $4\pi^0$	$(5.7 \pm 0.8) \times 10^{-4}$	
Γ_7 $\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$	
Γ_8 $K^+K^-\pi^0\pi^0$	$(1.18 \pm 0.29) \times 10^{-3}$	
Γ_9 $K^+\pi^-K^0\pi^0 + \text{c.c.}$	$(9.0 \pm 1.5) \times 10^{-3}$	
Γ_{10} $\rho^+K^-K^0 + \text{c.c.}$	$(5.3 \pm 1.3) \times 10^{-3}$	
Γ_{11} $K^*(892)^0K^0\pi^0 \rightarrow$ $K^+\pi^-K^0\pi^0 + \text{c.c.}$	$(2.5 \pm 0.7) \times 10^{-3}$	
Γ_{12} $K^+K^-\eta\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	
Γ_{13} $\pi^+\pi^-K_S^0K_S^0$	$(7.2 \pm 3.1) \times 10^{-4}$	
Γ_{14} $K^+K^-\eta$	$(3.3 \pm 1.0) \times 10^{-4}$	
Γ_{15} $K^0K^+\pi^- + \text{c.c.}$	$(7.3 \pm 0.6) \times 10^{-3}$	
Γ_{16} $K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(1.0 \pm 0.4) \times 10^{-3}$	
Γ_{17} $K^*(892)^+K^- + \text{c.c.}$	$(1.5 \pm 0.7) \times 10^{-3}$	
Γ_{18} $K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%
Γ_{19} $K_J^*(1430)^+K^- + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	$< 2.3 \times 10^{-3}$	CL=90%
Γ_{20} $K^+K^-\pi^0$	$(1.91 \pm 0.26) \times 10^{-3}$	
Γ_{21} $\eta\pi^+\pi^-$	$(5.0 \pm 0.5) \times 10^{-3}$	
Γ_{22} $a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(1.9 \pm 0.7) \times 10^{-3}$	
Γ_{23} $f_2(1270)\eta$	$(2.8 \pm 0.8) \times 10^{-3}$	
Γ_{24} $\pi^+\pi^-\eta'$	$(2.4 \pm 0.5) \times 10^{-3}$	
Γ_{25} $\pi^0f_0(980) \rightarrow \pi^0\pi^+\pi^-$	$< 6.0 \times 10^{-7}$	CL=90%
Γ_{26} $K^+K^*(892)^0\pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$	
Γ_{27} $K^*(892)^0K^*(892)^0$	$(1.5 \pm 0.4) \times 10^{-3}$	
Γ_{28} $K^+K^-K_S^0K_S^0$	$< 5 \times 10^{-4}$	CL=90%
Γ_{29} $K^+K^-K^+K^-$	$(5.6 \pm 1.2) \times 10^{-4}$	
Γ_{30} $K^+K^-\phi$	$(4.3 \pm 1.6) \times 10^{-4}$	
Γ_{31} $\omega\omega$	$(6.0 \pm 0.7) \times 10^{-4}$	
Γ_{32} $\omega\phi$	$(2.2 \pm 0.6) \times 10^{-5}$	
Γ_{33} $\phi\phi$	$(4.4 \pm 0.6) \times 10^{-4}$	
Γ_{34} $p\bar{p}$	$(7.3 \pm 0.4) \times 10^{-5}$	
Γ_{35} $p\bar{p}\pi^0$	$(1.64 \pm 0.20) \times 10^{-4}$	
Γ_{36} $p\bar{p}\eta$	$(1.53 \pm 0.26) \times 10^{-4}$	
Γ_{37} $p\bar{p}\omega$	$(2.24 \pm 0.33) \times 10^{-4}$	
Γ_{38} $p\bar{p}\phi$	$< 1.8 \times 10^{-5}$	CL=90%
Γ_{39} $p\bar{p}\pi^+\pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$	
Γ_{40} $p\bar{p}\pi^0\pi^0$		
Γ_{41} $p\bar{p}K^+K^-$ (non-resonant)	$(1.34 \pm 0.24) \times 10^{-4}$	
Γ_{42} $p\bar{p}K_S^0K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%
Γ_{43} $\Lambda\bar{\Lambda}$	$(1.18 \pm 0.19) \times 10^{-4}$	
Γ_{44} $\Lambda\bar{\Lambda}\pi^+\pi^-$	$< 1.5 \times 10^{-3}$	CL=90%
Γ_{45} $K^+\bar{p}\Lambda$	$(3.2 \pm 1.0) \times 10^{-4}$	
Γ_{46} $K^+p\Lambda(1520) + \text{c.c.}$	$(1.8 \pm 0.5) \times 10^{-4}$	
Γ_{47} $\Lambda(1520)\bar{\Lambda}(1520)$	$< 1.0 \times 10^{-4}$	CL=90%
Γ_{48} $\Sigma^0\bar{\Sigma}^0$	$< 4 \times 10^{-5}$	CL=90%
Γ_{49} $\Sigma^+\bar{\Sigma}^-$	$< 6 \times 10^{-5}$	CL=90%
Γ_{50} $\Xi^0\bar{\Xi}^0$	$< 6 \times 10^{-5}$	CL=90%
Γ_{51} $\Xi^-\bar{\Xi}^+$	$(8.4 \pm 2.3) \times 10^{-5}$	
Γ_{52} $\pi^+\pi^- + K^+K^-$	$< 2.1 \times 10^{-3}$	
Γ_{53} $K_S^0K_S^0$	$< 6 \times 10^{-5}$	CL=90%

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

DESIG=54

DESIG=62

DESIG=25

DESIG=19

DESIG=24

DESIG=40

DESIG=63

DESIG=64

DESIG=48

DESIG=49

DESIG=50

DESIG=26

DESIG=23

DESIG=27

Radiative decays

Γ_{54}	$\gamma J/\psi(1S)$	$(34.4 \pm 1.5) \%$
Γ_{55}	$\gamma \rho^0$	$(2.28 \pm 0.19) \times 10^{-4}$
Γ_{56}	$\gamma \omega$	$(7.1 \pm 0.9) \times 10^{-5}$
Γ_{57}	$\gamma \phi$	$(2.6 \pm 0.6) \times 10^{-5}$
Γ_{58}	$\gamma \gamma$	

NODE=M055;CLUMP=B
 DESIG=1
 DESIG=45
 DESIG=46
 DESIG=47
 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 223 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 312.2$ for 174 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_{29}	8				
x_{34}	-9	-4			
x_{43}	11	5	-5		
x_{54}	36	16	-32	20	
Γ	-13	-5	-59	-7	-30
	x_{15}	x_{29}	x_{34}	x_{43}	x_{54}

 $\chi_{c1}(1P)$ PARTIAL WIDTHS

$$\chi_{c1}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{34} \Gamma_{54} / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
21.7±0.8 OUR FIT			
21.4±0.9 OUR AVERAGE			
21.5±0.5±0.8	⁷ ANDREOTTI 05A	E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
21.4±1.5±2.2	^{7,8} ARMSTRONG 92	E760	$\bar{p}p \rightarrow e^+ e^- \gamma$
19.9 ^{+4.4} _{-4.0}	⁷ BAGLIN 86B	SPEC	$\bar{p}p \rightarrow e^+ e^- X$
⁷ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.			
⁸ Recalculated by ANDREOTTI 05A.			

NODE=M055220

NODE=M055223

NODE=M055G1
 NODE=M055G1

NODE=M055G;LINKAGE=7A
 NODE=M055G;LINKAGE=AN

 $\chi_{c1}(1P)$ BRANCHING RATIOS**HADRONIC DECAYS**

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

$$\Gamma_1 / \Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
5.8±1.4 OUR EVALUATION	Error includes scale factor of 1.2. Treating systematic error as correlated.		
5.8±1.1 OUR AVERAGE			
5.4±0.7±0.9	⁹ BAI 99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$
16.0±5.9±0.8	⁹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$
⁹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.			

NODE=M055225

NODE=M055305

NODE=M055R6
 NODE=M055R6

→ NOT CHECKED ←

NODE=M055R;LINKAGE=X2

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

$$\Gamma_2 / \Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
7.6±2.6 OUR EVALUATION	Treating systematic error as correlated.		
8 ±4 OUR AVERAGE	Error includes scale factor of 1.5.		
4.6±2.1±2.6	¹⁰ BAI 99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$
12.5±4.2±0.6	¹⁰ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$
¹⁰ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.			

NODE=M055R4
 NODE=M055R4

→ NOT CHECKED ←

NODE=M055R4;LINKAGE=X2

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.26±0.17 OUR AVERAGE		[(1.26 ± 0.17)% OUR 2011 AVERAGE]		
1.26±0.16±0.05	604.7	¹¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹¹ HE 08B reports $1.28 \pm 0.06 \pm 0.15 \pm 0.08$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R35
NODE=M055R35
NEW

NODE=M055R35;LINKAGE=HE

$\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.53±0.26 OUR AVERAGE		[(1.53 ± 0.26)% OUR 2011 AVERAGE]		
1.53±0.25±0.06	712.3	^{12,13} HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹² HE 08B reports $1.56 \pm 0.13 \pm 0.22 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹³ Calculated by us. We have added the values from HE 08B for $\rho^+\pi^-\pi^0$ and $\rho^-\pi^+\pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M055R36
NODE=M055R36
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±35	¹⁴ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹⁴ Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R8
NODE=M055R8

NODE=M055R;LINKAGE=T

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.57±0.03±0.08	608	¹⁵ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

¹⁵ ABLIKIM 11A reports $(0.57 \pm 0.03 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.

NODE=M055R44
NODE=M055R44

NODE=M055R44;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
4.5±1.0 OUR EVALUATION	Treating systematic error as correlated.		
4.5±0.9 OUR AVERAGE			

4.2±0.4±0.9	¹⁶ BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
7.3±3.0±0.4	¹⁶ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹⁶ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R5
NODE=M055R5

→ NOT CHECKED ←

NODE=M055R5;LINKAGE=X2

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.118±0.029 OUR AVERAGE		[(0.118 ± 0.029)% OUR 2011 AVERAGE]		

0.118±0.029±0.005	45.1	¹⁷ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹⁷ HE 08B reports $0.12 \pm 0.02 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R37
NODE=M055R37
NEW

NODE=M055R37;LINKAGE=HE

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.90±0.15 OUR AVERAGE		[(0.90 ± 0.15)% OUR 2011 AVERAGE]		

0.90±0.14±0.03	141.3	¹⁸ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹⁸ HE 08B reports $0.92 \pm 0.09 \pm 0.11 \pm 0.06$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\pi^-K^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R39
NODE=M055R39
NEW

NODE=M055R39;LINKAGE=HE

$$\Gamma(\rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.53±0.13 OUR AVERAGE		[(0.53 ± 0.13)% OUR 2011 AVERAGE]		
0.53±0.13±0.02	141.3	¹⁹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0$

¹⁹ HE 08B reports $0.54 \pm 0.11 \pm 0.07 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R40
NODE=M055R40

NEW

NODE=M055R40;LINKAGE=HE

$$\Gamma(K^*(892)^0 K^0 \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.25±0.07 OUR AVERAGE		[(0.25 ± 0.07)% OUR 2011 AVERAGE]		
0.25±0.07±0.01	141.3	²⁰ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²⁰ HE 08B reports $0.25 \pm 0.06 \pm 0.03 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 K^0 \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R41
NODE=M055R41

NEW

NODE=M055R41;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.12 ± 0.04 OUR AVERAGE		[(0.12 ± 0.04)% OUR 2011 AVERAGE]		
0.118±0.036±0.005	141.3	²¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²¹ HE 08B reports $0.12 \pm 0.03 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R42
NODE=M055R42

NEW

NODE=M055R42;LINKAGE=HE

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.2±3.1±0.3	19.8 ± 7.7	²² ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

²² ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ $= (0.67 \pm 0.26 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R05
NODE=M055R05

NODE=M055R05;LINKAGE=AB

$$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.33±0.10±0.01	²³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

²³ ATHAR 07 reports $(0.34 \pm 0.10 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R25
NODE=M055R25

NODE=M055R25;LINKAGE=AT

$$\Gamma(K^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
7.3±0.6 OUR FIT	

NODE=M055R17
NODE=M055R17

$$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.03±0.38±0.04	22	²⁴ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

²⁴ ABLIKIM 06R reports $(1.1 \pm 0.4 \pm 0.1) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R09
NODE=M055R09

NODE=M055R09;LINKAGE=AB

$\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.7 \pm 0.1$	27	25 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
25 ABLIKIM 06R reports $(1.6 \pm 0.7 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R10
 NODE=M055R10

NODE=M055R10;LINKAGE=AB

 $\Gamma(K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	26 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
26 ABLIKIM 06R reports $< 0.9 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.2 \times 10^{-2}$.				

NODE=M055R12
 NODE=M055R12

NODE=M055R12;LINKAGE=AB

 $\Gamma(K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	27 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
27 ABLIKIM 06R reports $< 2.4 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.2 \times 10^{-2}$.				

NODE=M055R13
 NODE=M055R13

NODE=M055R13;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$1.91 \pm 0.25 \pm 0.07$	28 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
28 ATHAR 07 reports $(1.95 \pm 0.16 \pm 0.23) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

NODE=M055R20
 NODE=M055R20

NODE=M055R20;LINKAGE=AT

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

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
5.0 ± 0.5 OUR AVERAGE				
$4.9 \pm 0.5 \pm 0.2$		29 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
$5.5 \pm 1.0 \pm 0.2$	222	30 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
29 ATHAR 07 reports $(5.0 \pm 0.3 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
30 ABLIKIM 06R reports $(5.9 \pm 0.7 \pm 0.8) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R08
 NODE=M055R08

NODE=M055R08;LINKAGE=AT

NODE=M055R08;LINKAGE=AB

 $\Gamma(a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.9 \pm 0.7 \pm 0.1$	58	31 ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
31 ABLIKIM 06R reports $(2.0 \pm 0.5 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R15
 NODE=M055R15

NODE=M055R15;LINKAGE=AB

$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 0.8 \pm 0.1$	53	³² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

³² ABLIKIM 06R reports $(3.0 \pm 0.7 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{23}/Γ

NODE=M055R16
NODE=M055R16

NODE=M055R16;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 0.5 \pm 0.1$	³³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

³³ ATHAR 07 reports $(2.4 \pm 0.4 \pm 0.3) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{24}/Γ

NODE=M055R28
NODE=M055R28

NODE=M055R28;LINKAGE=AT

 $\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	³⁴ ABLIKIM	11D BES3	$e^+e^- \rightarrow \pi^0 \pi^+ \pi^-$

³⁴ Assuming $a_0(980) - f_0(980)$ mixing and isospin breaking via γ^* and K^*K loops. The quoted limit is equivalent to a measurement of $(2.7 \pm 4.2 \pm 3.6) \times 10^{-7}$.

 Γ_{25}/Γ

NODE=M055R18
NODE=M055R18

NODE=M055R18;LINKAGE=AB

 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
32 ± 21	³⁵ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

³⁵ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

 Γ_{26}/Γ

NODE=M055R9
NODE=M055R9

NODE=M055R9;LINKAGE=T

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.4 \pm 0.1$	28.4 ± 5.5	^{36,37} ABLIKIM	04H BES	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

³⁶ ABLIKIM 04H reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.40 \pm 0.27 \pm 0.22) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³⁷ Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

 Γ_{27}/Γ

NODE=M055R26
NODE=M055R26

NODE=M055R26;LINKAGE=AB

NODE=M055R26;LINKAGE=AL

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 5	90	3.2 ± 2.4	³⁸ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

³⁸ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 4.2 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.2 \times 10^{-2}$.

 Γ_{28}/Γ

NODE=M055R06
NODE=M055R06

NODE=M055R06;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID
0.56 ± 0.12 OUR FIT	

 Γ_{29}/Γ

NODE=M055R14
NODE=M055R14

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.43 \pm 0.16 \pm 0.02$	17	³⁹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

³⁹ ABLIKIM 06T reports $(0.46 \pm 0.16 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{30}/Γ

NODE=M055R07
NODE=M055R07

NODE=M055R07;LINKAGE=AB

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.0 \pm 0.3 \pm 0.7$	597	40 ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
40 ABLIKIM 11K reports $(6.0 \pm 0.3 \pm 0.7) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.				

 Γ_{31}/Γ

NODE=M055R49
 NODE=M055R49

NODE=M055R49;LINKAGE=AL

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.22 \pm 0.06 \pm 0.02$	15	41 ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
41 ABLIKIM 11K reports $(0.22 \pm 0.06 \pm 0.02) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.				

 Γ_{32}/Γ

NODE=M055R50
 NODE=M055R50

NODE=M055R50;LINKAGE=AL

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.4 \pm 0.3 \pm 0.5$	366	42 ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
42 ABLIKIM 11K reports $(4.4 \pm 0.3 \pm 0.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.				

 Γ_{33}/Γ

NODE=M055R51
 NODE=M055R51

NODE=M055R51;LINKAGE=AL

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID
0.73 ± 0.04 OUR FIT	

 Γ_{34}/Γ

NODE=M055R11
 NODE=M055R11

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.164 ± 0.020 OUR AVERAGE			
0.172 $\pm$ 0.020 $\pm$ 0.007	43 ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.118 $\pm$ 0.049 $\pm$ 0.005	44 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
43 ONYISI 10 reports $(1.75 \pm 0.16 \pm 0.13 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			
44 ATHAR 07 reports $(1.2 \pm 0.5 \pm 0.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

 Γ_{35}/Γ

NODE=M055R21
 NODE=M055R21

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
$0.153 \pm 0.026 \pm 0.006$		45 ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.16	90	46 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
45 ONYISI 10 reports $(1.56 \pm 0.22 \pm 0.14 \pm 0.10) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
46 ATHAR 07 reports $< 0.16 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.2 \times 10^{-2}$.				

 Γ_{36}/Γ

NODE=M055R27
 NODE=M055R27

NODE=M055R27;LINKAGE=ON

NODE=M055R27;LINKAGE=AT

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$0.224 \pm 0.032 \pm 0.009$	47 ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
47 ONYISI 10 reports $(2.28 \pm 0.28 \pm 0.16 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

 Γ_{37}/Γ

NODE=M055R43
 NODE=M055R43

NODE=M055R43;LINKAGE=ON

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	48 ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$
48 ABLIKIM 11F reports $< 1.82 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.				

 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±0.15	49 BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
1.08±0.77±0.05	49 TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$
49 Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.			

 Γ_{39}/Γ

NODE=M055R7
 NODE=M055R7

→ NOT CHECKED ←

NODE=M055R7;LINKAGE=X2

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

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	90	50 HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0$
50 HE 08B reports $< 0.05\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.2 \times 10^{-2}$.				

 Γ_{40}/Γ

NODE=M055R38
 NODE=M055R38

NODE=M055R38;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.35±0.15±0.19	82 ± 9	51 ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$
51 ABLIKIM 11F reports $(1.35 \pm 0.15 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.				

 Γ_{41}/Γ

NODE=M055R45
 NODE=M055R45

NODE=M055R45;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	52 ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
52 Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) (9.1 \pm 0.6)\%$.				

 Γ_{42}/Γ

NODE=M055R02
 NODE=M055R02

NODE=M055R;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID
1.18±0.19 OUR FIT	

 Γ_{43}/Γ

NODE=M055R23
 NODE=M055R23

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	53 ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
53 Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) (9.1 \pm 0.6)\%$.				

 Γ_{44}/Γ

NODE=M055R01
 NODE=M055R01

NODE=M055R01;LINKAGE=AB

 $\Gamma(K^+\bar{p}\Lambda)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.32±0.09±0.01	54 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
54 ATHAR 07 reports $(0.33 \pm 0.09 \pm 0.04) \times 10^{-3}$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

 Γ_{45}/Γ

NODE=M055R22
 NODE=M055R22

NODE=M055R22;LINKAGE=AT

 $\Gamma(K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.8±0.4±0.3	48 ± 10	55 ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$
55 ABLIKIM 11F reports $(1.81 \pm 0.38 \pm 0.28) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.				

 Γ_{46}/Γ

NODE=M055R46
 NODE=M055R46

NODE=M055R46;LINKAGE=AB

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	56 ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$
56 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.				

NODE=M055R47
 NODE=M055R47

NODE=M055R47;LINKAGE=AB

 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.4	90	3.8 ± 2.5	57 NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Sigma^0\bar{\Sigma}^0$
57 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.2 \times 10^{-2}$.					

NODE=M055R32
 NODE=M055R32

NODE=M055R32;LINKAGE=NA

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90	4.3 ± 2.3	58 NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Sigma^+\bar{\Sigma}^-$
58 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.2 \times 10^{-2}$.					

NODE=M055R33
 NODE=M055R33

NODE=M055R33;LINKAGE=NA

 $\Gamma(\Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90	1.7 ± 2.4	59 NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Xi^0\bar{\Xi}^0$
59 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.2 \times 10^{-2}$.					

NODE=M055R34
 NODE=M055R34

NODE=M055R34;LINKAGE=NA

 $\Gamma(\Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.22 \pm 0.03$		16.4 ± 4.3	60 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		61 ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
60 NAIK 08 reports $(0.86 \pm 0.22 \pm 0.08) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
61 Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) (9.1 \pm 0.6)\%$.					

NODE=M055R03
 NODE=M055R03

NODE=M055R03;LINKAGE=NA

NODE=M055R03;LINKAGE=AB

 $[\Gamma(\pi^+\pi^-) + \Gamma(K^+K^-)]/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<21		62 FELDMAN	77 MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<38	90	62 BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma\chi_{c1}$
62 Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.				

NODE=M055R2
 NODE=M055R2

NODE=M055R2;LINKAGE=T

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	63 ABLIKIM	05O BES2	$\psi(2S) \rightarrow \chi_{c1}\gamma$
63 ABLIKIM 05O reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ $< 0.6 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.2 \times 10^{-2}$.				

NODE=M055R04
 NODE=M055R04

NODE=M055R04;LINKAGE=AB

RADIATIVE DECAYS

 $\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.344 ± 0.015 OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.379 \pm 0.008 \pm 0.021$	64 ADAM	05A CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$
64 Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma\gamma J/\psi)$ from ADAM 05A and $B(\psi(2S) \rightarrow \gamma\chi_{c1})$ from ATHAR 04.			

NODE=M055R1
 NODE=M055R1

NODE=M055R1;LINKAGE=AD

$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

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

228±19 OUR AVERAGE

[(229 ± 27) × 10^{-6} OUR 2011 AVERAGE]

228±13±22	432 ± 25	65 ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\rho^0$
229±25±9	186 ± 15	66 BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\rho^0$

65 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.

66 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R29
NODE=M055R29
NEW

NODE=M055R29;LINKAGE=AB

NODE=M055R29;LINKAGE=BE

$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{56}/Γ

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

71±9 OUR AVERAGE

[(78 ± 18) × 10^{-6} OUR 2011 AVERAGE]

70±7±7	136 ± 14	67 ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\omega$
78±18±3	39 ± 7	68 BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\omega$

67 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.

68 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R30
NODE=M055R30
NEW

NODE=M055R30;LINKAGE=AB

NODE=M055R30;LINKAGE=BE

$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{57}/Γ

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

26±5±2		43 ± 9	69 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	70 BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\phi$

69 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$.

70 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.2 \times 10^{-2}$.

NODE=M055R31
NODE=M055R31

NODE=M055R31;LINKAGE=AB

NODE=M055R31;LINKAGE=BE

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{58}/Γ

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

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

< 3.5	90	ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow 3\gamma$

<150	90	71 YAMADA	77 DASP	$e^+e^- \rightarrow 3\gamma$

71 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

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{34}/\Gamma \times \Gamma_{110}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

2.02±0.16 OUR FIT

1.1 ± 1.0	72 BAI	98i BES	$\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma\bar{p}p$

72 Calculated by us. The value for $B(\chi_{c1} \rightarrow p\bar{p})$ reported in BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B1
NODE=M055B1

NODE=M055B;LINKAGE=J2

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{43} / \Gamma \times \Gamma_{110}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
10.9±1.7 OUR FIT				
10.5±1.6±0.6	46 ± 7	⁷³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

NODE=M055B10
NODE=M055B10

⁷³ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow \Lambda \bar{\Lambda}) = (11.6 \pm 1.8 \pm 0.7 \pm 0.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B10;LINKAGE=NA

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{43} / \Gamma \times \Gamma_{110}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±0.5 OUR FIT				
7.1^{+2.8}_{-2.4}±1.3	9.0 ^{+3.5} _{-3.1}	⁷⁴ BAI	03E BES	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

NODE=M055B11
NODE=M055B11

⁷⁴ BAI 03E reports $[B(\chi_{c1} \rightarrow \Lambda \bar{\Lambda}) B(\psi(2S) \rightarrow \gamma \chi_{c1}) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p \bar{p})] = (1.33^{+0.52}_{-0.46} \pm 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p \bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M055B11;LINKAGE=BA

$$\Gamma(\chi_{c1}(1P) \Rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \Rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{54} / \Gamma \times \Gamma_{110}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.18±0.08 OUR FIT				
2.70±0.13 OUR AVERAGE				
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		⁷⁵ OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.2 ±0.5		⁷⁶ BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.9 ±0.5		⁷⁶ BARTEL	78B CNTR	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.0 ±1.5		⁷⁷ BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$
2.8 ±0.9		⁷⁵ WHITAKER	76 MRK1	$e^+ e^-$

NODE=M055B2
NODE=M055B2

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

3.56±0.03±0.12	24.9k	⁷⁸ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3.44±0.06±0.13	3.7k	⁷⁹ ADAM	05A CLEO	Repl. by MENDEZ 08

⁷⁵ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

⁷⁶ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

⁷⁷ Assumes isotropic gamma distribution.

⁷⁸ Not independent from other measurements of MENDEZ 08.

⁷⁹ Not independent from other values reported by ADAM 05A.

NODE=M055B;LINKAGE=3Q
NODE=M055B;LINKAGE=2Q
NODE=M055B;LINKAGE=EA
NODE=M055B2;LINKAGE=ME
NODE=M055B;LINKAGE=AD

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{54} / \Gamma \times \Gamma_{110}^{\psi(2S)} / \Gamma_9^{\psi(2S)}$$

$$\Gamma_{54} / \Gamma \times \Gamma_{110}^{\psi(2S)} / \Gamma_9^{\psi(2S)} = \Gamma_{54} / \Gamma \times \Gamma_{110}^{\psi(2S)} / (\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + 0.344 \Gamma_{110}^{\psi(2S)} + 0.195 \Gamma_{111}^{\psi(2S)})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.34±0.12 OUR FIT				

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

5.70±0.04±0.15	24.9k	⁸⁰ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.77±0.10±0.12	3.7k	ADAM	05A CLEO	Repl. by MENDEZ 08

⁸⁰ Not independent from other measurements of MENDEZ 08.

NODE=M055B7

NODE=M055B7

NODE=M055B7

NODE=M055B7;LINKAGE=ME

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{54} / \Gamma \times \Gamma_{110}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.46±0.23 OUR FIT				
10.15±0.28 OUR AVERAGE				

10.17±0.07±0.27	24.9k	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
12.6 ±0.3 ±3.8	3k	⁸¹ ABLIKIM	04B BES	$\psi(2S) \rightarrow J/\psi X$
8.5 ±2.1		⁸² 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	⁸³ ADAM	05A CLEO	Repl. by MENDEZ 08

NODE=M055B3
NODE=M055B3

⁸¹ From a fit to the J/ψ recoil mass spectra.

⁸² 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 $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

⁸³ Not independent from other values reported by ADAM 05A.

NODE=M055B;LINKAGE=AB

NODE=M055B;LINKAGE=J3

NODE=M055B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{15}/\Gamma \times \Gamma_{110}^{\psi(2S)}/\Gamma\psi(2S)}$$

NODE=M055B16
NODE=M055B16

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

6.8±0.5 OUR FIT

7.2±0.6 OUR AVERAGE

7.3±0.5±0.5

⁸⁴ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

7.0±0.5±0.9

⁸⁵ ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

⁸⁴ Calculated by us. The value of $B(\chi_{c1} \rightarrow K^0 K^+ \pi^- + \text{c.c.})$ reported by ATHAR 07 was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B16;LINKAGE=AT

⁸⁵ Calculated by us. ABLIKIM 06R reports $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-) = (4.0 \pm 0.3 \pm 0.5) \times 10^{-3}$. We use $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.7 \pm 0.4) \times 10^{-2}$.

NODE=M055B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{15}/\Gamma \times \Gamma_{110}^{\psi(2S)}/\Gamma\psi(2S)}$$

NODE=M055B17
NODE=M055B17

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

20.1±1.6 OUR FIT

13.2±2.4±3.2

⁸⁶ BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

⁸⁶ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{29}/\Gamma \times \Gamma_{110}^{\psi(2S)}/\Gamma\psi(2S)}$$

NODE=M055B14
NODE=M055B14

VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

0.52±0.11 OUR FIT

0.61±0.11±0.08

54 ⁸⁷ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

⁸⁷ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$.

NODE=M055B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{29}/\Gamma \times \Gamma_{110}^{\psi(2S)}/\Gamma\psi(2S)}$$

NODE=M055B15
NODE=M055B15

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

1.54±0.31 OUR FIT

1.13±0.40±0.29

⁸⁸ BAI 99B BES $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

⁸⁸ 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;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{34}/\Gamma \times \Gamma_{110}^{\psi(2S)}/\Gamma\psi(2S)}$$

NODE=M055B6
NODE=M055B6

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

6.8±0.5 OUR FIT

7.5±1.4 OUR AVERAGE Error includes scale factor of 2.0.

8.2±0.7±0.4

141 ± 13

⁸⁹ NAIK

08

CLEO

$\psi(2S) \rightarrow \gamma p \bar{p}$

4.8^{+1.4}_{-1.3}±0.6

18.2^{+5.5}_{-4.9}

BAI

04F

BES

$\psi(2S) \rightarrow \gamma \chi_{c1}(1P) \rightarrow \gamma \bar{p} p$

⁸⁹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow p \bar{p}) = (9.0 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B6;LINKAGE=NA

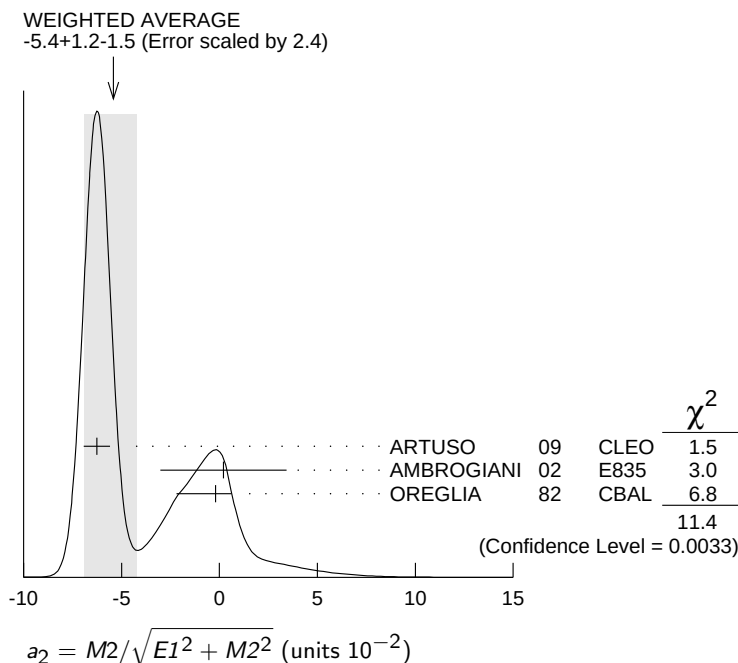
MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

NODE=M055240

$a_2 = M2/\sqrt{E1^2 + M2^2}$ Magnetic quadrupole fractional transition amplitude

 NODE=M055A1
 NODE=M055A1

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-5.4 $\pm$ 1.2	OUR AVERAGE	Error includes scale factor of 2.4. See the ideogram below.		
-6.26 $\pm$ 0.63 $\pm$ 0.24	39k	ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.2 $\pm$ 3.2 $\pm$ 0.4	2090	AMBROGIANI	02	E835 $p\bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi \gamma$
-0.2 $\pm$ 0.8	921	OREGLIA	82	CBAL $\psi(2S) \rightarrow \chi_{c1} \gamma \rightarrow J/\psi \gamma \gamma$
-2.0				



MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma \chi_{c1}(1S)$ RADIATIVE DECAY

NODE=M055250

$b_2 = M2/\sqrt{E1^2 + M2^2}$ Magnetic quadrupole fractional transition amplitude

 NODE=M055QB2
 NODE=M055QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 $\pm$ 0.8	OUR AVERAGE			
2.76 $\pm$ 0.73 $\pm$ 0.23	39k	ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
7.7 $\pm$ 5.0	921	OREGLIA	82	CBAL $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
-4.5				

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 $\pm$ 0.57	39k	⁹⁰ ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
-0.99				

⁹⁰ 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	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 011103R	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 091501R	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 011102R	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101R	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.)
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)
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=50846
REFID=50763
REFID=50769
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REFID=22059
REFID=22062
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

NODE=M144M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3525.41 ± 0.16 OUR AVERAGE		Error includes scale factor of 1.2.		
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	¹ 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	² 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	³ 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 Combination of exclusive and inclusive analyses for the reaction $\psi(2S) \rightarrow \pi^0 h_c \rightarrow \pi^0 \eta_c \gamma$. This result is the average of DOBBS 08A and ROSNER 05.

² Superseded by DOBBS 08A.

³ Mass central value and systematic error recalculated by us according to Eq. (16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.

NODE=M144M;LINKAGE=DO

NODE=M144M;LINKAGE=RO

NODE=M144M;LINKAGE=NW

$h_c(1P)$ WIDTH

NODE=M144W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1		13	ANDREOTTI	05B E835	$\bar{p} p \rightarrow \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.44	90	3679	⁴ ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
<1.1	90	59	ARMSTRONG	92D E760	$\bar{p} p \rightarrow J/\psi \pi^0$

⁴ The central value is $\Gamma = 0.73 \pm 0.45 \pm 0.28$ MeV.

NODE=M144W

NODE=M144W;LINKAGE=AB

$h_c(1P)$ DECAY MODES

NODE=M144215;NODE=M144

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi(1S)\pi^0$	
Γ_2 $J/\psi(1S)\pi\pi$	not seen
Γ_3 $p\bar{p}$	
Γ_4 $\eta_c(1S)\gamma$	(53 $\pm$ 7) %
Γ_5 $\pi^+\pi^-\pi^0$	< 2.3 $\times 10^{-3}$
Γ_6 $2\pi^+2\pi^-\pi^0$	(2.2 $^{+0.9}_{-0.8}$) %
Γ_7 $3\pi^+3\pi^-\pi^0$	< 3.0 %

DESIG=1

DESIG=2;OUR EST; $\rightarrow$ NOT CHECKED $\leftarrow$

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 $\pm$ 4.5	13	⁵ ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c\gamma$	
⁵ 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	
53 $\pm$ 7 OUR AVERAGE					
54.3 $\pm$ 6.7 $\pm$ 5.2	3679	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$	
48 $\pm$ 6 $\pm$ 7		⁶ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
48 $\pm$ 6 $\pm$ 7	1282	⁷ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$	
46 $\pm$ 12 $\pm$ 7	168	⁸ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0\eta_c\gamma$	

NODE=M144R2

NODE=M144R2

OCCUR=2

⁶ 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.

⁷ 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.

⁸ ROSNER 05 reports $[\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=DB

NODE=M144R2;LINKAGE=DO

NODE=M144R2;LINKAGE=RO

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE (units 10^{-3})		DOCUMENT ID	TECN	COMMENT	
<2.2		⁹ ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$	
⁹ 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

NODE=M144R01

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	¹⁰ ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0\gamma\eta_c$	

NODE=M144R02

NODE=M144R02

¹⁰ ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow 2\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (1.88^{+0.48+0.47}_{-0.45-0.30}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R02;LINKAGE=AD

$\Gamma(3\pi^+ 3\pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-2})

DOCUMENT ID

TECN

COMMENT

<2.9

11 ADAMS

09

CLEO

 $\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

¹¹ 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

12 ABLIKIM

10B

BES3

 $\psi(2S) \rightarrow \pi^0 \gamma X$

4.16 ± 0.30 ± 0.37

1430

13 DOBBS

08A

CLEO

 $\psi(2S) \rightarrow \pi^0 \gamma \eta_c$ ¹² Not independent of other branching fractions in ABLIKIM 10B.¹³ Not independent of other branching fractions in DOBBS 08A.

NODE=M144R04
 NODE=M144R04

NODE=M144R04;LINKAGE=AB
 NODE=M144R04;LINKAGE=DO

 $h_c(1P)$ REFERENCES

ABLIKIM	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=53348
 REFID=53103
 REFID=52579
 REFID=50768
 REFID=50812
 REFID=49579
 REFID=44074
 REFID=43307
 REFID=43174
 REFID=43180

NODE=M057

 $\chi_{c2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the
 $\chi_{c0}(1P)$ Listings.

NODE=M057

 $\chi_{c2}(1P)$ 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. ● ● ●

3543 ± 10

4

WHITAKER

76

MRK1

 $e^+ e^- \rightarrow J/\psi 2\gamma$ ¹ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.² Using mass of $\psi(2S) = 3686.0$ MeV.³ $J/\psi(1S)$ mass constrained to 3097 MeV.⁴ Assuming $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.⁵ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.⁶ From a simultaneous fit to radiative and hadronic decay channels.

NODE=M057M;LINKAGE=NW
 NODE=M057M;LINKAGE=C
 NODE=M057M;LINKAGE=P
 NODE=M057M;LINKAGE=E
 NODE=M057M;LINKAGE=D

NODE=M057M;LINKAGE=M

 $\chi_{c2}(1P)$ WIDTH

NODE=M057W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.98 ±0.11 OUR FIT				
[1.97 ± 0.11 MeV OUR 2011 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	⁷ ARMSTRONG 92	E760	$\bar{p}p \rightarrow e^+e^-\gamma$
2.6 +1.4 -1.0	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
2.8 +2.1 -2.0		⁸ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$

⁷ Recalculated by ANDREOTTI 05A.

⁸ Errors correspond to 90% confidence level; authors give only width range.

NODE=M057W
NEW

NODE=M057W;LINKAGE=AN
NODE=M057W;LINKAGE=E

$\chi_{c2}(1P)$ DECAY MODES

NODE=M057215;NODE=M057

Mode	Fraction (Γ_i/Γ)	Confidence level
Hadronic decays		
Γ_1 $2(\pi^+\pi^-)$	(1.10±0.11) %	
Γ_2 $\rho\rho$		
Γ_3 $\pi^+\pi^-\pi^0\pi^0$	(2.00±0.26) %	
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.4 ±0.4) %	
Γ_5 $4\pi^0$	(1.21±0.17) $\times 10^{-3}$	
Γ_6 $K^+K^-\pi^0\pi^0$	(2.2 ±0.5) $\times 10^{-3}$	
Γ_7 $K^+\pi^-K^0\pi^0 + \text{c.c.}$	(1.51±0.22) %	
Γ_8 $\rho^+K^-K^0 + \text{c.c.}$	(4.5 ±1.4) $\times 10^{-3}$	
Γ_9 $K^*(892)^0 K^+\pi^- \rightarrow$ $K^+\pi^-K^0\pi^0 + \text{c.c.}$	(3.2 ±0.9) $\times 10^{-3}$	
Γ_{10} $K^*(892)^0 K^0\pi^0 \rightarrow$ $K^+\pi^-K^0\pi^0 + \text{c.c.}$	(4.2 ±0.9) $\times 10^{-3}$	
Γ_{11} $K^*(892)^- K^+\pi^0 \rightarrow$ $K^+\pi^-K^0\pi^0 + \text{c.c.}$	(4.1 ±0.9) $\times 10^{-3}$	
Γ_{12} $K^*(892)^+ K^0\pi^- \rightarrow$ $K^+\pi^-K^0\pi^0 + \text{c.c.}$	(3.2 ±0.9) $\times 10^{-3}$	
Γ_{13} $K^+K^-\eta\pi^0$	(1.4 ±0.5) $\times 10^{-3}$	
Γ_{14} $K^+K^-\pi^+\pi^-$	(9.1 ±1.1) $\times 10^{-3}$	
Γ_{15} $K^+K^-\pi^+\pi^-\pi^0$	(1.3 ±0.4) %	
Γ_{16} $K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	(2.3 ±1.2) $\times 10^{-3}$	
Γ_{17} $K^*(892)^0\bar{K}^*(892)^0$	(2.5 ±0.5) $\times 10^{-3}$	
Γ_{18} $3(\pi^+\pi^-)$	(8.6 ±1.8) $\times 10^{-3}$	
Γ_{19} $\phi\phi$	(1.14±0.12) $\times 10^{-3}$	
Γ_{20} $\omega\omega$	(1.10±0.12) $\times 10^{-3}$	
Γ_{21} $\omega\phi$		
Γ_{22} $\pi\pi$	(2.43±0.13) $\times 10^{-3}$	
Γ_{23} $\rho^0\pi^+\pi^-$	(4.0 ±1.7) $\times 10^{-3}$	
Γ_{24} $\pi^+\pi^-\eta$	(5.2 ±1.4) $\times 10^{-4}$	
Γ_{25} $\pi^+\pi^-\eta'$	(5.5 ±2.0) $\times 10^{-4}$	
Γ_{26} $\eta\eta$	(5.9 ±0.5) $\times 10^{-4}$	
Γ_{27} K^+K^-	(1.09±0.08) $\times 10^{-3}$	
Γ_{28} $K_S^0 K_S^0$	(5.8 ±0.5) $\times 10^{-4}$	
Γ_{29} $\bar{K}^0 K^+\pi^- + \text{c.c.}$	(1.40±0.20) $\times 10^{-3}$	
Γ_{30} $K^+K^-\pi^0$	(3.3 ±0.8) $\times 10^{-4}$	
Γ_{31} $K^+K^-\eta$	< 3.5 $\times 10^{-4}$	90%
Γ_{32} $\eta\eta'$	< 6 $\times 10^{-5}$	90%
Γ_{33} $\eta'\eta'$	< 1.1 $\times 10^{-4}$	90%
Γ_{34} $\pi^+\pi^-K_S^0 K_S^0$	(2.4 ±0.6) $\times 10^{-3}$	
Γ_{35} $K^+K^-K_S^0 K_S^0$	< 4 $\times 10^{-4}$	90%
Γ_{36} $K^+K^-K^+K^-$	(1.78±0.22) $\times 10^{-3}$	
Γ_{37} $K^+K^-\phi$	(1.55±0.33) $\times 10^{-3}$	
Γ_{38} $p\bar{p}$	(7.2 ±0.4) $\times 10^{-5}$	
Γ_{39} $p\bar{p}\pi^0$	(5.1 ±0.5) $\times 10^{-4}$	

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

DESIG=35

DESIG=29

DESIG=30

DESIG=24

DESIG=32

DESIG=11

DESIG=37

Γ ₄₀	$p\bar{p}\eta$	$(1.90 \pm 0.28) \times 10^{-4}$		DESIG=41
Γ ₄₁	$p\bar{p}\omega$	$(3.9 \pm 0.5) \times 10^{-4}$		DESIG=61
Γ ₄₂	$p\bar{p}\phi$	$(3.0 \pm 1.0) \times 10^{-5}$		DESIG=66
Γ ₄₃	$p\bar{p}\pi^+\pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		DESIG=8
Γ ₄₄	$p\bar{p}\pi^0\pi^0$	$(8.6 \pm 2.6) \times 10^{-4}$		DESIG=53
Γ ₄₅	$p\bar{p}K^+K^-$ (non-resonant)	$(2.1 \pm 0.4) \times 10^{-4}$		DESIG=63
Γ ₄₆	$p\bar{p}K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	90%	DESIG=28
Γ ₄₇	$p\bar{p}\pi^-$	$(1.1 \pm 0.4) \times 10^{-3}$		DESIG=31
Γ ₄₈	$\Lambda\bar{\Lambda}$	$(1.86 \pm 0.27) \times 10^{-4}$		DESIG=19
Γ ₄₉	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$< 3.5 \times 10^{-3}$	90%	DESIG=27
Γ ₅₀	$K^+\bar{p}\Lambda + \text{c.c.}$	$(9.1 \pm 1.8) \times 10^{-4}$		DESIG=38
Γ ₅₁	$K^+p\Lambda(1520) + \text{c.c.}$	$(3.1 \pm 0.7) \times 10^{-4}$		DESIG=64
Γ ₅₂	$\Lambda(1520)\bar{\Lambda}(1520)$	$(5.1 \pm 1.6) \times 10^{-4}$		DESIG=65
Γ ₅₃	$\Sigma^0\bar{\Sigma}^0$	$< 8 \times 10^{-5}$	90%	DESIG=47
Γ ₅₄	$\Sigma^+\bar{\Sigma}^-$	$< 7 \times 10^{-5}$	90%	DESIG=48
Γ ₅₅	$\Xi^0\bar{\Xi}^0$	$< 1.1 \times 10^{-4}$	90%	DESIG=49
Γ ₅₆	$\Xi^-\bar{\Xi}^+$	$(1.55 \pm 0.35) \times 10^{-4}$		DESIG=26
Γ ₅₇	$J/\psi(1S)\pi^+\pi^-\pi^0$	$< 1.5 \%$	90%	DESIG=12

Radiative decays

Γ ₅₈	$\gamma J/\psi(1S)$	$(19.5 \pm 0.8) \%$		NODE=M057;CLUMP=B DESIG=6
Γ ₅₉	$\gamma\rho^0$	$< 2.1 \times 10^{-5}$	90%	DESIG=44
Γ ₆₀	$\gamma\omega$	$< 7 \times 10^{-6}$	90%	DESIG=45
Γ ₆₁	$\gamma\phi$	$< 8 \times 10^{-6}$	90%	DESIG=46
Γ ₆₂	$\gamma\gamma$	$(2.59 \pm 0.16) \times 10^{-4}$		DESIG=7

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 84 branching ratios uses 223 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 312.2$ for 174 degrees of freedom.

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

x_{14}	17									
x_{16}	4	22								
x_{17}	10	8	2							
x_{19}	12	11	2	6						
x_{22}	23	20	4	12	27					
x_{23}	20	4	1	2	3	5				
x_{26}	13	12	3	7	17	32	3			
x_{27}	18	16	3	9	20	39	4	24		
x_{28}	17	15	3	9	18	34	4	21	25	
x_{29}	9	8	2	5	10	19	2	12	14	13
x_{36}	12	10	2	6	11	22	3	13	16	14
x_{38}	7	6	1	4	1	1	2	0	1	2
x_{48}	8	7	2	4	10	20	2	12	14	13
x_{58}	28	24	5	14	30	59	6	36	44	39
x_{62}	-18	-15	-3	-9	1	3	-5	3	0	-2
Γ	-25	-21	-5	-13	-19	-36	-6	-21	-27	-25
	x_1	x_{14}	x_{16}	x_{17}	x_{19}	x_{22}	x_{23}	x_{26}	x_{27}	x_{28}

χ_{36}	8					
χ_{38}	1	2				
χ_{48}	7	8	0			
χ_{58}	21	25	-11	22		
χ_{62}	0	-3	27	2	9	
Γ	-13	-17	-50	-13	-49	-48
	χ_{29}	χ_{36}	χ_{38}	χ_{48}	χ_{58}	χ_{62}

$\chi_{c2}(1P)$ PARTIAL WIDTHS

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{38} \Gamma_{58} / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
27.7±1.4 OUR FIT			
27.5±1.5 OUR AVERAGE			
27.0±1.5±1.1	⁹ ANDREOTTI 05A	E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
27.7±1.5±2.0	^{9,10} ARMSTRONG 92	E760	$p\bar{p} \rightarrow e^+ e^- \gamma$
36 ±8	⁹ BAGLIN 86B	SPEC	$p\bar{p} \rightarrow e^+ e^- X$
⁹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.			
¹⁰ Recalculated by ANDREOTTI 05A.			

NODE=M057220

NODE=M057223

NODE=M057G1
NODE=M057G1NODE=M057G;LINKAGE=7A
NODE=M057G;LINKAGE=AN

$$\Gamma(\gamma\gamma) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{62} \Gamma_{58} / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
100± 6 OUR FIT				
[98 ± 6 eV OUR 2011 FIT]				
117± 10 OUR AVERAGE				
111± 12± 9	147 ± 15	¹¹ DOBBS	06 CLE3	$10.4 e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
114± 11± 9	136 ± 13.3	^{11,12} ABE	02T BELL	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
139± 55± 21		^{11,13} ACCIARRI	99E L3	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
242± 65± 51		^{11,14} ACKER.,K...	98 OPAL	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
150± 42± 36		^{11,15} DOMINICK	94 CLE2	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
470± 240± 120		^{11,16} BAUER	93 TPC	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
¹¹ Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1187 \pm 0.0008$.				
¹² All systematic errors added in quadrature.				
¹³ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACCIARRI 99E is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.0162 \pm 0.0014$.				
¹⁴ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACKERSTAFF,K 98 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1203 \pm 0.0038$.				
¹⁵ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in DOMINICK 94 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0597 \pm 0.0025$.				
¹⁶ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in BAUER 93 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0597 \pm 0.0025$.				

NODE=M057G2
NODE=M057G2
NEWNODE=M057G;LINKAGE=LL
NODE=M057G;LINKAGE=GT
NODE=M057G;LINKAGE=J4

NODE=M057G;LINKAGE=J5

NODE=M057G;LINKAGE=J6

NODE=M057G;LINKAGE=J7

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$$

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{22} \Gamma_{62} / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.24±0.08 OUR FIT				
[1.22 ± 0.08 eV OUR 2011 FIT]				
1.18±0.25 OUR AVERAGE				
1.44±0.54±0.47	34 ± 13	¹⁷ UEHARA	09 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1.14±0.21±0.17	54 ± 10	¹⁸ NAKAZAWA	05 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
¹⁷ We multiplied the measurement by 3 to convert from $\pi^0 \pi^0$ to $\pi\pi$. Interference with the continuum included.				
¹⁸ We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi\pi$.				
0.53±0.22±0.09	8	¹⁹ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
¹⁹ Interference with the continuum not included.				

NODE=M057224

NODE=M057G4
NODE=M057G4
NEW

NODE=M057G4;LINKAGE=UE

NODE=M057G;LINKAGE=NA

NODE=M057G13
NODE=M057G13

NODE=M057G13;LINKAGE=UE

$$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{27}\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.56±0.05 OUR FIT				
[0.55 ± 0.04 eV OUR 2011 FIT]				
0.44±0.11±0.07	33 ± 8	NAKAZAWA	05 BELL	10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$

NODE=M057G5
NODE=M057G5
NEW

$$\Gamma(K_S^0K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.297±0.026 OUR FIT				
[0.292 ± 0.025 eV OUR 2011 FIT]				
0.31 ±0.05 ±0.03	38 ± 7	CHEN	07B BELL	$e^+e^- \rightarrow e^+e^-\chi_{c2}$

NODE=M057G6
NODE=M057G6
NEW

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_1\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.6 ±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

$$\Gamma(\rho^0\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.0±0.9 OUR FIT				
3.2±1.9±0.5	986 ± 578	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$

NODE=M057G07
NODE=M057G07

$$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_2\Gamma_{62}/\Gamma$$

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

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{14}\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.7 ±0.5 OUR FIT				
[4.6 ± 0.5 eV OUR 2011 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
NEW

$$\Gamma(\bar{K}^0K^+\pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{29}\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.72±0.11 OUR FIT				
1.20±0.33±0.13	126	²⁰ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0K^\pm\pi^\mp$

NODE=M057G01
NODE=M057G01

²⁰We have multiplied $\bar{K}K\pi$ by 2/3 to obtain $\bar{K}^0K^+\pi^- + \text{c.c.}$

NODE=M057G01;LINKAGE=DE

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{62}/\Gamma$$

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

$$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{17}\Gamma_{62}/\Gamma$$

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

$$\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{36}\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.91±0.12 OUR FIT				
[0.90 ± 0.12 eV OUR 2011 FIT]				
1.10±0.21±0.15	126 ± 24	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+K^-)$

NODE=M057G11
NODE=M057G11
NEW

$$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_{62}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.58±0.06 OUR FIT				
[0.74 ± 0.14 eV OUR 2011 FIT]				
0.58±0.18±0.16	26.5 ± 8.1	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+K^-)$

NODE=M057G12
NODE=M057G12
NEW

$\chi_{c2}(1P)$ BRANCHING RATIOS

HADRONIC DECAYS

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

Γ_1/Γ

VALUE

DOCUMENT ID

0.0110±0.0011 OUR FIT

[0.0111 ± 0.0011 OUR 2011 FIT]

NODE=M057225

NODE=M057305

NODE=M057R2
NODE=M057R2
NEW

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

Γ_{23}/Γ_1

VALUE

DOCUMENT ID

TECN

COMMENT

0.36±0.15 OUR FIT**0.31±0.17**TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c2}$ NODE=M057R38
NODE=M057R38

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

Γ_3/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

2.00±0.26 OUR AVERAGE [(1.99 ± 0.26)% OUR 2011 AVERAGE]**2.00±0.25±0.08** 903.5 ²¹HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²¹HE 08B reports $1.87 \pm 0.07 \pm 0.22 \pm 0.13$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R46
NODE=M057R46

NEW

NODE=M057R46;LINKAGE=HE

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

Γ_4/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

2.4±0.4 OUR AVERAGE [(2.4 ± 0.4)% OUR 2011 AVERAGE]**2.4±0.4±0.1** 1031.9 ^{22,23}HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²²HE 08B reports $2.23 \pm 0.11 \pm 0.32 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²³Calculated 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

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

Γ_5/Γ

VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.21±0.16±0.05 1164 ²⁴ABLIKIM 11A BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

²⁴ABLIKIM 11A reports $(1.21 \pm 0.05 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R58
NODE=M057R58

NODE=M057R58;LINKAGE=AB

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

Γ_6/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

0.22±0.05 OUR AVERAGE [(0.22 ± 0.04)% OUR 2011 AVERAGE]**0.22±0.04±0.01** 76.9 ²⁵HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²⁵HE 08B reports $0.21 \pm 0.03 \pm 0.03 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R48
NODE=M057R48

NEW

NODE=M057R48;LINKAGE=HE

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

Γ_7/Γ

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

1.51±0.22 OUR AVERAGE [(1.50 ± 0.22)% OUR 2011 AVERAGE]**1.51±0.21±0.06** 211.6 ²⁶HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

²⁶HE 08B reports $1.41 \pm 0.11 \pm 0.16 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\pi^-K^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R50
NODE=M057R50

NEW

NODE=M057R50;LINKAGE=HE

$$\Gamma(\rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.45±0.14 OUR AVERAGE		[(0.45 ± 0.14)% OUR 2011 AVERAGE]		
0.45±0.13±0.02	62.9	27 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0$

27 HE 08B reports $0.42 \pm 0.11 \pm 0.06 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R51
NODE=M057R51

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
0.32±0.09 OUR AVERAGE		[(0.32 ± 0.09)% OUR 2011 AVERAGE]		
0.32±0.09±0.01	38.7	28 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0$

28 HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 K^+ \pi^- \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R57
NODE=M057R57

NEW

NODE=M057R57;LINKAGE=HE

$$\Gamma(K^*(892)^0 K^0 \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.42±0.09 OUR AVERAGE		[(0.42 ± 0.09)% OUR 2011 AVERAGE]		
0.42±0.09±0.02	63.0	29 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0$

29 HE 08B reports $0.39 \pm 0.07 \pm 0.05 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 K^0 \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R52
NODE=M057R52

NEW

NODE=M057R52;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.41±0.09 OUR AVERAGE		[(0.41 ± 0.09)% OUR 2011 AVERAGE]		
0.41±0.09±0.02	51.1	30 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0$

30 HE 08B reports $0.38 \pm 0.07 \pm 0.04 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R53
NODE=M057R53

NEW

NODE=M057R53;LINKAGE=HE

$$\Gamma(K^*(892)^+ K^0 \pi^- \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.32±0.09 OUR AVERAGE		[(0.32 ± 0.09)% OUR 2011 AVERAGE]		
0.32±0.09±0.01	39.3	31 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0$

31 HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ K^0 \pi^- \rightarrow K^+ \pi^- K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R54
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
0.14±0.05 OUR AVERAGE		[(0.14 ± 0.05)% OUR 2011 AVERAGE]		
0.14±0.05±0.01	22.9	32 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0$

32 HE 08B reports $0.13 \pm 0.04 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R55
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
9.1±1.1 OUR FIT	
[(9.2 ± 1.1) × 10 ⁻³ OUR 2011 FIT]	

NODE=M057R3
NODE=M057R3

NEW

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma(K^+ K^- \pi^+ \pi^-)$$

 Γ_{16}/Γ_{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

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$$

 Γ_{16}/Γ VALUE (units 10^{-4})

DOCUMENT ID

23±12 OUR FITNODE=M057R9
NODE=M057R9

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}$$

 Γ_{17}/Γ VALUE (units 10^{-3})

DOCUMENT ID

2.5±0.5 OUR FITNODE=M057R26
NODE=M057R26

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

 Γ_{18}/Γ 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

³³ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

8.7±5.9±0.4

³³ TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma \chi_{c2}$

³³ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+ \pi^-$ to $K^0 K^+ \pi^-$ decay.

NODE=M057R4
NODE=M057R4

→ NOT CHECKED ←

NODE=M057R;LINKAGE=X3

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

 Γ_{19}/Γ VALUE (units 10^{-3})

DOCUMENT ID

1.14±0.12 OUR FIT**[(1.48 ± 0.28) × 10⁻³ OUR 2011 FIT]**NODE=M057R20
NODE=M057R20

NEW

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

 Γ_{20}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.10±0.12 OUR AVERAGE**[(1.9 ± 0.6) × 10⁻³ OUR 2011 AVERAGE]**

1.07±0.12±0.04

762

³⁴ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma$ hadrons

1.9 ± 0.6 ± 0.1

27.7 ± 7.4

³⁵ ABLIKIM

05N

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma 6\pi$

³⁴ ABLIKIM 11K reports $(1.07 \pm 0.03 \pm 0.12) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³⁵ ABLIKIM 05N reports $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.165 \pm 0.044 \pm 0.032) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R28
NODE=M057R28

NEW

NODE=M057R28;LINKAGE=AL

NODE=M057R28;LINKAGE=AB

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

 Γ_{21}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<2.0

90

³⁶ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma$ hadrons

³⁶ ABLIKIM 11K reports $< 2 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\phi) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

NODE=M057R63
NODE=M057R63

NODE=M057R63;LINKAGE=AL

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

 Γ_{22}/Γ VALUE (units 10^{-3})

DOCUMENT ID

2.43±0.13 OUR FIT**[(2.42 ± 0.13) × 10⁻³ OUR 2011 FIT]**NODE=M057R27
NODE=M057R27

NEW

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

 Γ_{23}/Γ VALUE (units 10^{-4})

DOCUMENT ID

40±17 OUR FITNODE=M057R8
NODE=M057R8

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
0.52±0.14±0.02		37 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

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

<1.6 90 38 ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma \chi_{c2}$

37 ATHAR 07 reports $(0.49 \pm 0.12 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

38 ABLIKIM 06R reports $< 1.7 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

 Γ_{24}/Γ

NODE=M057R08
NODE=M057R08

NODE=M057R08;LINKAGE=AT

NODE=M057R08;LINKAGE=AB

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.55±0.20 OUR AVERAGE	[(0.54 ± 0.20) × 10 ⁻³ OUR 2011 AVERAGE]		

0.55±0.20±0.02 39 ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

39 ATHAR 07 reports $(0.51 \pm 0.18 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{25}/Γ

NODE=M057R35
NODE=M057R35

NEW

NODE=M057R35;LINKAGE=AT

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

VALUE (units 10^{-4})	DOCUMENT ID
5.9±0.5 OUR FIT	

 Γ_{26}/Γ

NODE=M057R16
NODE=M057R16

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

VALUE (units 10^{-3})	DOCUMENT ID
1.09±0.08 OUR FIT	

 Γ_{27}/Γ

NODE=M057R11
NODE=M057R11

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

VALUE (units 10^{-3})	DOCUMENT ID
0.58±0.05 OUR FIT	

 Γ_{28}/Γ

NODE=M057R19
NODE=M057R19

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.239±0.019 OUR FIT			
[0.240 ± 0.019 OUR 2011 FIT]			

 Γ_{28}/Γ_{22}

NODE=M057R36
NODE=M057R36
NEW

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

0.27 ±0.07 ±0.04 40,41 CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c2}$

40 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 $\pi\pi$.

41 Not independent from other measurements.

NODE=M057R36;LINKAGE=CH

NODE=M057R36;LINKAGE=NI

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.53±0.05 OUR FIT			

 Γ_{28}/Γ_{27}

NODE=M057R37
NODE=M057R37

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

0.70±0.21±0.12 42,43 CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c2}$

42 Using $\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.

43 Not independent from other measurements.

NODE=M057R37;LINKAGE=CH
NODE=M057R37;LINKAGE=NI

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.33±0.08±0.01	44 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

 Γ_{30}/Γ

NODE=M057R05
NODE=M057R05

44 ATHAR 07 reports $(0.31 \pm 0.07 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R05;LINKAGE=AT

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.35	90	45 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
45 ATHAR 07 reports $< 0.33 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.				

 Γ_{31}/Γ

NODE=M057R09
 NODE=M057R09

NODE=M057R09;LINKAGE=AT

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.6	90	3.3 ± 8.0	46 ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.5	90		47 ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
46 ASNER 09 reports $< 0.6 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					
47 Superseded by ASNER 09. ADAMS 07 reports $< 2.3 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					

 Γ_{32}/Γ

NODE=M057R03
 NODE=M057R03

NODE=M057R03;LINKAGE=AS

NODE=M057R03;LINKAGE=AD

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.1	90	12 ± 7	48 ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta' \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.3	90		49 ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
48 ASNER 09 reports $< 1.0 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					
49 Superseded by ASNER 09. ADAMS 07 reports $< 3.1 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					

 Γ_{33}/Γ

NODE=M057R04
 NODE=M057R04

NODE=M057R04;LINKAGE=AS

NODE=M057R04;LINKAGE=AD

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 0.6 \pm 0.1$		57 ± 11	50 ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma \chi_{c2}$
50 ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ = $(0.207 \pm 0.039 \pm 0.033) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					

 Γ_{34}/Γ

NODE=M057R31
 NODE=M057R31

NODE=M057R31;LINKAGE=AB

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4	90	2.3 ± 2.2	51 ABLIKIM	050 BES2	$e^+ e^- \rightarrow \chi_{c2} \gamma$
51 ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ < 3.5×10^{-5} which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					

 Γ_{35}/Γ

NODE=M057R32
 NODE=M057R32

NODE=M057R32;LINKAGE=AB

 $\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	DOCUMENT ID
1.78 ± 0.22 OUR FIT	

 Γ_{36}/Γ

NODE=M057R18
 NODE=M057R18

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.55 ± 0.33 OUR AVERAGE		[(1.55 ± 0.32) $\times 10^{-3}$ OUR 2011 AVERAGE]		
$1.55 \pm 0.32 \pm 0.06$	52	52 ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
52 ABLIKIM 06T reports $(1.67 \pm 0.26 \pm 0.24) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

 Γ_{37}/Γ

NODE=M057R01
 NODE=M057R01

NEW

NODE=M057R01;LINKAGE=AB

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

0.72±0.04 OUR FIT Γ_{38}/Γ NODE=M057R12
NODE=M057R12 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.51±0.05 OUR AVERAGE

0.52±0.04±0.02

53 ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

0.47±0.10±0.02

54 ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

53 ONYISI 10 reports $(4.83 \pm 0.25 \pm 0.35 \pm 0.31) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

54 ATHAR 07 reports $(0.44 \pm 0.08 \pm 0.05) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06
NODE=M057R06

NODE=M057R06;LINKAGE=ON

NODE=M057R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.190±0.028 OUR AVERAGE

0.188±0.028±0.007

55 ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

0.20 ±0.08 ±0.01

56 ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

55 ONYISI 10 reports $(1.76 \pm 0.23 \pm 0.14 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

56 ATHAR 07 reports $(0.19 \pm 0.07 \pm 0.02) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34
NODE=M057R34

NODE=M057R34;LINKAGE=ON

NODE=M057R34;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.39±0.05±0.02

57 ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

57 ONYISI 10 reports $(3.68 \pm 0.35 \pm 0.26 \pm 0.24) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{41}/Γ NODE=M057R56
NODE=M057R56

NODE=M057R56;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

3.0±0.9±0.1

24 ± 7

58 ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow p\bar{p}K^+K^-$

58 ABLIKIM 11F reports $(3.04 \pm 0.85 \pm 0.43) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{42}/Γ NODE=M057R62
NODE=M057R62

NODE=M057R62;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

1.32±0.34 OUR EVALUATION

Treating systematic error as correlated.

1.3 ±0.4 OUR AVERAGE

Error includes scale factor of 1.3.

1.17±0.19±0.30

59 BAI

99B

BES

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

2.64±1.03±0.14

59 TANENBAUM

78

MRK1

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

59 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_{43}/Γ NODE=M057R6
NODE=M057R6

→ NOT CHECKED ←

NODE=M057R6;LINKAGE=X3

$\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.086±0.026 OUR AVERAGE		[(0.085 ± 0.026)% OUR 2011 AVERAGE]		
0.086±0.026±0.003	29.2	⁶⁰ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

⁶⁰ HE 08B reports $0.08 \pm 0.02 \pm 0.01 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R49
NODE=M057R49

NEW

NODE=M057R49;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.09±0.35±0.08	131 ± 12	⁶¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$

⁶¹ ABLIKIM 11F reports $(2.08 \pm 0.19 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R59
NODE=M057R59

NODE=M057R59;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7.9	90	⁶² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2}\gamma$

⁶² Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

NODE=M057R30
NODE=M057R30

NODE=M057R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
11.1±3.8±0.4	⁶³ ABLIKIM	06I BES2	$\psi(2S) \rightarrow \gamma p\pi^- X$

⁶³ ABLIKIM 06I reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ = $(0.97 \pm 0.20 \pm 0.26) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R33
NODE=M057R33

NODE=M057R33;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
1.86±0.27 OUR FIT	

NODE=M057R25
NODE=M057R25

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.5	90	⁶⁴ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2}\gamma$

⁶⁴ Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

NODE=M057R29
NODE=M057R29

NODE=M057R29;LINKAGE=AB

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.91±0.17±0.04	⁶⁵ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

⁶⁵ ATHAR 07 reports $(0.85 \pm 0.14 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R07
NODE=M057R07

NODE=M057R07;LINKAGE=AT

 $\Gamma(K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±0.7±0.1	79 ± 13	⁶⁶ ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$

⁶⁶ ABLIKIM 11F reports $(3.06 \pm 0.50 \pm 0.54) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+p\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R60
NODE=M057R60

NODE=M057R60;LINKAGE=AB

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$5.1 \pm 1.6 \pm 0.2$	90	29 ± 7	⁶⁷ ABLIKIM	11F BES3	$\psi(2S) \rightarrow p\bar{p}K^+K^-$
⁶⁷ ABLIKIM 11F reports $(5.05 \pm 1.29 \pm 0.93) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					

NODE=M057R61
NODE=M057R61

NODE=M057R61;LINKAGE=AB

 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.8	90	7.5 ± 3.4	⁶⁸ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Sigma^0\bar{\Sigma}^0$
⁶⁸ NAIK 08 reports $< 0.75 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					

NODE=M057R43
NODE=M057R43

NODE=M057R43;LINKAGE=NA

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.7	90	4.0 ± 3.5	⁶⁹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Sigma^+\bar{\Sigma}^-$
⁶⁹ NAIK 08 reports $< 0.67 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					

NODE=M057R44
NODE=M057R44

NODE=M057R44;LINKAGE=NA

 $\Gamma(\Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.1	90	2.9 ± 1.7	⁷⁰ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Xi^0\bar{\Xi}^0$
⁷⁰ NAIK 08 reports $< 1.06 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 8.72 \times 10^{-2}$.					

NODE=M057R45
NODE=M057R45

NODE=M057R45;LINKAGE=NA

 $\Gamma(\Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.55 \pm 0.34 \pm 0.06$	90	29 ± 5	⁷¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Xi^-\bar{\Xi}^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.7	90		⁷² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2}\gamma$
⁷¹ NAIK 08 reports $(1.45 \pm 0.30 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
⁷² Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.					

NODE=M057R17
NODE=M057R17

NODE=M057R17;LINKAGE=NA

NODE=M057R17;LINKAGE=AB

 $\Gamma(J/\psi(1S)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.015	90	BARATE	81 SPEC	190 GeV $\pi^-\text{Be} \rightarrow 2\pi 2\mu$

NODE=M057R13
NODE=M057R13

RADIATIVE DECAYS

 $\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.195 ± 0.008 OUR FIT			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.199 \pm 0.005 \pm 0.012$	⁷³ ADAM	05A CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$
⁷³ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow \gamma\gamma J/\psi)$ from ADAM 05A and $B(\psi(2S) \rightarrow \gamma\chi_{c2})$ from ATHAR 04.			

NODE=M057R7
NODE=M057R7

NODE=M057R7;LINKAGE=AD

 $\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<21 (CL = 90%)					[$< 50 \times 10^{-6}$ (CL = 90%) OUR 2011 BEST LIMIT]
<21	90	13 ± 11	⁷⁴ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\rho^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 50	90	17.2 ± 6.8	⁷⁵ BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\rho^0$

NODE=M057R40
NODE=M057R40

⁷⁴ ABLIKIM 11E reports $< 20.8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \rho^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

⁷⁵ BENNETT 08A reports $< 50 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \rho^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

NODE=M057R40;LINKAGE=AB

NODE=M057R40;LINKAGE=BE

$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

<7 (CL = 90%) [$< 6 \times 10^{-6}$ (CL = 90%) OUR 2011 BEST LIMIT]

<7 90 0.0 ± 1.8 ⁷⁶ BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\omega$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6 90 1 ± 6 ⁷⁷ ABLIKIM 11E BES3 $\psi(2S) \rightarrow \gamma\gamma\omega$

⁷⁶ BENNETT 08A reports $< 7.0 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

NODE=M057R41;LINKAGE=BE

⁷⁷ ABLIKIM 11E reports $< 6.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

NODE=M057R41;LINKAGE=AB

$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

< 8 (CL = 90%) [$< 12 \times 10^{-6}$ (CL = 90%) OUR 2011 BEST LIMIT]

< 8 90 5 ± 5 ⁷⁸ 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 ⁷⁹ BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\phi$

⁷⁸ ABLIKIM 11E reports $< 8.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\phi) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

NODE=M057R42;LINKAGE=AB

⁷⁹ BENNETT 08A reports $< 13 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\phi) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 8.72 \times 10^{-2}$.

NODE=M057R42;LINKAGE=BE

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-4})	DOCUMENT ID

2.59±0.16 OUR FIT

[(2.56 ± 0.16) × 10⁻⁴ OUR 2011 FIT]

NODE=M057R1

NODE=M057R1

NEW

$\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{62}/Γ_{58}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

1.33±0.09 OUR FIT

[(1.31 ± 0.09) × 10⁻³ OUR 2011 FIT]

0.99±0.18 ⁸⁰ AMBROGIANI 00B E835 $\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$

⁸⁰ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M057R23

NODE=M057R23

NEW

NODE=M057R;LINKAGE=7A

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ $\Gamma_{62}/\Gamma \times \Gamma_{38}/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

1.86±0.18 OUR FIT

[(1.85 ± 0.18) × 10⁻⁸ OUR 2011 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

$\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$ $\Gamma_{14}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

2.36±0.27 OUR FIT

[(2.39 ± 0.27) × 10⁻³ OUR 2011 FIT]

2.5 ± 0.9 OUR AVERAGE Error includes scale factor of 2.3.

1.90±0.14±0.44 BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c2}$

3.8 ± 0.67 ⁸¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c2}$

⁸¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+\pi^-J/\psi) \times B(J/\psi \rightarrow \ell^+\ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B18

NODE=M057B18

NEW

NODE=M057B18;LINKAGE=TA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{17} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma \psi(2S)}{\Gamma_{\text{total}}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

2.2 ± 0.4 OUR FIT

3.11 ± 0.36 ± 0.48 ABLIKIM 04H BES2 $\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B19
NODE=M057B19

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{38} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

1.86 ± 0.14 OUR FIT

[(1.88 ± 0.14) × 10^{-5} OUR 2011 FIT]

1.4 ± 1.1 82 BAI 98I BES $\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma \bar{p} p$

NODE=M057B1
NODE=M057B1
NEW

⁸² Calculated by us. The value for $B(\chi_{c2} \rightarrow p \bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98d].

NODE=M057B;LINKAGE=J8

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{38} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma \psi(2S)}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

6.3 ± 0.5 OUR FIT

6.7 ± 1.1 OUR AVERAGE Error includes scale factor of 1.5.

NODE=M057B6
NODE=M057B6

7.2 ± 0.7 ± 0.4 121 ± 12 ⁸³ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma p \bar{p}$

4.4 +1.6 -1.4 ± 0.6 14.3 +5.2 -4.7 BAI 04F BES $\psi(2S) \rightarrow \gamma \chi_{c2}(1P) \rightarrow \gamma \bar{p} p$

⁸³ Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow p \bar{p}) = (7.7 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B6;LINKAGE=NA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{48} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma \psi(2S)}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

16.3 ± 2.3 OUR FIT

15.9 ± 2.1 ± 1.0 71 ± 9 ⁸⁴ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

NODE=M057B10
NODE=M057B10

⁸⁴ Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow \Lambda \bar{\Lambda}) = (17.0 \pm 2.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B10;LINKAGE=NA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{48} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

4.8 ± 0.7 OUR FIT

7.1 +3.1 -2.9 ± 1.3 8.3 +3.7 -3.4 ⁸⁵ BAI 03E BES $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

NODE=M057B11
NODE=M057B11

⁸⁵ BAI 03E reports $[B(\chi_{c2} \rightarrow \Lambda \bar{\Lambda}) B(\psi(2S) \rightarrow \gamma \chi_{c2}) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p \bar{p})] = (1.33 +0.59 -0.55 \pm 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p \bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M057B11;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi \pi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{22} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma \psi(2S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.11 ± 0.08 OUR FIT

[(2.12 ± 0.08) × 10^{-4} OUR 2011 FIT]

2.17 ± 0.09 OUR AVERAGE

NODE=M057B02
NODE=M057B02
NEW

2.19 ± 0.05 ± 0.15 4.5k ⁸⁶ ABLIKIM 10A BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

2.23 ± 0.06 ± 0.10 2.5k ⁸⁷ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

1.90 ± 0.08 ± 0.20 0.8k ⁸⁸ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

OCCUR=2

⁸⁶ 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 $\pi \pi$.

NODE=M057B02;LINKAGE=AB

⁸⁷ 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 $\pi \pi$.

NODE=M057B02;LINKAGE=AS

⁸⁸ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^0 \pi^0) = (0.68 \pm 0.03 \pm 0.07 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

NODE=M057B02;LINKAGE=AN

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{22}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

0.629±0.024 OUR FIT

0.54 ±0.06 OUR AVERAGE

0.66 ±0.18 ±0.37 21 ± 6 ⁸⁹ BAI 03C BES $\psi(2S) \rightarrow \gamma\pi^0\pi^0$
 0.54 ±0.05 ±0.04 185 ± 16 ⁹⁰ BAI 98I BES $\psi(2S) \rightarrow \gamma\pi^+\pi^-$

⁸⁹ We have multiplied $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

⁹⁰ Calculated by us. The value for $B(\chi_{c2} \rightarrow \pi^+\pi^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M057B9
NODE=M057B9

NODE=M057B;LINKAGE=BM
NODE=M057B;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{26}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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 ⁹¹ 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 ⁹² 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 $\psi(2S) \rightarrow \text{photons}$

⁹¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$.

⁹² Superseded by ASNER 09.

NODE=M057B04
NODE=M057B04

NODE=M057B04;LINKAGE=AB

NODE=M057B04;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{27}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

9.5±0.6 OUR FIT

10.5±0.3±0.6

1.6k ⁹³ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K^+K^-$
⁹³ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K^+K^-) = (1.13 \pm 0.03 \pm 0.06 \pm 0.07) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B03
NODE=M057B03

NODE=M057B03;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{27}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

0.283±0.017 OUR FIT

0.190±0.034±0.019

115 ± 13 ⁹⁴ BAI 98I BES $\psi(2S) \rightarrow \gamma K^+K^-$
⁹⁴ Calculated by us. The value for $B(\chi_{c2} \rightarrow K^+K^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B8
NODE=M057B8

NODE=M057B;LINKAGE=BI

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{28}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

5.1 ±0.4 OUR FIT

5.0 ±0.4 OUR AVERAGE

4.9 ±0.3 ±0.3 373 ± 20 ⁹⁵ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
 5.72±0.76±0.63 65 ABLIKIM 05O BES2 $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

⁹⁵ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K_S^0 K_S^0) = (0.53 \pm 0.03 \pm 0.03 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B12
NODE=M057B12

NODE=M057B12;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{28}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

15.0±1.1 OUR FIT

[(15.1 ± 1.1) × 10⁻⁵ OUR 2011 FIT]

14.7±4.1±3.3

⁹⁶ BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

NODE=M057B13
NODE=M057B13

NEW

⁹⁶ 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;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}} \\ \Gamma_{29} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M057B05
NODE=M057B05

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	⁹⁷ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
0.97±0.32±0.13	28	⁹⁸ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

⁹⁷ Calculated by us. ATHAR 07 reports $B(\chi_{c2} \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (1.3 \pm 0.2 \pm 0.1 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B05;LINKAGE=AT

⁹⁸ Calculated by us. ABLIKIM 06R reports $B(\chi_{c2} \rightarrow K_S^0 K^\pm \pi^\mp) = (0.6 \pm 0.2 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.1 \pm 0.6)\%$. We have multiplied by 2 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$ from $K_S^0 K^\pm \pi^\mp$.

NODE=M057B05;LINKAGE=AB

$$\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \\ \Gamma_1 / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

2.86±0.27 OUR FIT[(2.89 ± 0.27) × 10⁻³ OUR 2011 FIT]**3.1 ±1.0 OUR AVERAGE** Error includes scale factor of 2.5.

2.3 ±0.1 ±0.5	⁹⁹ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c2}$
4.3 ±0.6	¹⁰⁰ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B5
NODE=M057B5

NEW

⁹⁹ Calculated by us. The value for $B(\chi_{c2} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B;LINKAGE=K1

¹⁰⁰ The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow 2\pi^+ \pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times B(J/\psi(1S) \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B;LINKAGE=K2

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}} \\ \Gamma_{36} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.55±0.19 OUR FIT**1.76±0.16±0.24** 160 ¹⁰¹ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹⁰¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B14
NODE=M057B14

NODE=M057B14;LINKAGE=AB

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \\ \Gamma_{36} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

4.6±0.6 OUR FIT**3.6±0.6±0.6** 102 BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹⁰² 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

$$\Gamma(\chi_{c2}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}} \\ \Gamma_{19} / \Gamma \times \Gamma_{111}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.00±0.10 OUR FIT[(1.29 ± 0.24) × 10⁻⁴ OUR 2011 FIT]**0.98±0.13 OUR AVERAGE** Error includes scale factor of 1.3. [(1.38 ± 0.33) × 10⁻⁴ OUR 2011 AVERAGE]

0.94±0.03±0.10	849	¹⁰³ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{hadrons}$
1.38±0.24±0.23	41	¹⁰⁴ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NODE=M057B16
NODE=M057B16

NEW

NEW

¹⁰³ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi \phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35)\%$.

NODE=M057B16;LINKAGE=AL

¹⁰⁴ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi \phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{19}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.96±0.29 OUR FIT[(3.8 ± 0.7) × 10⁻⁴ OUR 2011 FIT]**4.8 ± 1.3 ± 1.3**

105 BAI

99B BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ 105 Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B17

NODE=M057B17

NEW

NODE=M057B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{58}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

1.70±0.04 OUR FIT**1.34±0.14 OUR AVERAGE**

Error includes scale factor of 1.9. See the ideogram below.

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

106 OREGLIA

82

CBAL

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

1.8 ± 0.5

107 BRANDELIK

79B

DASP

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

1.2 ± 0.2

107 BARTEL

78B

CNTR

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

2.2 ± 1.2

108 BIDDICK

77

CNTR

 $e^+e^- \rightarrow \gamma X$

1.2 ± 0.7

106 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

109 MENDEZ

08

CLEO

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

1.85±0.04±0.07

1.9k

110 ADAM

05A

CLEO

Repl. by MENDEZ 08

106 Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.107 Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

108 Assumes isotropic gamma distribution.

109 Not independent from other measurements of MENDEZ 08.

110 Not independent from other values reported by ADAM 05A.

NODE=M057B2

NODE=M057B2

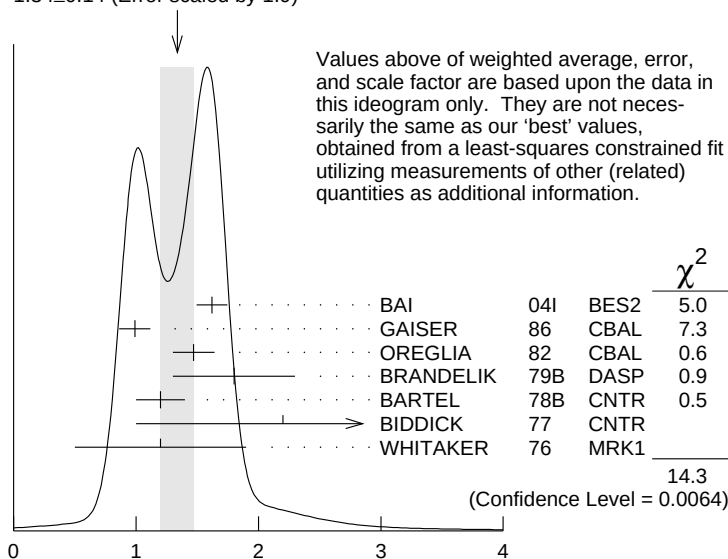
NODE=M057B;LINKAGE=3Q

NODE=M057B;LINKAGE=2Q

NODE=M057B;LINKAGE=EA

NODE=M057B2;LINKAGE=ME

NODE=M057B;LINKAGE=AD

WEIGHTED AVERAGE
1.34±0.14 (Error scaled by 1.9)

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{10^{-2}}$$

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\text{anything})}{\Gamma_{58}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}$$

$$\frac{\Gamma_{58}/\Gamma \times \Gamma_{111}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{0.344\Gamma_{110}^{\psi(2S)} + 0.195\Gamma_{111}^{\psi(2S)}} = \frac{\Gamma_{58}/\Gamma \times \Gamma_{111}^{\psi(2S)}}{(\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)})}$$

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

2.86±0.07 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.12±0.03±0.09

12.4k

111 MENDEZ

08

CLEO

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

3.11±0.07±0.07

1.9k

ADAM

05A

CLEO

Repl. by MENDEZ 08

NODE=M057B7

NODE=M057B7

NODE=M057B7

¹¹¹ Not independent from other measurements of MENDEZ 08.

NODE=M057B7;LINKAGE=ME

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{58}}{\Gamma} \times \frac{\Gamma_{111}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

NODE=M057B3
NODE=M057B3

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

5.07±0.13 OUR FIT

5.53±0.17 OUR AVERAGE

5.56±0.05±0.16	12.4k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
6.0 ±2.8	1.3k	¹¹² ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
3.9 ±1.2		¹¹³ 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	¹¹⁴ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹¹² From a fit to the J/ψ recoil mass spectra.

¹¹³ 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 $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (0.1181 \pm 0.0020)$.

¹¹⁴ Not independent from other values reported by ADAM 05A.

NODE=M057B;LINKAGE=AB
NODE=M057B;LINKAGE=H8

NODE=M057B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma \gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{62}}{\Gamma} \times \frac{\Gamma_{111}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

NODE=M057B4
NODE=M057B4

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

2.26±0.16 OUR FIT

[(2.24 ± 0.16) × 10^{-5} OUR 2011 FIT]

2.73±0.32 OUR AVERAGE

2.68±0.28±0.15	333 ± 35	ECKLUND	08A	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
7.0 ±2.1 ±2.0		LEE	85	CBAL	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NEW

MULTIPOLE AMPLITUDES IN $\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)$ RADIATIVE DECAY

NODE=M057240

$a_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M057A1
NODE=M057A1

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

−10.0± 1.5 OUR AVERAGE

− 9.3± 1.6±0.3	19.8k	¹¹⁵ ARTUSO	09	CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
− 9.3 ^{+3.9} _{−4.1} ±0.6	5.9k	¹¹⁶ AMBROGIANI	02	E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi \gamma$
−14 ± 6	1.9k	¹¹⁶ ARMSTRONG	93E	E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi \gamma$
−33.3 ^{+11.6} _{−29.2}	441	¹¹⁶ 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	¹¹⁷ ARTUSO	09	CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

OCCUR=2

¹¹⁵ From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

¹¹⁶ Assuming $a_3=0$.

¹¹⁷ From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A1;LINKAGE=AR
NODE=M057A1;LINKAGE=A
NODE=M057A1;LINKAGE=AT

$a_3 = E_3/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Electric octupole fractional transition amplitude

NODE=M057A2
NODE=M057A2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

1.6±1.3 OUR AVERAGE

1.7±1.4±0.3	19.8k	¹¹⁸ ARTUSO	09	CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.0 ^{+5.5} _{−4.4} ±0.9	5908	AMBROGIANI	02	E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi \gamma$
0 ⁺⁶ _{−5}	1904	ARMSTRONG	93E	E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi \gamma$

¹¹⁸ From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A2;LINKAGE=AR

MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ RADIATIVE DECAY

NODE=M057250

$b_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

2.2±1.8 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.
 [(1.0 ± 1.4) × 10⁻² OUR 2011 AVERAGE Scale factor = 1.1]

4.6±1.0±1.3	13.8k	119	ABLIKIM	11I	BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
0.2±1.5±0.4	19.8k	120	ARTUSO	09	CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-5.1 ^{+5.4} _{-3.6}	721	119	ABLIKIM	04I	BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
13.2 ^{+9.8} _{-7.5}	441	121	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 121 ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

119 From a fit with floating M_2 and E_3 amplitudes b_2 and b_3 .

120 From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

121 From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

NODE=M057QB2

NODE=M057QB2

NEW

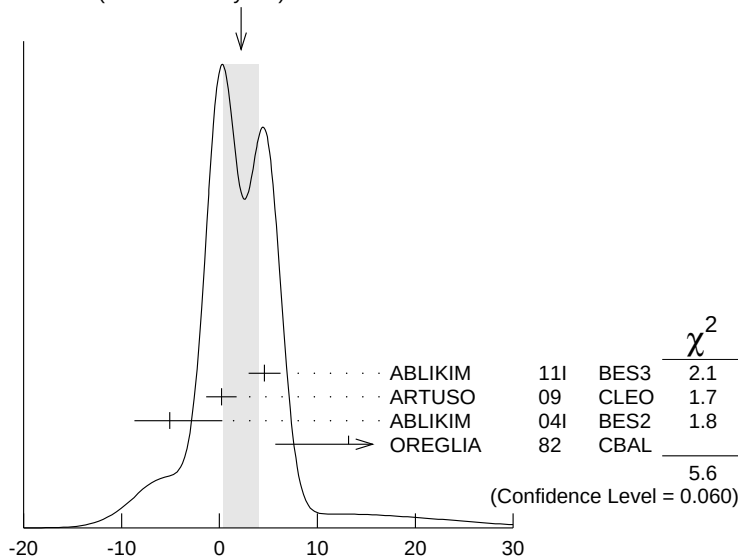
OCCUR=2

NODE=M057QB2;LINKAGE=AB

NODE=M057QB2;LINKAGE=AT

NODE=M057QB2;LINKAGE=AR

WEIGHTED AVERAGE
2.2±1.8 (Error scaled by 1.7)



$b_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude (units 10^{-2})

$b_3 = E_3/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

-0.3±1.0 OUR AVERAGE

[(-1.0 ± 1.1) × 10⁻² OUR 2011 AVERAGE]

1.5±0.8±1.8	13.8k	122	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	122	ABLIKIM	04I	BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$

122 From a fit with floating M_2 and E_3 amplitudes b_2 and b_3 .

NODE=M057QB3

NODE=M057QB3

NEW

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

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

-11⁺¹⁴₋₁₅ 19.8k 123 ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

123 Statistical and systematic errors combined. From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$. Not independent of values for $a_2(\chi_{c2}(1P))$ and $b_2(\chi_{c2}(1P))$ from ARTUSO 09.

NODE=M057QAR

NODE=M057QAR

NODE=M057QAR;LINKAGE=AR

$\chi_{c2}(1P)$ REFERENCES

NODE=M057

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 011103R	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 091501R	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 011102R	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101R	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 071101R	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 071101R	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

NEW

OCCUR=2

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

NODE=M059W

NODE=M059W
NEW

NODE=M059W;LINKAGE=DE
NODE=M059W;LINKAGE=VA
NODE=M059W;LINKAGE=AU
NODE=M059W;LINKAGE=AR
NODE=M059W;LINKAGE=W2
NODE=M059W;LINKAGE=W

NODE=M059215;NODE=M059

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3638.9±1.3 OUR AVERAGE				
[3637 ± 4 MeV OUR 2011 AVERAGE Scale factor = 1.7]				
3638.5±1.5±0.8	624	¹ DEL-AMO-SA..11M BABR		$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5±3.2±2.5	1201	¹ DEL-AMO-SA..11M BABR		$\gamma\gamma \rightarrow K^\mp K^- \pi^+ \pi^- \pi^0$
3636.1 ^{+3.9+0.7} _{-4.2-2.0}	128	² VINOKUROVA 11	BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm \pi^\mp)$
3626 ±5 ±6	311	³ 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	⁴ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
3630.8±3.4±1.0	112 ± 24	⁵ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
3654 ±6 ±8	39 ± 11	⁶ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
3594 ±5		⁷ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹ Ignoring possible interference with continuum.

² Accounts for interference with non-resonant continuum.

³ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE, K 02 and ABE 04G.

⁴ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

⁵ Superseded by DEL-AMO-SANCHEZ 11M.

⁶ Superseded by VINOKUROVA 11.

⁷ Assuming mass of $\psi(2S)$ = 3686 MeV.

$\eta_c(2S)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
10 ± 4 OUR AVERAGE					
[14 ± 7 MeV OUR 2011 AVERAGE]					
13.4± 4.6±3.2		624	⁸ 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	⁹ 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	¹⁰ 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	¹¹ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
<55	90	39 ± 11	¹² CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
<8.0	95		¹³ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

⁸ Ignoring possible interference with continuum.

⁹ Accounts for interference with non-resonant continuum.

¹⁰ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹¹ Superseded by DEL-AMO-SANCHEZ 11M.

¹² For a mass value of 3654 ± 6 MeV. Superseded by VINOKUROVA 11.

¹³ For a mass value of 3594 ± 5 MeV

$\eta_c(2S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	not seen	DESIG=1
Γ_2 $K\bar{K}\pi$	(1.9±1.2) %	DESIG=4
Γ_3 $2\pi^+ 2\pi^-$	not seen	DESIG=5
Γ_4 $\rho^0 \rho^0$	not seen	DESIG=16
Γ_5 $3\pi^+ 3\pi^-$	not seen	DESIG=8;OUR EVAL;→ NOT CHECKED ←
Γ_6 $K^+ K^- \pi^+ \pi^-$	not seen	DESIG=6
Γ_7 $K^{*0} \bar{K}^{*0}$	not seen	DESIG=17
Γ_8 $K^+ K^- \pi^+ \pi^- \pi^0$	(1.4±1.0) %	DESIG=9

Γ_9	$K^+ K^- 2\pi^+ 2\pi^-$	not seen	
Γ_{10}	$K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	not seen	
Γ_{11}	$2K^+ 2K^-$	not seen	
Γ_{12}	$\phi\phi$	not seen	
Γ_{13}	$p\bar{p}$		
Γ_{14}	$\gamma\gamma$	$< 5 \times 10^{-4}$	90%
Γ_{15}	$\pi^+ \pi^- \eta$	not seen	
Γ_{16}	$\pi^+ \pi^- \eta'$	not seen	
Γ_{17}	$K^+ K^- \eta$	not seen	
Γ_{18}	$\pi^+ \pi^- \eta_c(1S)$	not seen	

DESIG=10:OUR EVAL;
 NOT CHECKED ←
 DESIG=11:OUR EVAL;
 NOT CHECKED ←
 DESIG=7
 DESIG=18
 DESIG=3
 DESIG=2
 DESIG=12:OUR EVAL;
 NOT CHECKED ←
 DESIG=13:OUR EVAL;
 NOT CHECKED ←
 DESIG=14:OUR EVAL;
 NOT CHECKED ←
 DESIG=15:OUR EVAL;
 NOT CHECKED ←

$\eta_c(2S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$

Γ_{14}

VALUE (keV) DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.3±0.6 ¹⁴ ASNER 04 CLEO $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$

¹⁴ 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=M059216

NODE=M059W1
 NODE=M059W1

NODE=M059W1;LINKAGE=AS

$\eta_c(2S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M059218

$\Gamma(2\pi^+ 2\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_{14}/\Gamma$

VALUE (eV) CL% DOCUMENT ID TECN COMMENT

<6.5 90 UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(\pi^+ \pi^-)$

NODE=M059G01
 NODE=M059G01

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{14}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

41±4±6 624 ¹⁵ DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

¹⁵ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M059G04
 NODE=M059G04

NODE=M059G04;LINKAGE=DE

$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_{14}/\Gamma$

VALUE (eV) CL% DOCUMENT ID TECN COMMENT

<5.0 90 UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M059G02
 NODE=M059G02

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_8\Gamma_{14}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

30±6±5 1201 ¹⁶ DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹⁶ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M059G05
 NODE=M059G05

NODE=M059G05;LINKAGE=DE

$\Gamma(2K^+ 2K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{11}\Gamma_{14}/\Gamma$

VALUE (eV) CL% DOCUMENT ID TECN COMMENT

<2.9 90 UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(K^+ K^-)$

NODE=M059G03
 NODE=M059G03

$\eta_c(2S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma^2(\text{total})$

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^{17,18,19} AMBROGIANI 01 E835 $\bar{p}p \rightarrow \gamma\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 8.0 90^{17,18,20} AMBROGIANI 01 E835 $\bar{p}p \rightarrow \gamma\gamma$

<12.0 90 ^{18,20} AMBROGIANI 01 E835 $\bar{p}p \rightarrow \gamma\gamma$

¹⁷ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.

¹⁸ For a total width $\Gamma=5$ MeV.

¹⁹ For the resonance mass region 3589–3599 MeV/ c^2 .

²⁰ For the resonance mass region 3575–3660 MeV/ c^2 .

NODE=M059G1
 NODE=M059G1

OCCUR=2
 OCCUR=3

NODE=M059G1;LINKAGE=A
 NODE=M059G1;LINKAGE=B
 NODE=M059G1;LINKAGE=C1
 NODE=M059G1;LINKAGE=C2

$\eta_c(2S)$ BRANCHING RATIOS $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABREU	980	DLPH $e^+e^- \rightarrow e^+e^- + \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	²¹ EDWARDS	82C	CBAL $e^+e^- \rightarrow \gamma X$
²¹ For a mass value of 3594 ± 5 MeV			

NODE=M059220

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	²² 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	39 ± 11	²³ CHOI	02	BELL $B \rightarrow K K_S K^- \pi^+$
²² 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 $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77^{+0.55}_{-0.66}) \times 10^{-5}$.				
²³ 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 $\gamma\gamma \rightarrow \eta_c(2S)$
VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	11H	BES3 $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R01
NODE=M059R01

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	²⁴ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
²⁴ We have multiplied the value of $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\bar{K}\pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.				

NODE=M059R21
NODE=M059R21

NODE=M059R21;LINKAGE=DE

 $\Gamma(K^{*0}\bar{K}^{*0})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	11H	BES3 $\psi(2S) \rightarrow \gamma K^+K^-\pi^+\pi^-$

NODE=M059R16
NODE=M059R16 $\Gamma(2K^+2K^-)/\Gamma_{\text{total}}$ 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
$< 5 \times 10^{-4}$	90	²⁵ WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		AMBROGIANI	01	E835 $\bar{p}p \rightarrow \gamma\gamma$
< 0.01	90	LEE	85	CBAL $\psi' \rightarrow \text{photons}$
²⁵ WICHT 08 reports $[\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c(2S)K^+)] < 0.18 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c(2S)K^+) = 3.4 \times 10^{-4}$.				

NODE=M059R2
NODE=M059R2

NODE=M059R2;LINKAGE=W1

$\eta_c(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M059230

$$\Gamma(\eta_c(2S) \rightarrow 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_3 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R05
NODE=M059R05

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.6 \times 10^{-6}$	90	26 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$
26 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.				

NODE=M059R05;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \rho^0 \rho^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_4 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R18
NODE=M059R18

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<12.7 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

$$\Gamma(\eta_c(2S) \rightarrow 3\pi^+ 3\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_5 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R06
NODE=M059R06

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<13.2 \times 10^{-6}$	90	27 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
27 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.				

NODE=M059R06;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_6 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R07
NODE=M059R07

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.6 \times 10^{-6}$	90	28 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
28 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.				

NODE=M059R07;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^{*0} \bar{K}^{*0}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_7 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R19
NODE=M059R19

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<19.6 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_8 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R08
NODE=M059R08

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<43.0 \times 10^{-6}$	90	29 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

29 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R08;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_9 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R09
NODE=M059R09

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	30 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$

30 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R09;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{10} / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R10
NODE=M059R10

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<15.2 \times 10^{-6}$	90	31 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

31 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R10;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{12} / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

NODE=M059R20
NODE=M059R20

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.8 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{15} / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.3 \times 10^{-6}$	90	32 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$
32 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

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta') / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{16} / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.2 \times 10^{-6}$	90	33 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta'$
33 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

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{17} / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.9 \times 10^{-6}$	90	34 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$
34 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

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta_c(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{18} / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-4}$	90	35 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta_c(1S)$
35 Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.				

NODE=M059R14
NODE=M059R14

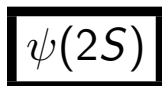
NODE=M059R14;LINKAGE=CR

$\eta_c(2S)$ REFERENCES

ABLIKIM	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 031101R	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=53929
REFID=16751
REFID=53927
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REFID=52064
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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.

$\psi(2S)$ MASS

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

3686.109^{+0.011}_{-0.014} OUR FIT

[3686.09 ± 0.04 MeV OUR 2011 FIT Scale factor = 1.6]

3686.108^{+0.011}_{-0.014} OUR AVERAGE

[3686.093 ± 0.034 MeV OUR 2011 AVERAGE Scale factor = 1.4]

3686.12 ± 0.06 ± 0.10	4k	AAIJ	12H	LHCB	$pp \rightarrow pp J/\psi \pi^+ \pi^-$
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	$\bar{p} p \rightarrow e^+ e^-$
3686.00 ± 0.10	413	⁴ ZHOLENTZ	80	OLYA	$e^+ e^-$

¹ From the scans in 2004 and 2006. ANASHIN 12 reports the value 3686.114 ± 0.007 ± 0.011^{+0.002}_{-0.012} MeV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

² Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).

³ Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $J/\psi(1S)$ mass from AULCHENKO 03.

⁴ Superseded by ARTAMONOV 00.

$m_{\psi(2S)} - m_{J/\psi(1S)}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

589.188 ± 0.028 OUR AVERAGE

589.194 ± 0.027 ± 0.011	⁵ 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	⁵ 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	⁶ BAI	98E	BES $e^+ e^-$

⁵ Redundant with data in mass above.

⁶ Systematic errors not evaluated.

$\psi(2S)$ WIDTH

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

304 ± 9 OUR FIT

286 ± 16 OUR AVERAGE

358 ± 88 ± 4		ABLIKIM	08B	BES2 $e^+ e^- \rightarrow \text{hadrons}$
290 ± 25 ± 4	2.7k	ANDREOTTI	07	E835 $p\bar{p} \rightarrow e^+ e^-, J/\psi X$
331 ± 58 ± 2		ABLIKIM	06L	BES2 $e^+ e^- \rightarrow \text{hadrons}$
264 ± 27		⁷ BAI	02B	BES2 $e^+ e^-$
287 ± 37 ± 16		⁸ ARMSTRONG	93B	E760 $\bar{p} p \rightarrow e^+ e^-$

⁷ 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.

⁸ The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].

NODE=M071

NODE=M071

NODE=M071M

NODE=M071M

NODE=M071M

NEW

NEW

NODE=M071M;LINKAGE=AN

NODE=M071M;LINKAGE=AR

NODE=M071M;LINKAGE=NW

NODE=M071M;LINKAGE=RZ

NODE=M071DM

NODE=M071DM

NODE=M071DM;LINKAGE=R

NODE=M071DM;LINKAGE=BD

NODE=M071W

NODE=M071W

NODE=M071W;LINKAGE=BC

NODE=M071W;LINKAGE=AN

$\psi(2S)$ DECAY MODES

NODE=M071220;NODE=M071

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 hadrons	$(97.85 \pm 0.13) \%$		DESIG=3
Γ_2 virtual $\gamma \rightarrow$ hadrons	$(1.73 \pm 0.14) \%$	S=1.5	DESIG=4
Γ_3 $g g g$	$(10.6 \pm 1.6) \%$		DESIG=255
Γ_4 $\gamma g g$	$(1.03 \pm 0.29) \%$		DESIG=256
Γ_5 light hadrons	$(15.4 \pm 1.5) \%$		DESIG=226
Γ_6 $e^+ e^-$	$(7.73 \pm 0.17) \times 10^{-3}$		DESIG=1
Γ_7 $\mu^+ \mu^-$	$(7.7 \pm 0.8) \times 10^{-3}$		DESIG=2
Γ_8 $\tau^+ \tau^-$	$(3.0 \pm 0.4) \times 10^{-3}$		DESIG=68
Decays into $J/\psi(1S)$ and anything			
Γ_9 $J/\psi(1S)$ anything	$(59.5 \pm 0.8) \%$		NODE=M071;CLUMP=A DESIG=11
Γ_{10} $J/\psi(1S)$ neutrals	$(24.6 \pm 0.4) \%$		DESIG=12
Γ_{11} $J/\psi(1S) \pi^+ \pi^-$	$(33.6 \pm 0.4) \%$		DESIG=13
Γ_{12} $J/\psi(1S) \pi^0 \pi^0$	$(17.75 \pm 0.34) \%$		DESIG=14
Γ_{13} $J/\psi(1S) \eta$	$(3.28 \pm 0.07) \%$		DESIG=15
Γ_{14} $J/\psi(1S) \pi^0$	$(1.30 \pm 0.10) \times 10^{-3}$	S=1.4	DESIG=18
Hadronic decays			
Γ_{15} $\pi^0 h_c(1P)$	$(8.6 \pm 1.3) \times 10^{-4}$		NODE=M071;CLUMP=B DESIG=254
Γ_{16} $3(\pi^+ \pi^-) \pi^0$	$(3.5 \pm 1.6) \times 10^{-3}$		DESIG=37
Γ_{17} $2(\pi^+ \pi^-) \pi^0$	$(2.9 \pm 1.0) \times 10^{-3}$	S=4.6	DESIG=25
Γ_{18} $\rho a_2(1320)$	$(2.6 \pm 0.9) \times 10^{-4}$		DESIG=65
Γ_{19} $p \bar{p}$	$(2.76 \pm 0.12) \times 10^{-4}$		DESIG=27
Γ_{20} $\Delta^{++} \bar{\Delta}^{--}$	$(1.28 \pm 0.35) \times 10^{-4}$		DESIG=70
Γ_{21} $\Lambda \bar{\Lambda} \pi^0$	$< 1.2 \times 10^{-4}$	CL=90%	DESIG=238
Γ_{22} $\Lambda \bar{\Lambda} \eta$	$< 4.9 \times 10^{-5}$	CL=90%	DESIG=239
Γ_{23} $\Lambda \bar{p} K^+$	$(1.00 \pm 0.14) \times 10^{-4}$		DESIG=214
Γ_{24} $\Lambda \bar{p} K^+ \pi^+ \pi^-$	$(1.8 \pm 0.4) \times 10^{-4}$		DESIG=215
Γ_{25} $\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.8 \pm 0.6) \times 10^{-4}$		DESIG=213
Γ_{26} $\Lambda \bar{\Lambda}$	$(2.8 \pm 0.5) \times 10^{-4}$	S=2.6	DESIG=28
Γ_{27} $\Sigma^+ \bar{\Sigma}^-$	$(2.6 \pm 0.8) \times 10^{-4}$		DESIG=223
Γ_{28} $\Sigma^0 \bar{\Sigma}^0$	$(2.2 \pm 0.4) \times 10^{-4}$	S=1.5	DESIG=71
Γ_{29} $\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(1.1 \pm 0.4) \times 10^{-4}$		DESIG=72
Γ_{30} $\Xi^- \bar{\Xi}^+$	$(1.8 \pm 0.6) \times 10^{-4}$	S=2.8	DESIG=29
Γ_{31} $\Xi^0 \bar{\Xi}^0$	$(2.8 \pm 0.9) \times 10^{-4}$		DESIG=224
Γ_{32} $\Xi(1530)^0 \bar{\Xi}(1530)^0$	$< 8.1 \times 10^{-5}$	CL=90%	DESIG=73
Γ_{33} $\Omega^- \bar{\Omega}^+$	$< 7.3 \times 10^{-5}$	CL=90%	DESIG=74
Γ_{34} $\pi^0 p \bar{p}$	$(1.50 \pm 0.08) \times 10^{-4}$	S=1.1	DESIG=35
Γ_{35} $N_1^*(1440) \bar{p} \rightarrow \pi^0 p \bar{p}$	$(8.1 \pm 0.8) \times 10^{-5}$		DESIG=261
Γ_{36} $\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}$	$(1.1 \pm 0.4) \times 10^{-5}$		DESIG=262
Γ_{37} $\eta p \bar{p}$	$(5.7 \pm 0.6) \times 10^{-5}$		DESIG=200
Γ_{38} $\eta f_0(2100) \rightarrow \eta p \bar{p}$	$(1.2 \pm 0.4) \times 10^{-5}$		DESIG=263
Γ_{39} $N^*(1535) \bar{p} \rightarrow \eta p \bar{p}$	$(4.4 \pm 0.7) \times 10^{-5}$		DESIG=264
Γ_{40} $\omega p \bar{p}$	$(6.9 \pm 2.1) \times 10^{-5}$		DESIG=77
Γ_{41} $\phi p \bar{p}$	$< 2.4 \times 10^{-5}$	CL=90%	DESIG=80
Γ_{42} $\pi^+ \pi^- p \bar{p}$	$(6.0 \pm 0.4) \times 10^{-4}$		DESIG=31
Γ_{43} $p \bar{n} \pi^-$ or c.c.	$(2.48 \pm 0.17) \times 10^{-4}$		DESIG=227
Γ_{44} $p \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		DESIG=228
Γ_{45} $2(\pi^+ \pi^- \pi^0)$	$(4.8 \pm 1.5) \times 10^{-3}$		DESIG=221
Γ_{46} $\eta \pi^+ \pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	DESIG=202
Γ_{47} $\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
Γ_{48} $2(\pi^+ \pi^-) \eta$	$(1.2 \pm 0.6) \times 10^{-3}$		DESIG=251
Γ_{49} $\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		DESIG=204
Γ_{50} $\omega \pi^+ \pi^-$	$(7.3 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=75
Γ_{51} $b_1^\pm \pi^\mp$	$(4.0 \pm 0.6) \times 10^{-4}$	S=1.1	DESIG=40
Γ_{52} $b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		DESIG=193
Γ_{53} $\omega f_2(1270)$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=64
Γ_{54} $\pi^+ \pi^- K^+ K^-$	$(7.5 \pm 0.9) \times 10^{-4}$	S=1.9	DESIG=26
Γ_{55} $\rho^0 K^+ K^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=205

Г ₅₆	$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=66
Г ₅₇	$K^+ K^- \pi^+ \pi^- \eta$	$(1.3 \pm 0.7) \times 10^{-3}$		DESIG=252
Г ₅₈	$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$		DESIG=240
Г ₅₉	$K^+ K^- 2(\pi^+ \pi^-)$	$(1.9 \pm 0.9) \times 10^{-3}$		DESIG=222
Г ₆₀	$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$		DESIG=41
Г ₆₁	$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=225
Г ₆₂	$\rho^0 p \bar{p}$	$(5.0 \pm 2.2) \times 10^{-5}$		DESIG=210
Г ₆₃	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \pm 2.5) \times 10^{-4}$		DESIG=34
Г ₆₄	$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	DESIG=24
Г ₆₅	$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	DESIG=33
Г ₆₆	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$		DESIG=206
Г ₆₇	$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		DESIG=216
Г ₆₈	$K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$		DESIG=217
Г ₆₉	$K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$		DESIG=218
Г ₇₀	$K^*(892)^+ K^- \rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$		DESIG=219
Г ₇₁	$K^*(892)^0 K^- \rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$		DESIG=220
Г ₇₂	$\eta K^+ K^-$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=207
Г ₇₃	$\omega K^+ K^-$	$(1.85 \pm 0.25) \times 10^{-4}$	S=1.1	DESIG=76
Г ₇₄	$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	DESIG=32
Г ₇₅	$p \bar{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		DESIG=211
Г ₇₆	$K^+ K^-$	$(6.3 \pm 0.7) \times 10^{-5}$		DESIG=23
Г ₇₇	$K_S^0 K_L^0$	$(5.4 \pm 0.5) \times 10^{-5}$		DESIG=85
Г ₇₈	$\pi^+ \pi^- \pi^0$	$(1.68 \pm 0.26) \times 10^{-4}$	S=1.4	DESIG=36
Г ₇₉	$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9 \pm_{-0.4}^{+1.2}) \times 10^{-4}$		DESIG=201
Г ₈₀	$\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8	DESIG=22
Г ₈₁	$\pi^+ \pi^-$	$(8 \pm 5) \times 10^{-5}$		DESIG=21
Г ₈₂	$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90%	DESIG=42
Г ₈₃	$K^+ K^- \pi^0$	$< 2.96 \times 10^{-5}$	CL=90%	DESIG=38
Г ₈₄	$K^+ \bar{K}^*(892)^- + \text{c.c.}$	$(1.7 \pm_{-0.7}^{+0.8}) \times 10^{-5}$		DESIG=39
Г ₈₅	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$		DESIG=194
Г ₈₆	$\phi \pi^+ \pi^-$	$(1.17 \pm 0.29) \times 10^{-4}$	S=1.7	DESIG=78
Г ₈₇	$\phi f_0(980) \rightarrow \pi^+ \pi^-$	$(6.8 \pm 2.5) \times 10^{-5}$	S=1.1	DESIG=81
Г ₈₈	$2(K^+ K^-)$	$(6.0 \pm 1.4) \times 10^{-5}$		DESIG=208
Г ₈₉	$\phi K^+ K^-$	$(7.0 \pm 1.6) \times 10^{-5}$		DESIG=79
Г ₉₀	$2(K^+ K^-) \pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$		DESIG=209
Г ₉₁	$\phi \eta$	$(2.8 \pm_{-0.8}^{+1.0}) \times 10^{-5}$		DESIG=89
Г ₉₂	$\phi \eta'$	$(3.1 \pm 1.6) \times 10^{-5}$		DESIG=90
Г ₉₃	$\omega \eta'$	$(3.2 \pm_{-2.1}^{+2.5}) \times 10^{-5}$		DESIG=91
Г ₉₄	$\omega \pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		DESIG=92
Г ₉₅	$\rho \eta'$	$(1.9 \pm_{-1.2}^{+1.7}) \times 10^{-5}$		DESIG=93
Г ₉₆	$\rho \eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1	DESIG=94
Г ₉₇	$\omega \eta$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=95
Г ₉₈	$\phi \pi^0$	$< 4 \times 10^{-6}$	CL=90%	DESIG=96
Г ₉₉	$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	DESIG=229
Г ₁₀₀	$p \bar{p} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		DESIG=212
Г ₁₀₁	$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$		DESIG=237
Г ₁₀₂	$\phi f'_2(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		DESIG=67
Г ₁₀₃	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$< 8.8 \times 10^{-6}$	CL=90%	DESIG=195
Г ₁₀₄	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$< 1.0 \times 10^{-5}$	CL=90%	DESIG=196
Г ₁₀₅	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$< 7.0 \times 10^{-6}$	CL=90%	DESIG=197
Г ₁₀₆	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$< 2.6 \times 10^{-5}$	CL=90%	DESIG=198
Г ₁₀₇	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$< 6.0 \times 10^{-6}$	CL=90%	DESIG=199
Г ₁₀₈	$K_S^0 K_S^0$	$< 4.6 \times 10^{-6}$		DESIG=86

Radiative decays

Γ_{109}	$\gamma\chi_{c0}(1P)$	$(9.68 \pm 0.31) \%$			NODE=M071;CLUMP=C
Γ_{110}	$\gamma\chi_{c1}(1P)$	$(9.2 \pm 0.4) \%$			DESIG=56
Γ_{111}	$\gamma\chi_{c2}(1P)$	$(8.72 \pm 0.34) \%$			DESIG=58
Γ_{112}	$\gamma\eta_c(1S)$	$(3.4 \pm 0.5) \times 10^{-3}$	S=1.3		DESIG=59
Γ_{113}	$\gamma\eta_c(2S)$	$< 8 \times 10^{-4}$	CL=90%		DESIG=61
Γ_{114}	$\gamma\pi^0$	$(1.6 \pm 0.4) \times 10^{-6}$			DESIG=63
Γ_{115}	$\gamma\eta'(958)$	$(1.23 \pm 0.06) \times 10^{-4}$			DESIG=52
Γ_{116}	$\gamma f_2(1270)$	$(2.1 \pm 0.4) \times 10^{-4}$			DESIG=54
Γ_{117}	$\gamma f_0(1710)$				DESIG=82
Γ_{118}	$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(3.0 \pm 1.3) \times 10^{-5}$			DESIG=236
Γ_{119}	$\gamma f_0(1710) \rightarrow \gamma K\bar{K}$	$(6.0 \pm 1.6) \times 10^{-5}$			DESIG=83
Γ_{120}	$\gamma\gamma$	$< 1.4 \times 10^{-4}$	CL=90%		DESIG=84
Γ_{121}	$\gamma\eta$	$(1.4 \pm 0.5) \times 10^{-6}$			DESIG=51
Γ_{122}	$\gamma\eta\pi^+\pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$			DESIG=53
Γ_{123}	$\gamma\eta(1405)$				DESIG=230
Γ_{124}	$\gamma\eta(1405) \rightarrow \gamma K\bar{K}\pi$	$< 9 \times 10^{-5}$	CL=90%		DESIG=231
Γ_{125}	$\gamma\eta(1405) \rightarrow \eta\pi^+\pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$			DESIG=62
Γ_{126}	$\gamma\eta(1475)$				DESIG=232
Γ_{127}	$\gamma\eta(1475) \rightarrow K\bar{K}\pi$	$< 1.4 \times 10^{-4}$	CL=90%		DESIG=233
Γ_{128}	$\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-$	$< 8.8 \times 10^{-5}$	CL=90%		DESIG=234
Γ_{129}	$\gamma 2(\pi^+\pi^-)$	$(4.0 \pm 0.6) \times 10^{-4}$			DESIG=235
Γ_{130}	$\gamma K^{*0} K^+\pi^- + \text{c.c.}$	$(3.7 \pm 0.9) \times 10^{-4}$			DESIG=241
Γ_{131}	$\gamma K^{*0} \bar{K}^{*0}$	$(2.4 \pm 0.7) \times 10^{-4}$			DESIG=242
Γ_{132}	$\gamma K_S^0 K^+\pi^- + \text{c.c.}$	$(2.6 \pm 0.5) \times 10^{-4}$			DESIG=243
Γ_{133}	$\gamma K^+ K^-\pi^+\pi^-$	$(1.9 \pm 0.5) \times 10^{-4}$			DESIG=244
Γ_{134}	$\gamma p\bar{p}$	$(3.9 \pm 0.5) \times 10^{-5}$	S=2.0		DESIG=245
Γ_{135}	$\gamma f_2(1950) \rightarrow \gamma p\bar{p}$	$(1.20 \pm 0.22) \times 10^{-5}$			DESIG=246
Γ_{136}	$\gamma f_2(2150) \rightarrow \gamma p\bar{p}$	$(7.2 \pm 1.8) \times 10^{-6}$			DESIG=257
Γ_{137}	$\gamma X(1835) \rightarrow \gamma p\bar{p}$	$< 1.6 \times 10^{-6}$	CL=90%		DESIG=258
Γ_{138}	$\gamma X \rightarrow \gamma p\bar{p}$	$[a] < 2 \times 10^{-6}$	CL=90%		DESIG=259
Γ_{139}	$\gamma\pi^+\pi^- p\bar{p}$	$(2.8 \pm 1.4) \times 10^{-5}$			DESIG=260
Γ_{140}	$\gamma 2(\pi^+\pi^-) K^+ K^-$	$< 2.2 \times 10^{-4}$	CL=90%		DESIG=247
Γ_{141}	$\gamma 3(\pi^+\pi^-)$	$< 1.7 \times 10^{-4}$	CL=90%		DESIG=248
Γ_{142}	$\gamma K^+ K^- K^+ K^-$	$< 4 \times 10^{-5}$	CL=90%		DESIG=249

[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 223 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 312.2$ for 174 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	5									
x_8	1	0								
x_{11}	44	12	3							
x_{12}	39	8	2	64						
x_{13}	27	7	2	57	35					
x_{19}	2	1	0	7	5	4				
x_{109}	2	1	0	4	3	2	0			
x_{110}	2	1	0	5	2	3	0	0		
x_{111}	3	1	0	6	4	4	0	0	0	
Γ	-79	-6	-2	-52	-46	-32	-10	-2	-3	-3
	x_6	x_7	x_8	x_{11}	x_{12}	x_{13}	x_{19}	x_{109}	x_{110}	x_{111}

$\psi(2S)$ 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
2.35 ± 0.04 OUR 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	⁹ 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	¹⁰ LUTH	75	MRK1 e^+e^-

NODE=M071W1
NODE=M071W1

⁹ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channel, assuming $\Gamma_e = \Gamma_\mu = \Gamma_\tau/0.38847$.

NODE=M071W;LINKAGE=BB

¹⁰ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M071W1;LINKAGE=F

 $\Gamma(\gamma\gamma)$ Γ_{120}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	BRANDELIK	79C	DASP e^+e^-

NODE=M071W51
NODE=M071W51 $\psi(2S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M071230

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel(i) in the e^+e^- annihilation. We list only data that have not been used to determine the partial width $\Gamma(i)$ or the branching ratio $\Gamma(i)/\text{total}$.

NODE=M071230

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_6 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.233 $\pm 0.015 \pm 0.042$			
	¹¹ ANASHIN	12	KEDR $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.2 ± 0.4	ABRAMS	75	MRK1 e^+e^-

NODE=M071G3
NODE=M071G3

¹¹ ANASHIN 12 reports the value $2.233 \pm 0.015 \pm 0.037 \pm 0.020$ keV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

NODE=M071G3;LINKAGE=AN

 $\Gamma(\tau^+\tau^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_8 \Gamma_6 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.0 ± 2.6	79	¹² ANASHIN	07	KEDR $e^+e^- \rightarrow \psi(2S) \rightarrow \tau^+\tau^-$

NODE=M071G9
NODE=M071G9

¹² Using $\psi(2S)$ total width of 337 ± 13 keV. Systematic errors not evaluated.

NODE=M071G9;LINKAGE=AN

 $\Gamma(J/\psi(1S)\pi^+\pi^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_{11} \Gamma_6 / \Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.789 ± 0.015 OUR FIT				
0.82 ± 0.04 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.				
$0.852 \pm 0.010 \pm 0.026$	$19.5k \pm 243$	ADAM	06	CLEO $3.773 e^+e^- \rightarrow \gamma\psi(2S)$
$0.76 \pm 0.05 \pm 0.01$	544	¹³ AUBERT	05D	BABR $10.6 e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-\gamma$
0.68 ± 0.09		¹⁴ BAI	98E	BES e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.90 \pm 0.08 \pm 0.05$	256	¹⁵ AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow J/\psi \pi^+\pi^-\gamma$

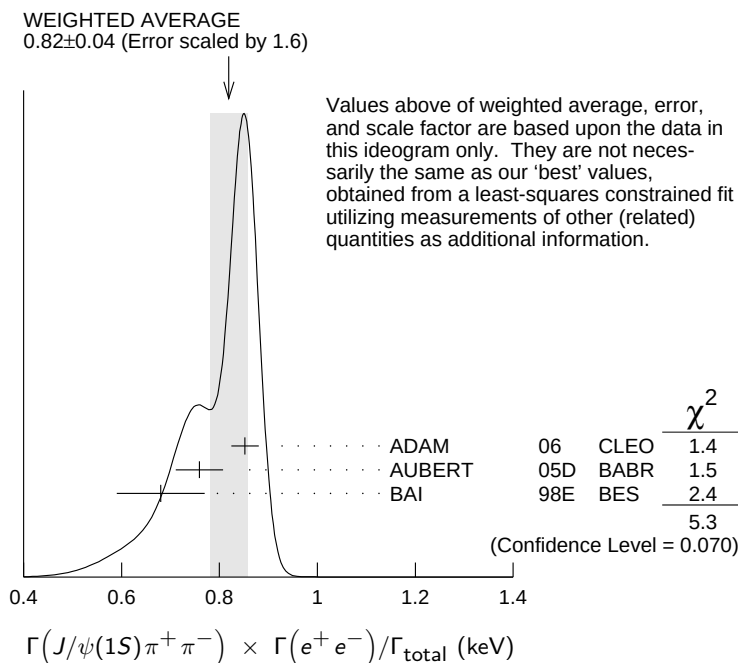
NODE=M071G1
NODE=M071G1

- ¹³ AUBERT 05D reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+\mu^-)] = 0.0450 \pm 0.0018 \pm 0.0022$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.93 \pm 0.06) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ¹⁴ 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 $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.
- ¹⁵ 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 $B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0) = (2.07 \pm 0.12) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G1;LINKAGE=AU

NODE=M071G1;LINKAGE=A

NODE=M071G1;LINKAGE=UB



$$\Gamma(J/\psi(1S)\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}\Gamma_6/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.417±0.010 OUR FIT				
0.411±0.008±0.018	3.6k±96	ADAM	06	CLEO 3.773 e ⁺ e ⁻ → γψ(2S)

NODE=M071G6
NODE=M071G6

$$\Gamma(J/\psi(1S)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
77.0± 1.9 OUR FIT				
87 ± 9 OUR AVERAGE				
83 ±25 ±5	14	¹⁶ 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)

NODE=M071G7
NODE=M071G7

¹⁶ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow J/\psi\eta) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.11 \pm 0.33 \pm 0.07$ eV.

NODE=M071G7;LINKAGE=UB

$$\Gamma(J/\psi(1S)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{14}\Gamma_6/\Gamma$$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8	90	<37	ADAM	06	CLEO 3.773 e ⁺ e ⁻ → γψ(2S)

NODE=M071G8
NODE=M071G8

$$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.647±0.028 OUR FIT				
0.59 ±0.05 OUR AVERAGE				
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

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_6/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.5±0.4±0.1	AUBERT	07BD	BABR 10.6 e ⁺ e ⁻ → Λ $\bar{\Lambda}$ γ

NODE=M071G11
NODE=M071G11

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_6/\Gamma$$

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

$$\Gamma(K^+K^-2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{59}\Gamma_6/\Gamma$$

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

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{54}\Gamma_6/\Gamma$$

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

$$\Gamma(\phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{87}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.347±0.169±0.003	6±3	17 AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M071G13
NODE=M071G13

¹⁷ 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

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{86}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.57±0.23±0.01	10	18 AUBERT,BE	06D BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M071G10
NODE=M071G10

¹⁸ 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

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{50}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.01±0.84±0.02	37	19 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$

NODE=M071G02
NODE=M071G02

¹⁹ 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

$$\Gamma(2(\pi^+\pi^-\eta)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{48}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.87±1.41±0.01	16	20 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\eta)\gamma$

NODE=M071G03
NODE=M071G03

²⁰ 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 $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$. 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

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{66}\Gamma_6/\Gamma$$

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

$$\Gamma(K^+K^-\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{57}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.05±1.80±0.02	7	21 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$

NODE=M071G05
NODE=M071G05

²¹ 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 $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$. 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

$\psi(2S)$ BRANCHING RATIOS

NODE=M071235

 $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.9785 $\pm$ 0.0013 OUR AVERAGE0.9779 $\pm$ 0.0015 ²² BAI 02B BES2 e^+e^- 0.981 $\pm$ 0.003 ²² LUTH 75 MRK1 e^+e^- ²² 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 ^{23,24} SETH 04 RVUE e^+e^- 0.0199 $\pm$ 0.0019 ²³ BAI 02B BES2 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.029 $\pm$ 0.004 ²³ LUTH 75 MRK1 e^+e^- ²³ Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.²⁴ 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 $\Gamma(ggg)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

10.58 $\pm$ 1.62 2.9 M ²⁵ LIBBY 09 CLEO $\psi(2S) \rightarrow \text{hadrons}$ ²⁵ Calculated using $\Gamma(\gamma gg)/\Gamma(ggg) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09, $B(\psi(2S) \rightarrow X J/\psi)$ relative and absolute branching fractions from MENDEZ 08, $B(\psi(2S) \rightarrow \gamma \eta_c)$ from MITCHELL 09, and $B(\psi(2S) \rightarrow \text{virtual } \gamma \rightarrow \text{hadrons})$, $B(\psi(2S) \rightarrow \gamma \chi_{cJ})$, and $B(\psi(2S) \rightarrow \ell^+\ell^-)$ from PDG 08. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ LIBBY 09 measurement.NODE=M071S43
NODE=M071S43

NODE=M071S43;LINKAGE=LI

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

1.025 $\pm$ 0.288 200 k ²⁶ LIBBY 09 CLEO $\psi(2S) \rightarrow \gamma + \text{hadrons}$ ²⁶ Calculated using $\Gamma(\gamma gg)/\Gamma(ggg) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ LIBBY 09 measurement.NODE=M071S44
NODE=M071S44

NODE=M071S44;LINKAGE=LI

 $\Gamma(\gamma gg)/\Gamma(ggg)$ 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 ²⁷ 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 ²⁸ ADAM 05A CLEO $e^+e^- \rightarrow \psi(2S)$ ²⁷ Uses $B(\psi(2S) \rightarrow J/\psi X)$ from MENDEZ 08 and other branching fractions from PDG 07.²⁸ 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

77.3 $\pm$ 1.7 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

88 $\pm$ 13 ²⁹ FELDMAN 77 RVUE e^+e^- ²⁹ From an overall fit assuming equal partial widths for e^+e^- and $\mu^+\mu^-$. For a measurement of the ratio see the entry $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ below. Includes LUTH 75, HILGER 75, BURMESTER 77.NODE=M071R1
NODE=M071R1

NODE=M071R;LINKAGE=L

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	DOCUMENT ID

77 $\pm$ 8 OUR FITNODE=M071R2
NODE=M071R2

$$\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$$

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

30 ±4 OUR FIT
30.8±2.1±3.8
³⁰ ABLIKIM 06W BES $e^+e^- \rightarrow \psi(2S)$
³⁰ 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

NODE=M071R75;LINKAGE=AB

———— DECAYS INTO $J/\psi(1S)$ AND ANYTHING ————

$$\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.595 ±0.008 OUR FIT
0.55 ±0.07 OUR AVERAGE

0.51 ±0.12

BRANDELIK 79C DASP $e^+e^- \rightarrow \mu^+\mu^-X$

0.57 ±0.08

ABRAMS 75B MRK1 $e^+e^- \rightarrow \mu^+\mu^-X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6254±0.0016±0.0155 1.1M ³¹ MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-X$

0.5950±0.0015±0.0190 151k ADAM 05A CLEO Repl. by MENDEZ 08

³¹ Not independent from other measurements of MENDEZ 08.

$$\Gamma_9/\Gamma$$

NODE=M071R10
NODE=M071R10

NODE=M071R10;LINKAGE=ME

$$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$$

$$\Gamma_6/\Gamma_9 = \Gamma_6/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.344\Gamma_{110}+0.195\Gamma_{111})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

1.299±0.026 OUR FIT
1.28 ±0.04 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

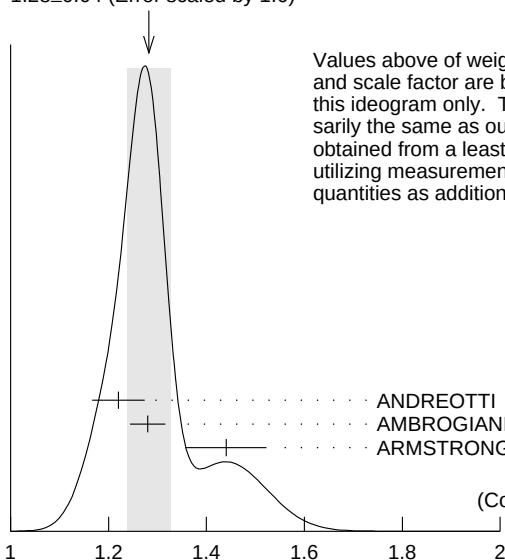
1.22 ±0.02 ±0.05 5097 ± 73 ³² ANDREOTTI 05 E835 $p\bar{p} \rightarrow \psi(2S) \rightarrow e^+e^-$

1.28 ±0.03 ±0.02 ³² AMBROGIANI 00A E835 $p\bar{p} \rightarrow \psi(2S)$

1.44 ±0.08 ±0.02 ³² ARMSTRONG 97 E760 $\bar{p}p \rightarrow \psi(2S)$
³² Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R72
NODE=M071R72

NODE=M071R;LINKAGE=7A

WEIGHTED AVERAGE
1.28±0.04 (Error scaled by 1.6)


Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

			χ^2
ANDREOTTI	05	E835	1.3
AMBROGIANI	00A	E835	0.0
ARMSTRONG	97	E760	3.7
			5.0

(Confidence Level = 0.082)

 $\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$ (units 10^{-2})

$$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\text{anything})$$

$$\Gamma_7/\Gamma_9 = \Gamma_7/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.344\Gamma_{110}+0.195\Gamma_{111})$$

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

0.246 ± 0.004 OUR FIT Γ_{10}/Γ NODE=M071R18
NODE=M071R18 $\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.336 ± 0.004 OUR FIT**0.343 ± 0.011 OUR AVERAGE**

Error includes scale factor of 1.7.

0.3504 ± 0.0007 ± 0.0077 565k MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+ \ell^- \pi^+ \pi^-$ 0.323 ± 0.014 BAI 02B BES2 $e^+ e^-$ 0.32 ± 0.04 ABRAMS 75B MRK1 $e^+ e^- \rightarrow J/\psi \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.3354 ± 0.0014 ± 0.0110 60k ³³ADAM 05A CLEO Repl. by MENDEZ 08³³Not independent from other values reported by ADAM 05A. Γ_{11}/Γ NODE=M071R12
NODE=M071R12

NODE=M071R;LINKAGE=AD

 $\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE

DOCUMENT ID

TECN

COMMENT

0.0230 ± 0.0005 OUR FIT**0.0252 ± 0.0028 ± 0.0011**³⁴AUBERT 02B BABR $e^+ e^-$ ³⁴Using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$. Γ_6/Γ_{11} NODE=M071R73
NODE=M071R73

NODE=M071R73;LINKAGE=7A

 $\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE

DOCUMENT ID

TECN

COMMENT

0.0229 ± 0.0025 OUR FIT**0.0224 ± 0.0029 OUR AVERAGE**0.0216 ± 0.0026 ± 0.0014 ³⁵AUBERT 02B BABR $e^+ e^-$ 0.0327 ± 0.0077 ± 0.0072 ³⁵GRIBUSHIN 96 FMPS $515 \pi^- \text{Be} \rightarrow 2\mu X$ ³⁵Using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$. Γ_7/Γ_{11} NODE=M071R63
NODE=M071R63

NODE=M071R;LINKAGE=Q2

 $\Gamma(\tau^+\tau^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

9.0 ± 1.1 OUR FIT**8.73 ± 1.39 ± 1.57**

BAI

02

BES

 $e^+ e^-$ Γ_8/Γ_{11} NODE=M071R76
NODE=M071R76 $\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything})$

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.5646 ± 0.0026 OUR FIT

[0.5647 ± 0.0026 OUR 2011 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 ^{36,37}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. • • •

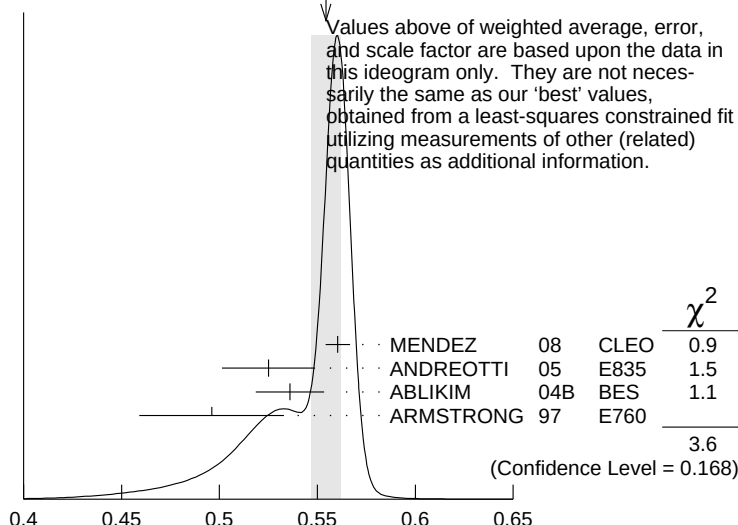
0.5637 ± 0.0027 ± 0.0046 60k ADAM 05A CLEO Repl. by MENDEZ 08

³⁶From a fit to the J/ψ recoil mass spectra.³⁷ABLIKIM 04B quotes $B(\psi(2S) \rightarrow J/\psi X) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-)$. Γ_{11}/Γ_9 NODE=M071R70
NODE=M071R70
NEW

NODE=M071R;LINKAGE=AB

NODE=M071R;LINKAGE=AL

WEIGHTED AVERAGE
0.554±0.008 (Error scaled by 1.3)



$$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything}) \quad \Gamma_{11}/\Gamma_9$$

$$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{10}/\Gamma_{11} = (0.9761\Gamma_{12} + 0.719\Gamma_{13} + 0.344\Gamma_{110} + 0.195\Gamma_{111})/\Gamma_{11}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.731±0.008 OUR FIT			
0.73 ±0.09	TANENBAUM 76	MRK1	e^+e^-

NODE=M071R11
NODE=M071R11

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ
0.1775±0.0034 OUR FIT					
[0.1776 ± 0.0034 OUR 2011 FIT]					

NODE=M071R17
NODE=M071R17
NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.1769±0.0008±0.0053	61k	³⁸ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.1652±0.0014±0.0058	13.4k	³⁹ ADAM	05A	CLEO	Repl. by MENDEZ 08

³⁸ Not independent from other measurements of MENDEZ 08.

³⁹ Not independent from other values reported by ADAM 05A.

NODE=M071R17;LINKAGE=ME
NODE=M071R17;LINKAGE=AD

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ_9
0.2982±0.0032 OUR FIT					
0.320 ±0.012 OUR AVERAGE					

0.300 ±0.008 ±0.022	1655 ± 44	ANDREOTTI	05	E835	$\psi(2S) \rightarrow J/\psi X$
0.328 ±0.013 ±0.008		AMBROGIANI	00A	E835	$p\bar{p} \rightarrow \psi(2S)$
0.323 ±0.033		ARMSTRONG	97	E760	$\bar{p}p \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.2829±0.0012±0.0056	61k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.2776±0.0025±0.0043	13.4k	ADAM	05A	CLEO	Repl. by MENDEZ 08

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ_{11}
0.528 ±0.008 OUR FIT					
0.513 ±0.022 OUR AVERAGE					

Error includes scale factor of 2.2.

0.5047±0.0022±0.0102	61k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.570 ±0.009 ±0.026	14k	⁴⁰ 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	^{41,42} ADAM	05A	CLEO	Repl. by MENDEZ 08
0.571 ±0.018 ±0.044		⁴³ ANDREOTTI	05	E835	$\psi(2S) \rightarrow J/\psi X$
0.53 ±0.06		TANENBAUM	76	MRK1	e^+e^-
0.64 ±0.15		⁴⁴ HILGER	75	SPEC	e^+e^-

⁴⁰ From a fit to the J/ψ recoil mass spectra.

⁴¹ Not independent from other values reported by ADAM 05A.

⁴² Using 13,217 $J/\psi\pi^0\pi^0$ and 60,010 $J/\psi\pi^+\pi^-$ events.

⁴³ Not independent from other values reported by ANDREOTTI 05.

⁴⁴ Ignoring the $J/\psi(1S)\eta$ and $J/\psi(1S)\gamma\gamma$ decays.

NODE=M071R14
NODE=M071R14

NODE=M071R14;LINKAGE=AB
NODE=M071R14;LINKAGE=AD
NODE=M071R14;LINKAGE=AM
NODE=M071R;LINKAGE=AN
NODE=M071R;LINKAGE=I

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0328 ± 0.0007 OUR FIT**0.0296 ± 0.0031 OUR AVERAGE**

Error includes scale factor of 1.8. See the ideogram below.

0.0298 ± 0.0009 ± 0.0023	5.7k	BAI	04I	BES2	$\psi(2S) \rightarrow J/\psi \gamma \gamma$
0.0255 ± 0.0029	386	45 OREGLIA	80	CBAL	$e^+ e^- \rightarrow J/\psi 2\gamma$
0.045 ± 0.012	17	46 BRANDELIK	79B	DASP	$e^+ e^- \rightarrow J/\psi 2\gamma$
0.042 ± 0.006	164	46 BARTEL	78B	CNTR	$e^+ e^-$

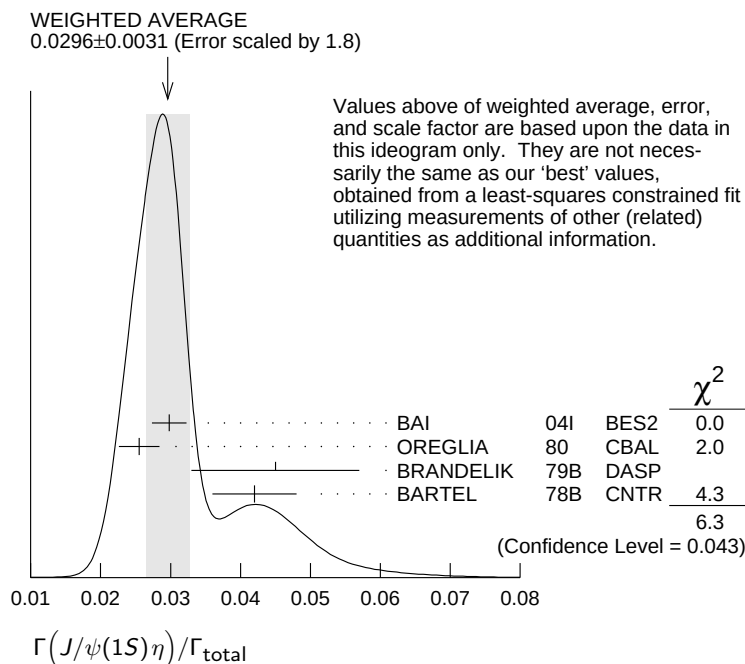
• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0343 ± 0.0004 ± 0.0009	18.4k	47 MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+ \ell^- \eta$
0.0325 ± 0.0006 ± 0.0011	2.8k	48 ADAM	05A	CLEO	Repl. by MENDEZ 08
0.043 ± 0.008	44	TANENBAUM	76	MRK1	$e^+ e^-$

⁴⁵ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.⁴⁶ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.⁴⁷ Not independent from other measurements of MENDEZ 08.⁴⁸ Not independent from other values reported by ADAM 05A.

NODE=M071R15
 NODE=M071R15

NODE=M071R;LINKAGE=3Q
 NODE=M071R;LINKAGE=2Q
 NODE=M071R15;LINKAGE=ME
 NODE=M071R15;LINKAGE=AD

 $\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\text{anything})$ Γ_{13}/Γ_9

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0551 ± 0.0009 OUR FIT**0.058 ± 0.007 OUR AVERAGE**

Error includes scale factor of 1.4. See the ideogram below.

0.050 ± 0.006 ± 0.003	298 ± 20	ANDREOTTI	05	E835	$\psi(2S) \rightarrow J/\psi X$
0.072 ± 0.009		AMBROGIANI	00A	E835	$p\bar{p} \rightarrow \psi(2S)$
0.061 ± 0.015		ARMSTRONG	97	E760	$\bar{p}p \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

⁴⁹ MENDEZ 08 $\psi(2S) \rightarrow \ell^+ \ell^- \eta$

ADAM 05A CLEO Repl. by MENDEZ 08

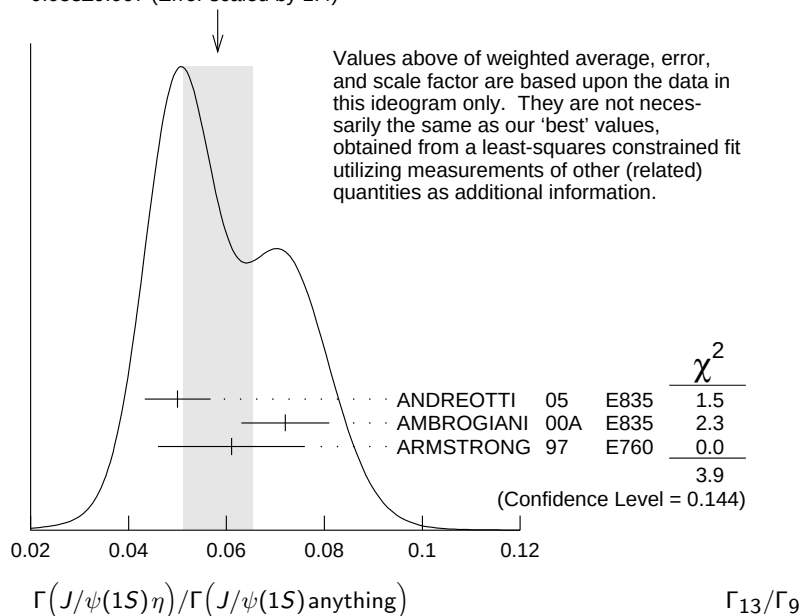
⁴⁹ Not independent from other measurements of MENDEZ 08.

NODE=M071R68
 NODE=M071R68

OCCUR=2

NODE=M071R68;LINKAGE=ME

WEIGHTED AVERAGE
0.058±0.007 (Error scaled by 1.4)



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_{13}/Γ_{11}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0976±0.0016 OUR FIT				
0.0979±0.0018 OUR AVERAGE				
0.0979±0.0010±0.0015	18.4k	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$
0.098 ±0.005 ±0.010	2k	50 ABLIKIM	04B	BES $\psi(2S) \rightarrow J/\psi X$
0.091 ±0.021		51 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	52 ADAM	05A	CLEO Repl. by MENDEZ 08
0.095 ±0.007 ±0.007		53 ANDREOTTI	05	E835 $\psi(2S) \rightarrow J/\psi X$

⁵⁰ From a fit to the J/ψ recoil mass spectra.

⁵¹ 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 $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (0.1181 \pm 0.0020)$.

⁵² Not independent from other values reported by ADAM 05A.

⁵³ Not independent from other values reported by ANDREOTTI 05.

NODE=M071R71
NODE=M071R71

NODE=M071R71;LINKAGE=AB
NODE=M071R;LINKAGE=8H

NODE=M071R71;LINKAGE=AD
NODE=M071R71;LINKAGE=AN

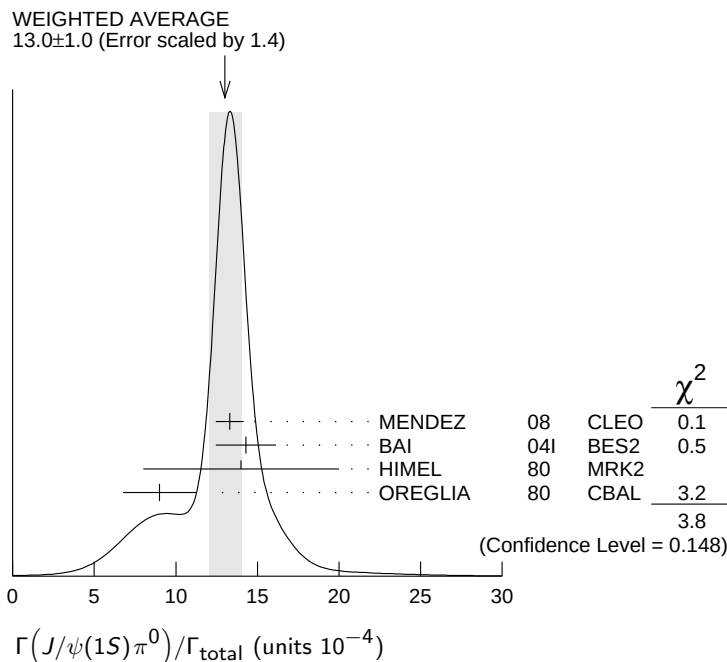
$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$

Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13.0±1.0 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
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	54 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
⁵⁴ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.				

NODE=M071R16
NODE=M071R16

NODE=M071R16;LINKAGE=3Q



$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_{14}/\Gamma_9 = \Gamma_{14}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13} + 0.344\Gamma_{110} + 0.195\Gamma_{111})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.213±0.012±0.003	527	⁵⁵ MENDEZ	08	CLEO	$e^+e^- \rightarrow J/\psi\gamma\gamma$
0.22 ±0.02 ±0.01		⁵⁶ ADAM	05A	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

⁵⁵ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

⁵⁶ Not independent from other values reported by ADAM 05A.

NODE=M071S25
NODE=M071S25

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

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±0.022±0.005	527	⁵⁷ MENDEZ	08	CLEO	$e^+e^- \rightarrow J/\psi\gamma\gamma$
0.39 ±0.04 ±0.01		⁵⁸ ADAM	05A	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

⁵⁷ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

⁵⁸ Not independent from other values reported by ADAM 05A.

NODE=M071S26
NODE=M071S26

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

[(8.4 ± 1.6) × 10⁻⁴ OUR 2011 AVERAGE]

9.0±1.5±1.3	3k	⁵⁹ GE	11	CLEO	$\Upsilon(2S) \rightarrow \pi^0 \text{ anything}$
8.4±1.3±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	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$

⁵⁹ Assuming a width $\Gamma(h_c(1P)) = 0.86 \text{ MeV} \equiv \Gamma_0$, a measured dependence of the central value of $B = (7.6 + 1.4 \times \Gamma(h_c(1P))/\Gamma_0) \times 10^{-4}$, and with a systematic error that accounts for the width variation range 0.43–1.29 MeV.

NODE=M071310

NODE=M071S42
NODE=M071S42

NEW

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

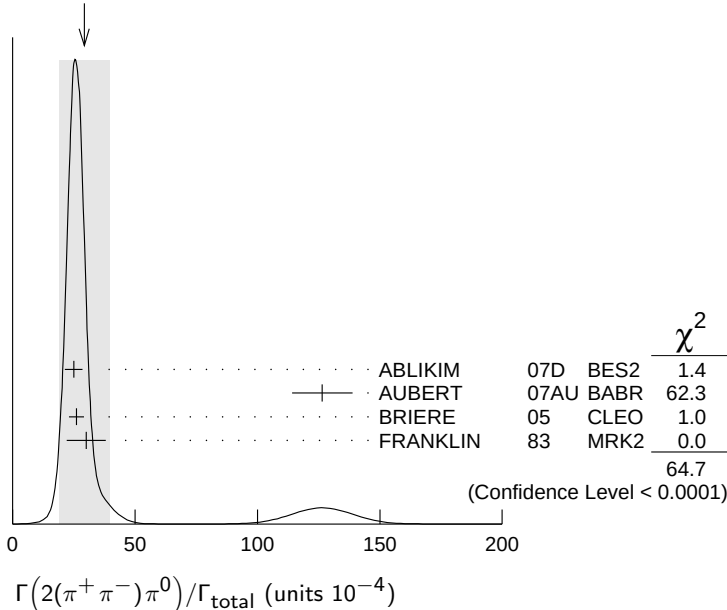
NODE=M071R22
NODE=M071R22

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
29 ± 10 OUR AVERAGE		Error includes scale factor of 4.6. See the ideogram below.		
24.9 ± 0.7 ± 3.6	2173	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
127 ± 12 ± 2	410	60 AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0\gamma$
26.1 ± 0.7 ± 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^-

60 AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (297 \pm 22 \pm 18) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.35 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R22;LINKAGE=UB

WEIGHTED AVERAGE
29±10 (Error scaled by 4.6)

 $\Gamma(\rho a_2(1320))/\Gamma_{\text{total}}$ Γ_{18}/Γ

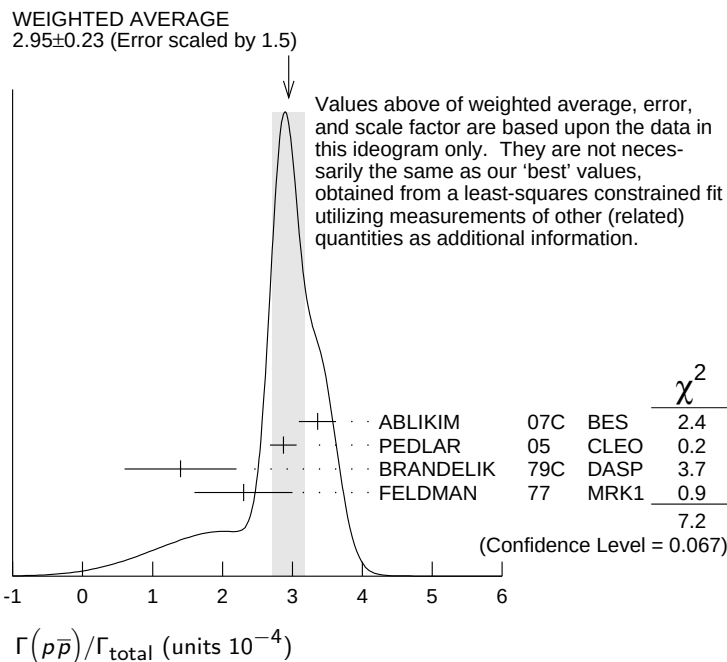
NODE=M071R65
NODE=M071R65

<i>VALUE</i> (units 10^{-4})	<i>CL%</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
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	$e^+ e^-$	

 $\Gamma(\rho\bar{p})/\Gamma_{\text{total}}$ Γ_{19}/Γ

NODE=M071R25
NODE=M071R25

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.76 ± 0.12 OUR 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	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
2.87 ± 0.12 ± 0.15	557	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
1.4 ± 0.8	4	BRANDELIK	79C DASP	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
2.3 ± 0.7		FELDMAN	77 MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$



$\Gamma(p\bar{p})/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{19}/Γ_{11}

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.2 ± 0.4 OUR FIT			
6.98 ± 0.49 ± 0.97	BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

NODE=M071S40
NODE=M071S40

$\Gamma(\Delta^{++}\bar{\Delta}^{--})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
12.8 ± 1.0 ± 3.4	157	⁶¹ BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

NODE=M071R50
NODE=M071R50

⁶¹ 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^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	⁶² ABLIKIM	07H	BES2 $e^+e^- \rightarrow \psi(2S)$

NODE=M071R6
NODE=M071R6

⁶² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.

NODE=M071R6;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.49	90	⁶³ ABLIKIM	07H	BES2 $e^+e^- \rightarrow \psi(2S)$

NODE=M071R7
NODE=M071R7

⁶³ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.

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

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

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.
$3.39 \pm 0.20 \pm 0.32$		337	ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
$6.4 \pm 1.8 \pm 0.1$			⁶⁴ AUBERT	07BD BABR	$10.6 e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$
$3.28 \pm 0.23 \pm 0.25$		208	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
$1.81 \pm 0.20 \pm 0.27$		80	⁶⁵ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4 90 FELDMAN 77 MRK1 $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

⁶⁴ 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 $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.35 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

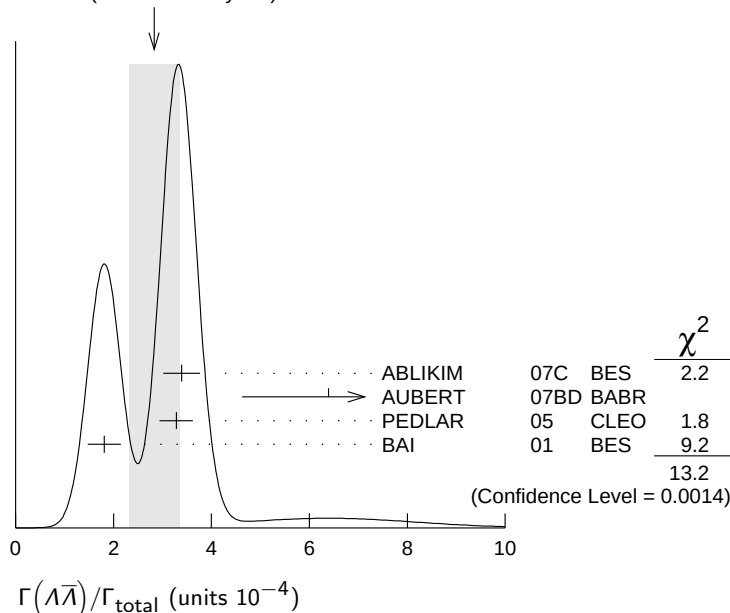
⁶⁵ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R28
NODE=M071R28

NODE=M071R28;LINKAGE=AU

NODE=M071R28;LINKAGE=PP

WEIGHTED AVERAGE
 2.8 ± 0.5 (Error scaled by 2.6)

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$25.7 \pm 4.4 \pm 6.8$	35	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

 Γ_{27}/Γ

NODE=M071R47
NODE=M071R47

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$

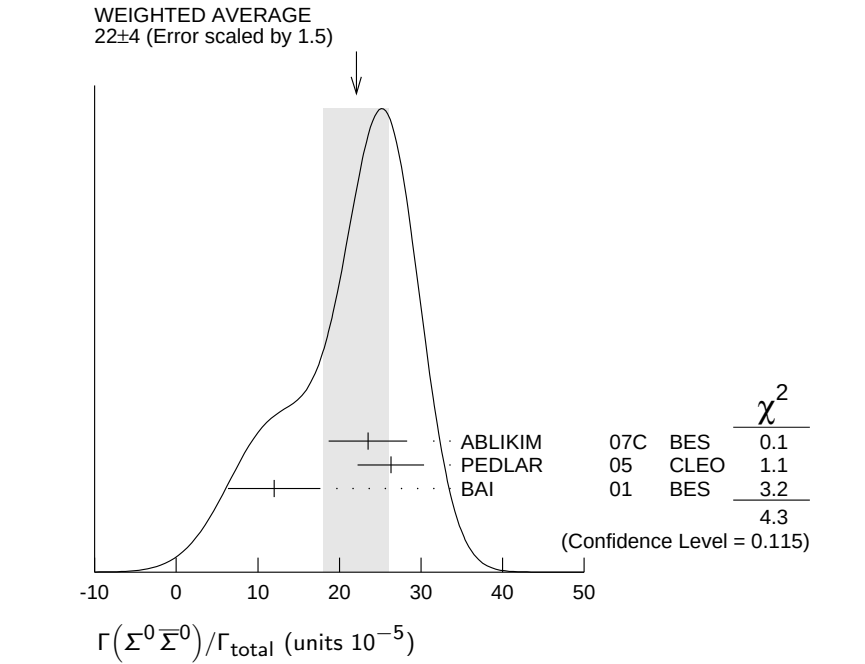
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
22 ± 4				OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.
$23.5 \pm 3.6 \pm 3.2$	59	ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
$26.3 \pm 3.5 \pm 2.1$	58	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
$12 \pm 4 \pm 4$	8	⁶⁶ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

⁶⁶ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

 Γ_{28}/Γ

NODE=M071R51
NODE=M071R51

NODE=M071R51;LINKAGE=PP



$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-) / \Gamma_{\text{total}}$						Γ_{29} / Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
11±3±3	14	⁶⁷ BAI	01	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons	

⁶⁷ 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_{30} / 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	⁶⁸ BAI	01	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

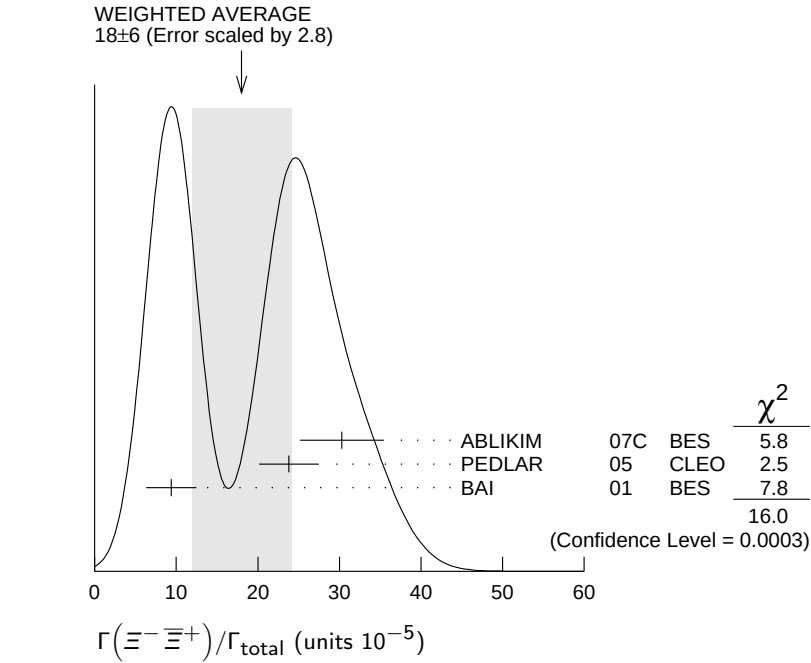
• • • We do not use the following data for averages, fits, limits, etc. • • •

<20	90	FELDMAN	77	MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

⁶⁸ 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_{31}/Γ

NODE=M071R48
NODE=M071R48

 $\Gamma(\Xi(1530)^0 \Xi(1530)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 8.1	90	⁶⁹ BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<32	90	PEDLAR	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

 Γ_{32}/Γ

NODE=M071R53
NODE=M071R53

⁶⁹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R53;LINKAGE=PP

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.3	90	⁷⁰ BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<16	90	PEDLAR	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

 Γ_{33}/Γ

NODE=M071R54
NODE=M071R54

⁷⁰ 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
1.50±0.08 OUR AVERAGE	Error includes scale factor of 1.1.			
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	⁷¹ 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_{34}/Γ

NODE=M071R35
NODE=M071R35

⁷¹ Computed using $B(\pi^0 \rightarrow \gamma \gamma) = (98.80 \pm 0.03)\%$.

NODE=M071R35;LINKAGE=AB

 $\Gamma(N_1^*(1440) \bar{p} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
8.1±0.7±0.3	474	⁷² ALEXANDER	10	CLEO $\psi(2S) \rightarrow \pi^0 p \bar{p}$

⁷² 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.

 Γ_{35}/Γ

NODE=M071S50
NODE=M071S50

NODE=M071S50;LINKAGE=AL

 $\Gamma(\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.4±0.1	76	⁷³ ALEXANDER	10	CLEO $\psi(2S) \rightarrow \pi^0 p \bar{p}$

⁷³ 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.

 Γ_{36}/Γ

NODE=M071S51
NODE=M071S51

NODE=M071S51;LINKAGE=AL

 $\Gamma(\eta p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.7±0.6 OUR AVERAGE				
5.6±0.6±0.3	154	ALEXANDER	10	CLEO $\psi(2S) \rightarrow \eta p \bar{p}$
5.8±1.1±0.7	44.8 ± 8.5	⁷⁴ ABLIKIM	05E	BES2 $e^+e^- \rightarrow \psi(2S) \rightarrow$ $p \bar{p} \gamma \gamma$
8 ± 3 ± 3	9.8	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow$ $p \bar{p} \pi^+ \pi^- \pi^0$

 Γ_{37}/Γ

NODE=M071R56
NODE=M071R56

⁷⁴ Computed using $B(\eta \rightarrow \gamma \gamma) = (39.43 \pm 0.26)\%$.

NODE=M071R56;LINKAGE=AB

 $\Gamma(\eta f_0(2100) \rightarrow \eta p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.4±0.1	31	⁷⁵ ALEXANDER	10	CLEO $\psi(2S) \rightarrow \eta p \bar{p}$

⁷⁵ From a fit of the $p \bar{p}$ and $p \eta$ distributions to a combination of $N^*(1535) \bar{p}$ and $\eta f_0(2100)$.

 Γ_{38}/Γ

NODE=M071S52
NODE=M071S52

NODE=M071S52;LINKAGE=AL

 $\Gamma(N^*(1535) \bar{p} \rightarrow \eta p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±0.6±0.3	123	⁷⁶ ALEXANDER	10	CLEO $\psi(2S) \rightarrow \eta p \bar{p}$

⁷⁶ From a fit of the $p \bar{p}$ and $p \eta$ distributions to a combination of $N^*(1535) \bar{p}$ and $\eta f_0(2100)$.

 Γ_{39}/Γ

NODE=M071S53
NODE=M071S53

NODE=M071S53;LINKAGE=AL

$\Gamma(\omega p \bar{p})/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.69±0.21 OUR AVERAGE				
0.6 ±0.2 ±0.2 21.2		BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$
0.8 ±0.3 ±0.1 14.9 ± 0.1	77	BAI	03B BES	$\psi(2S) \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$
77 Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.				

NODE=M071R79
NODE=M071R79

NODE=M071R;LINKAGE=B3

 $\Gamma(\phi p \bar{p})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	90	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.26	90	78 BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- p \bar{p}$
78 Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.				

NODE=M071R82
NODE=M071R82

NODE=M071R82;LINKAGE=B3

 $\Gamma(\pi^+ \pi^- p \bar{p})/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±0.4 OUR AVERAGE				
5.9±0.2±0.4	904.5	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^-$
8 ±2		79 TANENBAUM	78 MRK1	$e^+ e^-$
79 Assuming entirely strong decay.				

NODE=M071R31
NODE=M071R31

NODE=M071R;LINKAGE=K

 $\Gamma(p \bar{n} \pi^- \text{ or c.c. })/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.48±0.17 OUR AVERAGE				
2.45±0.11±0.21	851	ABLIKIM	06I BES2	$e^+ e^- \rightarrow p \pi^- X$
2.52±0.12±0.22	849	ABLIKIM	06I BES2	$e^+ e^- \rightarrow \bar{p} \pi^+ X$

NODE=M071R01
NODE=M071R01

OCCUR=2

 $\Gamma(p \bar{n} \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.18±0.50±0.50	135 ± 21	ABLIKIM	06I BES2	$e^+ e^- \rightarrow p \pi^- \pi^0 X$

NODE=M071R02
NODE=M071R02

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M071S06
NODE=M071S06

 $\Gamma(\eta \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.5±0.7±1.5		80 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	81 BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow \gamma\gamma)$
8.1±1.4±1.6	50.0	81 BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow 3\pi)$

NODE=M071S07
NODE=M071S07

OCCUR=2

OCCUR=3

80 Average of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow 3\pi$.

81 Not independent from other values reported by BRIERE 05.

NODE=M071S07;LINKAGE=BR
NODE=M071S07;LINKAGE=BI

 $\Gamma(2(\pi^+ \pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.6±0.1	16	82 AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow 2(\pi^+ \pi^-) \eta \gamma$
82 AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+ \pi^-) \eta) \cdot B(\eta \rightarrow \gamma\gamma) = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$.				

NODE=M071S38
NODE=M071S38

NODE=M071S38;LINKAGE=UB

 $\Gamma(\eta' \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.5±1.6±1.3	12.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$

NODE=M071S08
NODE=M071S08

$\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{50}/Γ

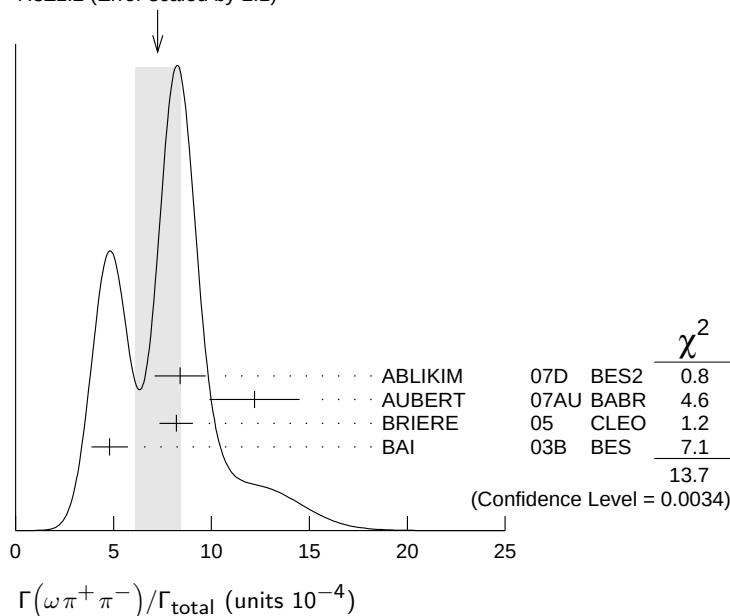
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±1.2 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
8.4±0.5±1.2	386	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
12.2±2.2±0.7	37	⁸³ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
8.2±0.5±0.7	391	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
4.8±0.6±0.7	100 ± 22	⁸⁴ BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
⁸³ 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.				
⁸⁴ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.				

NODE=M071R77
 NODE=M071R77

NODE=M071R77;LINKAGE=UB

NODE=M071R77;LINKAGE=B3

WEIGHTED AVERAGE
 7.3±1.2 (Error scaled by 2.1)

 $\Gamma(b_1^\pm\pi^\mp)/\Gamma_{\text{total}}$ Γ_{51}/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	^{85,86} 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		⁸⁵ BAI	99C BES	Repl. by BAI 03B
⁸⁵ Assuming $B(b_1 \rightarrow \omega\pi)=1$.				
⁸⁶ 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_{52}/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_{53}/Γ

<u>VALUE (units 10^{-4})</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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	⁸⁷ BAI	03B BES		$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
<1.7	90	BAI	98J BES		Repl. by BAI 03B
⁸⁷ 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_{54}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5±0.9 OUR AVERAGE		Error includes scale factor of 1.9.		
10.9±1.9±0.2	85	⁸⁸ 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		⁸⁹ TANENBAUM	78 MRK1	e^+e^-
⁸⁸ 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 $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.35 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
⁸⁹ Assuming entirely strong decay.				

NODE=M071R24
 NODE=M071R24

NODE=M071R24;LINKAGE=BE

NODE=M071R24;LINKAGE=K

 $\Gamma(\rho^0K^+K^-)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.2±0.4	223.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow K^+K^-\pi^+\pi^-$

NODE=M071S09
 NODE=M071S09

 $\Gamma(K^*(892)^0\bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.86±0.32±0.43	93 ± 16	BAI	04C		$\psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.2	90	BAI	98J BES		e^+e^-

NODE=M071R66
 NODE=M071R66

 $\Gamma(K^+K^-\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.7±0.1	7	⁹⁰ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$
⁹⁰ 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_{58}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.0±2.5±1.8	65	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R09
 NODE=M071R09

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
10.0±1.8±2.1	⁹¹ BAI	99C BES	e^+e^-
⁹¹ 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_{61}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.25±0.37	83 ± 9	ABLIKIM	050 BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R49
 NODE=M071R49

 $\Gamma(\rho^0\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.5±0.1±0.2	61.1	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}\pi^+\pi^-$

NODE=M071S14
 NODE=M071S14

 $\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{63}/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_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.6 OUR AVERAGE		Error includes scale factor of 2.2.		
2.2±0.2±0.2	308	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)$
4.5±1.0		TANENBAUM	78 MRK1	e^+e^-

NODE=M071R27
 NODE=M071R27

 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.6 OUR AVERAGE		Error includes scale factor of 1.4.		
2.0±0.2±0.4	285.5	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)$
4.2±1.5		TANENBAUM	78 MRK1	e^+e^-

NODE=M071R33
 NODE=M071R33

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

12.6±0.9 OUR AVERAGE

18.7±5.7±0.3	32	92 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	$e^+e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

92 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 $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.35 \pm 0.04$ 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_{67}/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_{68}/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_{69}/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_{70}/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_{71}/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

 $\Gamma(\eta K^+ K^-)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.3

90	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S11
 NODE=M071S11

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{73}/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	93 BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

93 Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R78
 NODE=M071R78

NODE=M071R78;LINKAGE=B3

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

3.5 ±2.0 OUR AVERAGE Error includes scale factor of 2.8.

5.45±0.42±0.87	671	ABLIKIM	05H BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow 3(\pi^+ \pi^-)$
1.5 ±1.0		94 TANENBAUM	78 MRK1	e^+e^-

94 Assuming entirely strong decay.

NODE=M071R32
 NODE=M071R32

NODE=M071R32;LINKAGE=K

 $\Gamma(\rho \bar{\rho} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

7.3±0.4±0.6

434.9	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho \bar{\rho} \pi^+ \pi^- \pi^0$

NODE=M071S15
 NODE=M071S15

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) CL%**6.3±0.7 OUR AVERAGE**

6.3±0.6±0.3

10 ±7

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 5

90

FELDMAN

77

MRK1 e^+e^- Γ_{76}/Γ NODE=M071R23
NODE=M071R23 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS**5.4 ±0.5 OUR AVERAGE**

5.8 ±0.8 ±0.4

5.24±0.47±0.48 156 ± 14

95 DOBBS

06A

CLEO e^+e^-

BAI

04B

BES2 $\psi(2S) \rightarrow K_S^0 K_L^0 \rightarrow$ $\pi^+ \pi^- X$ Γ_{77}/Γ NODE=M071R87
NODE=M071R87⁹⁵ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6860 \pm 0.0027$.

NODE=M071R;LINKAGE=KZ

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**1.68±0.26 OUR AVERAGE**

Error includes scale factor of 1.4. See the ideogram below.

1.81±0.18±0.19

260 ± 19

⁹⁶

ABLIKIM

05J

BES2

 $e^+e^- \rightarrow \psi(2S)$ 1.88^{+0.16}_{-0.15}±0.28

194

ADAM

05

CLEO

 $e^+e^- \rightarrow \psi(2S)$

0.85±0.46

4

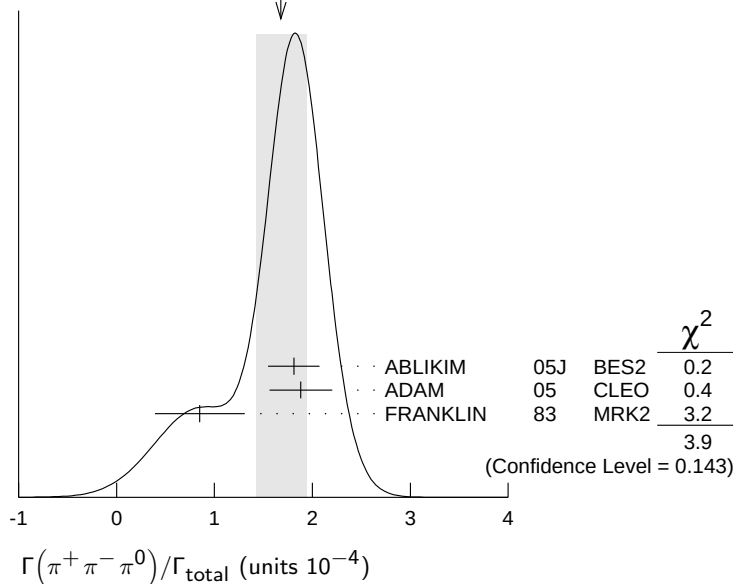
FRANKLIN

83

MRK2

 $e^+e^- \rightarrow \text{hadrons}$ ⁹⁶ From a PW analysis of $\psi(2S) \rightarrow \pi^+ \pi^- \pi^0$.NODE=M071R36
NODE=M071R36

NODE=M071R;LINKAGE=AK

WEIGHTED AVERAGE
1.68±0.26 (Error scaled by 1.4) $\Gamma(\rho(2150)\pi \rightarrow \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

1.94±0.25^{+1.15}_{-0.34}⁹⁷ ABLIKIM

05J

BES2

 $\psi(2S) \rightarrow \rho(2150)\pi \rightarrow \pi^+ \pi^- \pi^0$ ⁹⁷ From a PW analysis of $\psi(2S) \rightarrow \pi^+ \pi^- \pi^0$. Γ_{79}/Γ 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

0.32±0.12 OUR AVERAGE

0.51±0.07±0.11

⁹⁸

ABLIKIM

05J

BES2

 $\psi(2S) \rightarrow \rho(770)\pi \rightarrow$
 $\pi^+ \pi^- \pi^0$ 0.24^{+0.08}_{-0.07}±0.02

22

ADAM

05

CLEO

 $e^+e^- \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.83

90

1

FRANKLIN

83

MRK2

 e^+e^-

<10

90

BARTEL

76

CNTR

 e^+e^-

<10

90

⁹⁹

ABRAMS

75

MRK1

 e^+e^- Γ_{80}/Γ NODE=M071R26
NODE=M071R26

⁹⁸ From a PW analysis of $\psi(2S) \rightarrow \pi^+ \pi^- \pi^0$.

⁹⁹ Final state $\rho^0 \pi^0$.

NODE=M071R26;LINKAGE=AK

NODE=M071R;LINKAGE=N

$\Gamma(\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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 $e^+ e^-$

NODE=M071R20
NODE=M071R20

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	90	100 BAI	99C	BES $e^+ e^-$

NODE=M071R45
NODE=M071R45

¹⁰⁰ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$

NODE=M071R;LINKAGE=M3

$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<2.96	90	1	FRANKLIN	83	MRK2 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M071R38
NODE=M071R38

$\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.7^{+0.8}_{-0.7} OUR AVERAGE					
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 $e^+ e^- \rightarrow \psi(2S)$

NODE=M071R39
NODE=M071R39

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5.4 90 FRANKLIN 83 MRK2 $e^+ e^- \rightarrow \text{hadrons}$

$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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

$\Gamma(K^+ \bar{K}^*(892)^- + \text{c.c.})/\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})$ Γ_{84}/Γ_{85}

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_{86}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.17 ± 0.29 OUR AVERAGE				
2.43 ± 0.95 ± 0.04	10 ± 4 ^{101,102}	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	103 BAI	03B	BES $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M071R80
NODE=M071R80

¹⁰¹ 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 $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.35 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R80;LINKAGE=BE

¹⁰² Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

NODE=M071R80;LINKAGE=UB

¹⁰³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R80;LINKAGE=B3

$\Gamma(\phi f_0(980) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

0.68±0.25 OUR AVERAGE Error includes scale factor of 1.1.

1.45±0.70±0.03	6 ± 3	^{104,105} AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

0.6 ±0.2 ±0.1	18.4 ± 6.4	¹⁰⁶ BAI	03B BES	$\psi(2S) \rightarrow K^+K^-\pi^+\pi^-$

¹⁰⁴ 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 $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.35 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

¹⁰⁵ Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.¹⁰⁶ 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_{88}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

0.6±0.1±0.1	59.2	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)$

NODE=M071S12
 NODE=M071S12

 $\Gamma(\phi K^+K^-)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

0.70±0.16 OUR AVERAGE

0.8 ±0.2 ±0.1	36.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)$

0.6 ±0.2 ±0.1	16.1 ± 5.0	¹⁰⁷ BAI	03B BES	$\psi(2S) \rightarrow 2(K^+K^-)$

¹⁰⁷ 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_{90}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

1.1±0.2±0.2	44.7	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)\pi^0$

NODE=M071S13
 NODE=M071S13

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

2.8^{+1.0}_{-0.8} OUR AVERAGE

2.0 ^{+1.5} _{-1.1} ±0.4	6	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$

3.3±1.1±0.5	17	ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R89
 NODE=M071R89

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

3.1±1.4±0.7	8	¹⁰⁸ ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

¹⁰⁸ 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_{93}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

3.2^{+2.4}_{-2.0}±0.7	4	¹⁰⁹ ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

¹⁰⁹ 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_{94}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

2.1 ±0.6 OUR AVERAGE

2.5 ^{+1.2} _{-1.0} ±0.2	14	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$

1.87 ^{+0.68} _{-0.62} ±0.28	14	ABLIKIM	04L BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R92
 NODE=M071R92

 $\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

1.87^{+1.64}_{-1.11}±0.33	2	ABLIKIM	04L BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R93
 NODE=M071R93

$\Gamma(\rho\eta)/\Gamma_{\text{total}}$						Γ_{96}/Γ	NODE=M071R94 NODE=M071R94
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT			
2.2 $\pm$ 0.6 OUR AVERAGE Error includes scale factor of 1.1.							
3.0 $^{+1.1}_{-0.9} \pm 0.2$	18	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$		
1.78 $^{+0.67}_{-0.62} \pm 0.17$	13	ABLIKIM	04L	BES	$e^+e^- \rightarrow \psi(2S)$		
$\Gamma(\omega\eta)/\Gamma_{\text{total}}$						Γ_{97}/Γ	NODE=M071R95 NODE=M071R95
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT			
<1.1	90	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$		
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<3.1	90	ABLIKIM	04K	BES	$e^+e^- \rightarrow \psi(2S)$		
$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$						Γ_{98}/Γ	NODE=M071R96 NODE=M071R96
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT			
<0.4	90	ABLIKIM	04K	BES	$e^+e^- \rightarrow \psi(2S)$		
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<0.7	90	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$		
$\Gamma(\eta_c\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$						Γ_{99}/Γ	NODE=M071R03 NODE=M071R03
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT			
<1.0	90	PEDLAR	07	CLEO	$e^+e^- \rightarrow \psi(2S)$		
$\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}}$						Γ_{100}/Γ	NODE=M071S16 NODE=M071S16
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT			
2.7$\pm$0.6$\pm$0.4	30.1	BRIERE	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$		
$\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$						Γ_{101}/Γ	NODE=M071R08 NODE=M071R08
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT			
0.81$\pm$0.11$\pm$0.14	50	¹¹⁰ ABLIKIM	08C	BES2	$e^+e^- \rightarrow J/\psi$		
¹¹⁰ Using $B(\bar{\Lambda} \rightarrow \bar{p}\pi^+) = 63.9\%$ and $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$.							
$\Gamma(\phi f_2'(1525))/\Gamma_{\text{total}}$						Γ_{102}/Γ	NODE=M071R67 NODE=M071R67
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT		
0.44$\pm$0.12$\pm$0.11	20 $\pm$ 6	BAI	04C		$\psi(2S) \rightarrow 2(K^+K^-)$		
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<0.45	90	BAI	98J	BES	$e^+e^- \rightarrow 2(K^+K^-)$		
$\Gamma(\Theta(1540)\bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$						Γ_{103}/Γ	NODE=M071S01 NODE=M071S01
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT			
<0.88	90	BAI	04G	BES2	e^+e^-		
$\Gamma(\Theta(1540)K^-\bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$						Γ_{104}/Γ	NODE=M071S02 NODE=M071S02
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT			
<1.0	90	BAI	04G	BES2	e^+e^-		
$\Gamma(\Theta(1540)K_S^0\bar{p} \rightarrow K_S^0\bar{p}K^+n)/\Gamma_{\text{total}}$						Γ_{105}/Γ	NODE=M071S03 NODE=M071S03
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT			
<0.70	90	BAI	04G	BES2	e^+e^-		
$\Gamma(\bar{\Theta}(1540)K^+n \rightarrow K_S^0\bar{p}K^+n)/\Gamma_{\text{total}}$						Γ_{106}/Γ	NODE=M071S04 NODE=M071S04
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT			
<2.6	90	BAI	04G	BES2	e^+e^-		
$\Gamma(\bar{\Theta}(1540)K_S^0p \rightarrow K_S^0pK^-\bar{n})/\Gamma_{\text{total}}$						Γ_{107}/Γ	NODE=M071S05 NODE=M071S05
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT			
<0.60	90	BAI	04G	BES2	e^+e^-		

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{108}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

<0.046

111 BAI

04D

BES

 $e^+ e^-$

111 Forbidden by CP.

NODE=M071R88
NODE=M071R88

NODE=M071R;LINKAGE=BA

NODE=M071315

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_{109}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

9.68±0.31 OUR 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

112 GAISER

86

CBAL

 $e^+ e^- \rightarrow \gamma X$

7.2 ±2.3

112 BIDDICK

77

CNTR

 $e^+ e^- \rightarrow \gamma X$

7.5 ±2.6

112 WHITAKER

76

MRK1

 $e^+ e^-$ 112 Angular distribution $(1+\cos^2\theta)$ assumed.NODE=M071R55
NODE=M071R55

NODE=M071R;LINKAGE=A

 $\Gamma(\gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_{110}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

9.2 ±0.4 OUR 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

113 GAISER

86

CBAL

 $e^+ e^- \rightarrow \gamma X$

7.1 ±1.9

114 BIDDICK

77

CNTR

 $e^+ e^- \rightarrow \gamma X$ 113 Angular distribution $(1-0.189 \cos^2\theta)$ assumed.

114 Valid for isotropic distribution of the photon.

NODE=M071R58
NODE=M071R58NODE=M071R;LINKAGE=G
NODE=M071R;LINKAGE=B $\Gamma(\gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$ Γ_{111}/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

8.72±0.34 OUR FIT

[(8.75 ± 0.35) × 10^{-2} OUR 2011 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

115 GAISER

86

CBAL

 $e^+ e^- \rightarrow \gamma X$

7.0 ±2.0

116 BIDDICK

77

CNTR

 $e^+ e^- \rightarrow \gamma X$ 115 Angular distribution $(1-0.052 \cos^2\theta)$ assumed.

116 Valid for isotropic distribution of the photon.

NODE=M071R59
NODE=M071R59

NEW

NODE=M071R;LINKAGE=F
NODE=M071R59;LINKAGE=B $[\Gamma(\gamma\chi_{c0}(1P)) + \Gamma(\gamma\chi_{c1}(1P)) + \Gamma(\gamma\chi_{c2}(1P))]/\Gamma_{\text{total}}$ ($\Gamma_{109}+\Gamma_{110}+\Gamma_{111})/\Gamma$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

27.6±0.3±2.0

117 ATHAR

04

CLEO

 $e^+ e^- \rightarrow \gamma X$ 117 Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.NODE=M071R19
NODE=M071R19

NODE=M071R;LINKAGE=AH

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{109}/\Gamma_{110}$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.02±0.01±0.07

118 ATHAR

04

CLEO

 $e^+ e^- \rightarrow \gamma X$ 118 Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.NODE=M071R97
NODE=M071R97

NODE=M071R97;LINKAGE=AH

 $\Gamma(\gamma\chi_{c2}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{111}/\Gamma_{110}$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.03±0.02±0.03

119 ATHAR

04

CLEO

 $e^+ e^- \rightarrow \gamma X$ 119 Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.NODE=M071R98
NODE=M071R98

NODE=M071R98;LINKAGE=AH

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c2}(1P))$ $\Gamma_{109}/\Gamma_{111}$

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.99±0.02±0.08

120 ATHAR

04

CLEO

 $e^+ e^- \rightarrow \gamma X$ 120 Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.NODE=M071R99
NODE=M071R99

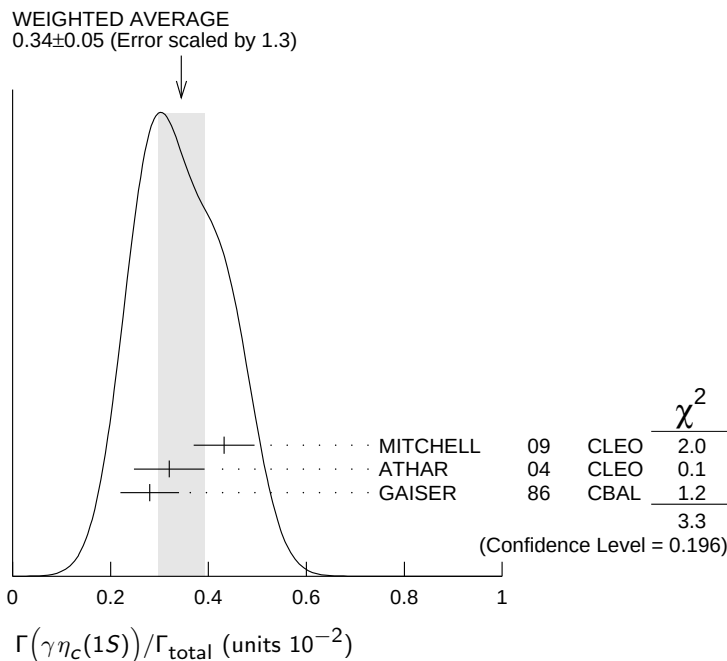
NODE=M071R99;LINKAGE=AH

$\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.34 ± 0.05 OUR AVERAGE		Error includes scale factor of 1.3.		See the ideogram below.
0.432 ± 0.016 ± 0.060		MITCHELL 09	CLEO	$e^+e^- \rightarrow \gamma X$
0.32 ± 0.04 ± 0.06	2560	121 ATHAR 04	CLEO	$e^+e^- \rightarrow \gamma X$
0.28 ± 0.06		122 GAISER 86	CBAL	$e^+e^- \rightarrow \gamma X$
121 ATHAR 04 used $\Gamma_{\eta_c(1S)} = 24.8 \pm 4.9$ MeV to obtain this result.				
122 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

 $\Gamma(\gamma\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{113}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8 × 10⁻⁴	90	123 CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K \bar{K} \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 2 × 10 ⁻³	90	ATHAR 04	CLEO	$e^+e^- \rightarrow \gamma X$
0.2–1.3 × 10 ⁻²	95	EDWARDS 82C	CBAL	$e^+e^- \rightarrow \gamma X$
123 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=CR

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{114}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.58 ± 0.40 ± 0.13		37	ABLIKIM 10F	BES3	$\psi(2S) \rightarrow \gamma\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 5	90		PEDLAR 09	CLE3	$\psi(2S) \rightarrow \gamma X$
< 5400	95		124 LIBERMAN 75	SPEC	e^+e^-
< 1 × 10 ⁴	90		WIJK 75	DASP	e^+e^-
124 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_{115}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.23 ± 0.06 OUR AVERAGE					
1.26 ± 0.03 ± 0.08		2226	125 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		126 BRAUNSCH... 77	DASP	e^+e^-
< 11	90		127 BARTEL 76	CNTR	e^+e^-

NODE=M071R44
 NODE=M071R44

¹²⁵ Combining the results from $\eta' \rightarrow \pi^+ \pi^- \eta$ and $\eta' \rightarrow \pi^+ \pi^- \gamma$ decay modes.

¹²⁶ Restated by us using total decay width 228 keV.

¹²⁷ The value is normalized to the branching ratio for $\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$.

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.12±0.19±0.32	128,129	BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.08±0.19±0.33	200.6 ± 18.8	¹²⁸ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
2.90±1.08±1.07	29.9 ± 11.1	¹²⁸ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

¹²⁸ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

¹²⁹ Combining the results from $\pi^+ \pi^-$ and $\pi^0 \pi^0$ decay modes.

NODE=M071R44;LINKAGE=AB

NODE=M071R;LINKAGE=R

NODE=M071R;LINKAGE=C

NODE=M071R84
NODE=M071R84

OCCUR=2

OCCUR=3

NODE=M071R;LINKAGE=3B

NODE=M071R;LINKAGE=B9

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{118}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.301±0.041±0.124	35.6 ± 4.8	¹³⁰ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

¹³⁰ 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_{119}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.604±0.090±0.132	39.6 ± 5.9	^{31,132} BAI	03C BES	$\psi(2S) \rightarrow \gamma K^+ K^-$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
< 1.56	90	6.8 ± 3.1	^{31,132} BAI	03C BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹³¹ 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.

¹³² 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_{121}/Γ

<u>VALUE (units 10^{-6})</u>	<u>CL%</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.38±0.48±0.09	13	133	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	$e^+ e^- \rightarrow 3\gamma$

¹³³ 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_{122}/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_{124}/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	¹³⁴ SCHARRE	80 MRK1	$e^+ e^-$

¹³⁴ 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_{125}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.36±0.25±0.05	10	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M071R05
NODE=M071R05

$\Gamma(\gamma \eta(1475) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}$ Γ_{127}/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_{128}/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_{129}/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_{130}/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_{131}/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_{132}/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_{133}/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_{134}/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	¹³⁵ 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

¹³⁵ 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_{135}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.2 \pm 0.2 \pm 0.1$	111	¹³⁶ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$

NODE=M071S46
 NODE=M071S46

¹³⁶ 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_{136}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.72 \pm 0.18 \pm 0.03$	73	¹³⁷ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$

NODE=M071S47
 NODE=M071S47

¹³⁷ 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_{137}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<5.4	90	ABLIKIM	07D BES	$\psi(2S) \rightarrow \gamma p\bar{p}$

NODE=M071S48
 NODE=M071S48

 $\Gamma(\gamma X \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{138}/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_{139}/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_{140}/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_{141}/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_{142}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S37
 NODE=M071S37

 $\psi(2S)$ 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 138	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

138 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 139	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

139 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

AAIJ	12H	arXiv:1112.5310	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54056
ANASHIN	12	PL B711 280	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=54038
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 011102R	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 (errat.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
PDG	07	Unofficial 2007 WWW edition		(PDG Collab.)	REFID=52717; ERROR=2
PEDLAR	07	PRL D75 011102R	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 091103R	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
DOBBS	06A	PR D74 011105R	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 051108R	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 031101R	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)	REFID=22216
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22173
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
OREGLIA	80	PRL 45 959	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22207
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
		Translated from YAF 34 1471.			
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BRANDELIK	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22114
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
BRAUNSCH...	77	PL 67B 249	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22197
BURMESTER	77	PL 66B 395	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22198
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)	REFID=22064
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22192
TANENBAUM	76	PRL 36 402	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL) IG	REFID=22194
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151
ABRAMS	75	Stanford Symp. 25	G.S. Abrams	(LBL)	REFID=22176
ABRAMS	75B	PRL 34 1181	G.S. Abrams <i>et al.</i>	(LBL, SLAC)	REFID=22177
BOYARSKI	75C	Palermo Conf. 54	A.M. Boyarski <i>et al.</i>	(SLAC, LBL)	REFID=22179
HILGER	75	PRL 35 625	E. Hilger <i>et al.</i>	(STAN, PENN)	REFID=22186
LIBERMAN	75	Stanford Symp. 55	A.D. Liberman	(STAN)	REFID=22046
LUTH	75	PRL 35 1124	V. Luth <i>et al.</i>	(SLAC, LBL) JPC	REFID=22188
WIJK	75	Stanford Symp. 69	B.H. Wiik	(DESY)	REFID=22050

$\psi(3770)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M053

 $\psi(3770)$ MASS (MeV)

NODE=M053M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M053M

3773.11±0.32 OUR FIT

NEW

[3772.92 ± 0.35 MeV OUR 2011 FIT Scale factor = 1.1]

3776.4 ±1.5 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below. [3775.2 ± 1.7 MeV OUR 2011 AVERAGE Scale factor = 1.4]

NEW

3779.2	+1.8 -1.7	+0.6 -0.8	1	ANASHIN	12A	KEDR	$e^+e^- \rightarrow D\bar{D}$
3772.0	±1.9		2,3	ABLIKIM	08D	BES2	$e^+e^- \rightarrow \text{hadrons}$
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. • • •

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.

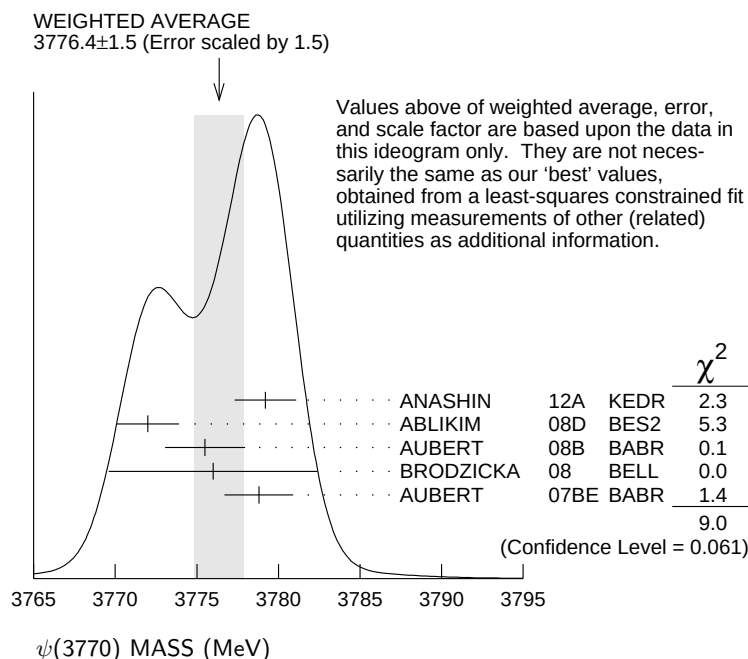
NODE=M053M;LINKAGE=AN

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 $\delta = 0^\circ$.

NODE=M053M;LINKAGE=AB

³ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.

NODE=M053M;LINKAGE=NI

 $m_{\psi(3770)} - m_{\psi(2S)}$

NODE=M053DM

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M053DM

87.00±0.32 OUR FIT

NEW

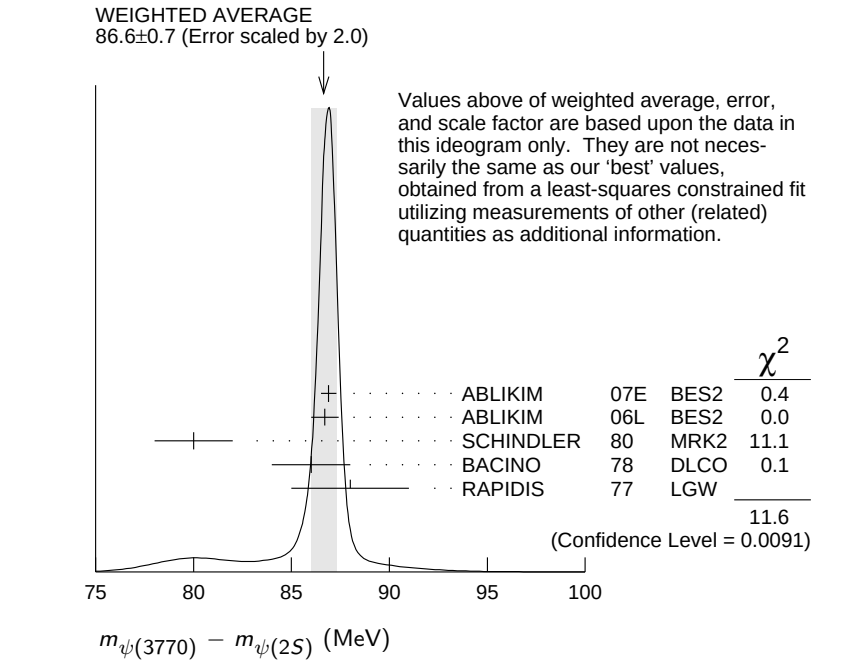
[86.83 ± 0.35 MeV OUR 2011 FIT Scale factor = 1.1]

86.6 ±0.7 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.

86.9	±0.4	4	ABLIKIM	07E	BES2	$e^+e^- \rightarrow \text{hadrons}$
86.7	±0.7		ABLIKIM	06L	BES2	$e^+e^- \rightarrow \text{hadrons}$
80	±2		SCHINDLER	80	MRK2	e^+e^-
86	±2	5	BACINO	78	DLCO	e^+e^-
88	±3		RAPIDIS	77	LGW	e^+e^-

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



$\psi(3770)$ WIDTH

NODE=M053W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.2± 1.0 OUR FIT				
[27.3 ± 1.0 MeV OUR 2011 FIT]				
27.5± 0.9 OUR AVERAGE				
[27.6 ± 1.0 MeV OUR 2011 AVERAGE]				
24.9 ⁺ ₋ 4.6 ⁺ ₋ 0.5 _{-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^-

NODE=M053W
NEW
NEW

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	DESIG=2
Γ_2 $D^0\bar{D}^0$	(52 ± 5) %	S=2.0	DESIG=5
Γ_3 D^+D^-	(41 ± 4) %	S=2.0	DESIG=6
Γ_4 $J/\psi\pi^+\pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		DESIG=4
Γ_5 $J/\psi\pi^0\pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		DESIG=46
Γ_6 $J/\psi\eta$	$(9 \pm 4) \times 10^{-4}$		DESIG=47
Γ_7 $J/\psi\pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	DESIG=48
Γ_8 e^+e^-	$(9.6 \pm 0.7) \times 10^{-6}$	S=1.3	DESIG=1

Decays to light hadrons

NODE=M053;CLUMP=H

Г ₉	$b_1(1235)\pi$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=20
Г ₁₀	$\phi\eta'$	< 7	$\times 10^{-4}$	CL=90%	DESIG=17
Г ₁₁	$\omega\eta'$	< 4	$\times 10^{-4}$	CL=90%	DESIG=16
Г ₁₂	$\rho^0\eta'$	< 6	$\times 10^{-4}$	CL=90%	DESIG=15
Г ₁₃	$\phi\eta$	(3.1 $\pm$ 0.7)	$\times 10^{-4}$		DESIG=8
Г ₁₄	$\omega\eta$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=14
Г ₁₅	$\rho^0\eta$	< 5	$\times 10^{-4}$	CL=90%	DESIG=13
Г ₁₆	$\phi\pi^0$	< 3	$\times 10^{-5}$	CL=90%	DESIG=12
Г ₁₇	$\omega\pi^0$	< 6	$\times 10^{-4}$	CL=90%	DESIG=11
Г ₁₈	$\pi^+\pi^-\pi^0$	< 5	$\times 10^{-6}$	CL=90%	DESIG=9
Г ₁₉	$\rho\pi$	< 5	$\times 10^{-6}$	CL=90%	DESIG=10
Г ₂₀	$K^*(892)^+K^- + \text{c.c.}$	< 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}	$\Lambda\bar{\Lambda}\pi^0$	< 1.2	$\times 10^{-3}$	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

Radiative decays

Γ_{91}	$\gamma\chi_{c2}$	< 9	$\times 10^{-4}$	CL=90%	DESIG=51
Γ_{92}	$\gamma\chi_{c1}$	(2.9 $\pm$ 0.6)	$\times 10^{-3}$		DESIG=50
Γ_{93}	$\gamma\chi_{c0}$	(7.3 $\pm$ 0.9)	$\times 10^{-3}$		DESIG=49
Γ_{94}	$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%	DESIG=213
Γ_{95}	$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=212
Γ_{96}	$\gamma\pi^0$	< 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$\pm$0.018 OUR FIT	Error includes scale factor of 1.4.	[0.265 $\pm$ 0.018 keV OUR 2011 FIT Scale factor = 1.3]		
0.256$\pm$0.016 OUR AVERAGE	Error includes scale factor of 1.2.	[0.259 $\pm$ 0.016 keV OUR 2011 AVERAGE Scale factor = 1.2]		

NODE=M053W1
 NODE=M053W1
 NEW
 NEW

0.154 $^{+0.079+0.021}_{-0.058-0.027}$	9,10	ANASHIN	12A	KEDR	$e^+e^- \rightarrow D\bar{D}$
0.22 $\pm$ 0.05	11,12	ABLIKIM	08D	BES2	$e^+e^- \rightarrow$ hadrons
0.277 $\pm$ 0.011 $\pm$ 0.013	12	ABLIKIM	07E	BES2	$e^+e^- \rightarrow$ hadrons
0.203 $\pm$ 0.003 $^{+0.041}_{-0.027}$	1.4M 12,13	BESSION	06	CLEO	$e^+e^- \rightarrow$ hadrons
0.276 $\pm$ 0.050	12	SCHINDLER	80	MRK2	e^+e^-
0.18 $\pm$ 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 $\pm$ 0.09	15	RAPIDIS	77	LGW	e^+e^-

OCCUR=2

⁹ Solution I of the two solutions.

¹⁰ Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.

¹¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.

¹² Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.

¹³ BESSION 06 (as corrected in BESSION 10) measure $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08^{+0.41}_{-0.30}$ nb at $\sqrt{s} = 3773 \pm 1$ MeV, and obtain Γ_{ee} from the Born-level cross section calculated using $\psi(3770)$ mass and width from our 2004 edition, PDG 04.

¹⁴ Solution II of the two solutions.

¹⁵ See also $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ below.

NODE=M053W1;LINKAGE=A1
 NODE=M053W1;LINKAGE=AN
 NODE=M053W1;LINKAGE=AB

NODE=M053W1;LINKAGE=NI

NODE=M053W1;LINKAGE=BE

NODE=M053W1;LINKAGE=A2
 NODE=M053W1;LINKAGE=R

 $\psi(3770)$ BRANCHING RATIOS

NODE=M053230

 $\Gamma(D\bar{D})/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_2 + \Gamma_3)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R1
 NODE=M053R1

0.93 $^{+0.08}_{-0.09}$ OUR FIT Error includes scale factor of 2.0.

0.93 $^{+0.08}_{-0.09}$ OUR AVERAGE Error includes scale factor of 2.1.

0.849 $\pm$ 0.056 $\pm$ 0.018	16	ABLIKIM	08B	BES2	$e^+e^- \rightarrow$ non- $D\bar{D}$
1.033 $\pm$ 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 $\pm$ 0.050 $\pm$ 0.036	18,19	ABLIKIM	07K	BES2	$e^+e^- \rightarrow$ non- $D\bar{D}$
0.836 $\pm$ 0.073 $\pm$ 0.042	19	ABLIKIM	06L	BES2	$e^+e^- \rightarrow D\bar{D}$
0.855 $\pm$ 0.017 $\pm$ 0.058	19,20	ABLIKIM	06N	BES2	$e^+e^- \rightarrow D\bar{D}$

 $\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M053R46
 NODE=M053R46

0.52 $\pm$ 0.05 OUR FIT Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.467 \pm 0.047 \pm 0.023$	ABLIKIM	06L	BES2	$e^+e^- \rightarrow D^0\bar{D}^0$
$0.499 \pm 0.013 \pm 0.038$	²⁰ ABLIKIM	06N	BES2	$e^+e^- \rightarrow D^0\bar{D}^0$

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M053R47
 NODE=M053R47

0.41 $\pm$ 0.04 OUR FIT Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.369 \pm 0.037 \pm 0.028$	ABLIKIM	06L	BES2	$e^+e^- \rightarrow D^+D^-$
$0.357 \pm 0.011 \pm 0.034$	²⁰ ABLIKIM	06N	BES2	$e^+e^- \rightarrow D^+D^-$

$\Gamma(D^0\bar{D}^0)/\Gamma(D^+D^-)$ Γ_2/Γ_3 NODE=M053R5
NODE=M053R5

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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	$B^+ \rightarrow \psi(3770)K^+$

 $\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ NODE=M053R4
NODE=M053R4

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	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ NODE=M053R7
NODE=M053R7

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
0.080±0.025±0.016	39 ± 14	ADAM	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_6/Γ NODE=M053R8
NODE=M053R8

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
87±33±22	22 ± 10	ADAM	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ NODE=M053R9
NODE=M053R9

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<28	90	<10	ADAM	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_8/Γ NODE=M053R2
NODE=M053R2

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
0.96±0.07 OUR FIT	Error includes scale factor of 1.3. [(0.97 ± 0.07) × 10 ⁻⁵ OUR 2011 FIT Scale factor = 1.2]		
1.3 ±0.2	RAPIDIS	77 LGW	e^+e^-

NEW

¹⁶ Neglecting interference.¹⁷ Obtained by comparing a measurement of the total cross section (corrected in BESSON 10) with that of $D\bar{D}$ reported by CLEO in DOBBS 07.¹⁸ Using $\sigma^{obs} = 7.07 \pm 0.58$ nb and neglecting interference.¹⁹ Not independent of ABLIKIM 08B.²⁰ From a measurement of $\sigma(e^+e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.²¹ See ADLER 88C for older measurements of this quantity.NODE=M053R1;LINKAGE=AI
NODE=M053R1;LINKAGE=BENODE=M053R1;LINKAGE=AL
NODE=M053R1;LINKAGE=SU
NODE=M053R;LINKAGE=AB

NODE=M053R5;LINKAGE=CH

NODE=M053250

DECAYS TO LIGHT HADRONS

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ Γ_9/Γ NODE=M053R82
NODE=M053R82

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{10}/Γ NODE=M053R83
NODE=M053R83

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\omega\eta')/\Gamma_{\text{total}}$ Γ_{11}/Γ NODE=M053R84
NODE=M053R84

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\rho^0\eta')/\Gamma_{\text{total}}$ Γ_{12}/Γ NODE=M053R85
NODE=M053R85

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	22 ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ NODE=M053R6
NODE=M053R6

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.1±0.6±0.3	22 ADAMS	06 CLEO	3.773 $e^+e^- \rightarrow \phi\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19	23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

$\Gamma(\omega\eta)/\Gamma_{\text{total}}$						Γ_{14}/Γ	NODE=M053R86 NODE=M053R86
VALUE (units 10^{-5})	CL%		DOCUMENT ID	TECN	COMMENT		
<1.4	90	22	ADAMS	06	CLEO	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(\rho^0\eta)/\Gamma_{\text{total}}$						Γ_{15}/Γ	NODE=M053R87 NODE=M053R87
VALUE (units 10^{-4})	CL%		DOCUMENT ID	TECN	COMMENT		
<5	90	22	ADAMS	06	CLEO	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$						Γ_{16}/Γ	NODE=M053R11 NODE=M053R11
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	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$						Γ_{17}/Γ	NODE=M053R88 NODE=M053R88
VALUE (units 10^{-4})	CL%		DOCUMENT ID	TECN	COMMENT		
<6	90	22	ADAMS	06	CLEO	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$						Γ_{18}/Γ	NODE=M053R89 NODE=M053R89
VALUE (units 10^{-6})	CL%		DOCUMENT ID	TECN	COMMENT		
<5	90	22,24	ADAMS	06	CLEO	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(\rho\pi)/\Gamma_{\text{total}}$						Γ_{19}/Γ	NODE=M053R90 NODE=M053R90
VALUE (units 10^{-6})	CL%		DOCUMENT ID	TECN	COMMENT		
<5	90	22,24	ADAMS	06	CLEO	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(K^*(892)^+K^- + \text{c.c.})/\Gamma_{\text{total}}$						Γ_{20}/Γ	NODE=M053R91 NODE=M053R91
VALUE (units 10^{-5})	CL%		DOCUMENT ID	TECN	COMMENT		
<1.4	90	22	ADAMS	06	CLEO	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(K^*(892)^0\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$						Γ_{21}/Γ	NODE=M053R92 NODE=M053R92
VALUE (units 10^{-3})	CL%		DOCUMENT ID	TECN	COMMENT		
<1.2	90	22	ADAMS	06	CLEO	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$						Γ_{22}/Γ	NODE=M053R3 NODE=M053R3
VALUE (units 10^{-5})	CL%		DOCUMENT ID	TECN	COMMENT		
< 1.2	90	25	CRONIN-HEN..06	CLEO	$e^+e^- \rightarrow \psi(3770)$		
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<21	90	26	ABLIKIM	04F	BES	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$						Γ_{23}/Γ	NODE=M053R21 NODE=M053R21
VALUE (units 10^{-4})	CL%		DOCUMENT ID	TECN	COMMENT		
<11.2	90	27	HUANG	06A	CLEO	$e^+e^- \rightarrow \psi(3770)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<48		23	ABLIKIM	07B	BES2	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$						Γ_{24}/Γ	NODE=M053R22 NODE=M053R22
VALUE (units 10^{-4})	CL%		DOCUMENT ID	TECN	COMMENT		
<10.6	90	27	HUANG	06A	CLEO	$e^+e^- \rightarrow \psi(3770)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<62		23	ABLIKIM	07B	BES2	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$						Γ_{25}/Γ	NODE=M053R72 NODE=M053R72
VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT		
<58.5	90	305	ABLIKIM	08N	BES2	$e^+e^- \rightarrow \psi(3770)$	
$\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$						Γ_{26}/Γ	NODE=M053R24 NODE=M053R24
VALUE (units 10^{-4})	CL%		DOCUMENT ID	TECN	COMMENT		
< 6.0	90	27	HUANG	06A	CLEO	$e^+e^- \rightarrow \psi(3770)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •							
<55	90	23	ABLIKIM	07I	BES2	$3.77 e^+e^-$	

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

<91

DOCUMENT ID

TECN

COMMENT

23 ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{27}/Γ NODE=M053R07
NODE=M053R07 $\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

<137

DOCUMENT ID

TECN

COMMENT

23 ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{28}/Γ NODE=M053R10
NODE=M053R10 $\Gamma(3(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) CL% EVTS

<117.4

90

59

DOCUMENT ID

TECN

COMMENT

ABLIKIM 08N BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{29}/Γ NODE=M053R74
NODE=M053R74 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

<1.24

CL%

90

DOCUMENT ID

TECN

COMMENT

27 HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$ Γ_{30}/Γ NODE=M053R23
NODE=M053R23

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.3

90

23 ABLIKIM

10D

BES2

 $e^+e^- \rightarrow \psi(3770)$ $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) CL% EVTS

<8.9

90

218

DOCUMENT ID

TECN

COMMENT

ABLIKIM 08N BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{31}/Γ NODE=M053R70
NODE=M053R70 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

<6.9

CL%

90

DOCUMENT ID

TECN

COMMENT

23 ABLIKIM 07F BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{32}/Γ NODE=M053R53
NODE=M053R53 $\Gamma(\eta3\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

<13.4

CL%

90

DOCUMENT ID

TECN

COMMENT

27 HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$ Γ_{33}/Γ NODE=M053R25
NODE=M053R25 $\Gamma(\eta2(\pi^+\pi^-))/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

<243

DOCUMENT ID

TECN

COMMENT

23 ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{34}/Γ NODE=M053R08
NODE=M053R08 $\Gamma(\eta\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-2})

<1.45

CL%

90

DOCUMENT ID

TECN

COMMENT

23 ABLIKIM 10D BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{35}/Γ NODE=M053R77
NODE=M053R77 $\Gamma(\eta'3\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

<24.4

CL%

90

DOCUMENT ID

TECN

COMMENT

27 HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$ Γ_{36}/Γ NODE=M053R26
NODE=M053R26 $\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

< 9.0

CL%

90

DOCUMENT ID

TECN

COMMENT

27 HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$ Γ_{37}/Γ NODE=M053R27
NODE=M053R27

• • • We do not use the following data for averages, fits, limits, etc. • • •

<48

23 ABLIKIM

07B

BES2

 $e^+e^- \rightarrow \psi(3770)$ $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

< 4.1

CL%

90

DOCUMENT ID

TECN

COMMENT

27 HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$ Γ_{38}/Γ NODE=M053R28
NODE=M053R28

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16

23 ABLIKIM

07B

BES2

 $e^+e^- \rightarrow \psi(3770)$ $\Gamma(K^+K^-2\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) CL% EVTS

<4.2

90

14

DOCUMENT ID

TECN

COMMENT

ABLIKIM 08N BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{39}/Γ NODE=M053R71
NODE=M053R71 $\Gamma(4(\pi^+\pi^-))/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

<16.7

CL%

90

DOCUMENT ID

TECN

COMMENT

23 ABLIKIM 07F BES2 $e^+e^- \rightarrow \psi(3770)$ Γ_{40}/Γ NODE=M053R50
NODE=M053R50

$\Gamma(4(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$					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	$e^+e^- \rightarrow \psi(3770)$		

$$\Gamma(\rho^0 K^+ K^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{55}/Γ

 NODE=M053R54
 NODE=M053R54

$$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$$

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	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{56}/Γ

 NODE=M053R33
 NODE=M053R33

$$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$$

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	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{57}/Γ

 NODE=M053R34
 NODE=M053R34

$$\Gamma(2(K^+ K^-)\pi^0)/\Gamma_{\text{total}}$$

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	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{58}/Γ

 NODE=M053R35
 NODE=M053R35

$$\Gamma(2(K^+ K^-)\pi^+\pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	23 ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{59}/Γ

 NODE=M053R48
 NODE=M053R48

$$\Gamma(K_S^0 K^- \pi^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<3.2	90	18	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{60}/Γ

 NODE=M053R64
 NODE=M053R64

$$\Gamma(K_S^0 K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<13.3	90	40	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{61}/Γ

 NODE=M053R65
 NODE=M053R65

$$\Gamma(K_S^0 K^- \rho^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.6	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{62}/Γ

 NODE=M053R15
 NODE=M053R15

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<8.7	90	39	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{63}/Γ

 NODE=M053R66
 NODE=M053R66

$$\Gamma(K_S^0 K^- \pi^+ \rho^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{64}/Γ

 NODE=M053R16
 NODE=M053R16

$$\Gamma(K_S^0 K^- \pi^+ \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{65}/Γ

 NODE=M053R17
 NODE=M053R17

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<41.8	90	23	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{66}/Γ

 NODE=M053R67
 NODE=M053R67

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<4.8	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{67}/Γ

 NODE=M053R18
 NODE=M053R18

$$\Gamma(K_S^0 K^- \pi^+ 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<12.2	90	4	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

 Γ_{68}/Γ

 NODE=M053R68
 NODE=M053R68

$\Gamma(K_S^0 K^- \pi^+ 2\pi^0)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<26.5	90	17	ABLIKIM	08M	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R69
NODE=M053R69

 $\Gamma(K_S^0 K^- K^+ K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{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

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<12	23 ABLIKIM	07B	BES2 $e^+ e^- \rightarrow \psi(3770)$

NODE=M053R09
NODE=M053R09

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ 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

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ 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

 $\Gamma(\omega p\bar{p})/\Gamma_{\text{total}}$ 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
<12	90	23 ABLIKIM	07I	BES2 $3.77 e^+ e^-$

NODE=M053R63
NODE=M053R63

 $\Gamma(p\bar{p}2(\pi^+\pi^-))/\Gamma_{\text{total}}$ 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

 $\Gamma(\eta p\bar{p})/\Gamma_{\text{total}}$ 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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	23 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R56
 NODE=M053R56

 $\Gamma(\rho\bar{\rho}K^+K^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ

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	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R40
 NODE=M053R40

 $\Gamma(\eta\rho\bar{\rho}K^+K^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	23 ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R80
 NODE=M053R80

 $\Gamma(\pi^0\rho\bar{\rho}K^+K^-)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	23 ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R81
 NODE=M053R81

 $\Gamma(\phi\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<9		23 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R41
 NODE=M053R41

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<39	90	23 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R43
 NODE=M053R43

 $\Gamma(\Lambda\bar{\rho}K^+)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R44
 NODE=M053R44

 $\Gamma(\Lambda\bar{\rho}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	27 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R45
 NODE=M053R45

22 Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053R6;LINKAGE=AD

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.

NODE=M053R10;LINKAGE=AK

24 Data suggest possible destructive interference with continuum.

NODE=M053R89;LINKAGE=AD

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 $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895 \pm 0.0014$.

NODE=M053R3;LINKAGE=CR

26 Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$.

NODE=M053R3;LINKAGE=AB

27 Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R;LINKAGE=HU

28 Using $\sigma^{obs} = 7.15 \pm 0.27 \pm 0.27$ nb and neglecting interference.

NODE=M053R24;LINKAGE=AB

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	29 COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

NODE=M053R03
 NODE=M053R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.0	90	30 BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$

$\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{92}/Γ **$2.9 \pm 0.5 \pm 0.4$**

31

BRIERE

06

CLEO

 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}, \gamma\gamma J/\psi$ NODE=M053R02
NODE=M053R02

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $3.9 \pm 1.4 \pm 0.6$ 54 $\pm$ 17

32

BRIERE

06

CLEO

 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$ $2.8 \pm 0.5 \pm 0.4$ 53 $\pm$ 10

29

COAN

06A

CLEO

 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$ $\Gamma(\gamma\chi_{c1})/\Gamma(J/\psi\pi^+\pi^-)$

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{92}/Γ_4 **$1.49 \pm 0.31 \pm 0.26$** 53 $\pm$ 10

33

COAN

06A

CLEO

 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$ NODE=M053R04
NODE=M053R04 $\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{93}/Γ **$7.3 \pm 0.7 \pm 0.6$** 274 $\pm$ 27

34

BRIERE

06

CLEO

 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$ NODE=M053R01
NODE=M053R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 44 90

29

COAN

06A

CLEO

 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$ $\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c2})$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{93}/Γ_{91}

• • • We do not use the following data for averages, fits, limits, etc. • • •

>8 90

35

BRIERE

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R06
NODE=M053R06 $\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c1})$

VALUE

DOCUMENT ID

TECN

COMMENT

 Γ_{93}/Γ_{92}

• • • We do not use the following data for averages, fits, limits, etc. • • •

 2.5 ± 0.6

35

BRIERE

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ NODE=M053R05
NODE=M053R05 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{94}/Γ **<1.8**

90

36

PEDLAR

09

CLE3

 $\psi(2S) \rightarrow \gamma X$ NODE=M053R14
NODE=M053R14 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{95}/Γ **<1.5**

90

36

PEDLAR

09

CLE3

 $\psi(2S) \rightarrow \gamma X$ NODE=M053R13
NODE=M053R13 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{96}/Γ **<2**

90

PEDLAR

09

CLE3

 $\psi(2S) \rightarrow \gamma X$ NODE=M053R12
NODE=M053R12

29 Using $\Gamma_{ee}(\psi(2S)) = (2.54 \pm 0.03 \pm 0.11)$ keV from ADAM 06 and taking $\sigma(e^+e^- \rightarrow D\bar{D})$ from HE 05 for $\sigma(e^+e^- \rightarrow \psi(3770))$.

30 Uses $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = 9.22 \pm 0.11 \pm 0.46\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.

31 Averages the two measurements from COAN 06A and BRIERE 06.

32 Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = 9.07 \pm 0.11 \pm 0.54\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.

33 Using $B(\psi(3770) \rightarrow J/\psi\pi^+\pi^-) = (1.89 \pm 0.20 \pm 0.20) \times 10^{-3}$ from ADAM 06.

34 Uses $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = 9.33 \pm 0.14 \pm 0.61\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.

35 Not independent of other results in BRIERE 06.

36 Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.

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

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 011102R	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 011103R	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 111105R	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 031106R	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(3872)

$$J^G(J^{PC}) = 0^{?}(?^{?}+)$$

Seen 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, but not seen in the $\gamma \chi_{c1}$ final state of these decays. Possibly absent in the invariant mass spectrum of the final state $\pi^+ \pi^- J/\psi(1S)$ in $e^+ e^-$ collisions. Interpretation as a 1^{--} charmonium state not favored. Isovector hypothesis excluded by AUBERT 05B and CHOI 11. A helicity amplitude analysis of the $X(3872) \rightarrow J/\psi \pi^+ \pi^-$ decay gives two possible J^{PC} assignments: $J^{PC} = 1^{++}$ and 2^{-+} (ABULENCIA 07E and CHOI 11). A study of the 3π invariant mass distribution in $J/\psi \omega$ decays slightly favors $J^P = 2^{-}$ (DEL-AMO-SANCHEZ 10B).

See our note on "Developments in Heavy Quarkonium Spectroscopy".

X(3872) MASS FROM J/ψ X MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3871.68 ± 0.17 OUR AVERAGE				
[3871.57 ± 0.25 MeV OUR 2011 AVERAGE Scale factor = 1.1]				
3871.95 ± 0.48 ± 0.12	0.5k	AAIJ	12H	LHCB $pp \rightarrow pp J/\psi \pi^+ \pi^-$
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 $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M176

NODE=M176

NODE=M176M

NODE=M176M

NEW

OCCUR=2

• • • 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	$300 \pi^\pm L_i \rightarrow J/\psi \pi^+ \pi^- X$

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.

OCCUR=2

NODE=M176M;LINKAGE=CO

NODE=M176M;LINKAGE=AC

NODE=M176M;LINKAGE=AA

NODE=M176M;LINKAGE=AB

NODE=M176M;LINKAGE=AE

NODE=M176M;LINKAGE=AU

NODE=M176M;LINKAGE=AT

NODE=M176M;LINKAGE=CH

NODE=M176M;LINKAGE=AN

$X(3872)$ MASS FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

3872.9 ^{+0.6+0.4} _{-0.4-0.5}	50	^{10,11} AUSHEV	10	BELL	$B \rightarrow \bar{D}^{*0} D^0 K$
3875.1 ^{+0.7} _{-0.5} ± 0.5	33 ± 6	¹¹ AUBERT	08B	BABR	$B \rightarrow \bar{D}^{*0} D^0 K$
3875.2 ± 0.7 ^{+0.9} _{-1.8}	24 ± 6	^{11,12} GOKHROO	06	BELL	$B \rightarrow D^0 \bar{D}^0 \pi^0 K$

¹⁰ Calculated from the measured $m_{X(3872)} - m_{D^{*0}} - m_{D^0} = 1.1^{+0.6+0.1}_{-0.4-0.3}$ MeV.

¹¹ Experiments report $D^{*0} \bar{D}^0$ invariant mass above $D^{*0} \bar{D}^0$ threshold because D^{*0} decay products are kinematically constrained to the D^{*0} mass, even though the D^{*0} may decay off-shell.

¹² Superseded by AUSHEV 10.

NODE=M176MD0

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 ± 3.1 ± 3.0	522	ABAZOV	04F	D0 $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M176207

NODE=M176DM

$m_{X(3872)} - m_{\psi(2S)}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

187.4 ± 1.4	25	¹³ AUBERT	05R	BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

¹³ Superseded by AUBERT 06.

NODE=M176DM2;LINKAGE=AU

$X(3872)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.2 (CL = 90%)					[<2.3 MeV (CL = 90%) OUR 2011 BEST LIMIT]

<1.2	90	CHOI	11	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.3	90	AUBERT	08Y	BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
<4.1	90	69 AUBERT	06	BABR	$B \rightarrow K \pi^+ \pi^- J/\psi$
<2.3	90	36 ¹⁴ CHOI	03	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$

¹⁴ Superseded by CHOI 11.

NODE=M176W

NODE=M176W

NODE=M176W;LINKAGE=CH

X(3872) WIDTH FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.9^{+2.8+0.2}_{-1.4-1.1}$	50	¹⁵ AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$
$3.0^{+1.9}_{-1.4} \pm 0.9$	33 ± 6	AUBERT	08B	BABR $B \rightarrow \bar{D}^{*0} D^0 K$

¹⁵ With a measured value of $B(B \rightarrow X(3872)K) \times B(X(3872) \rightarrow D^{*0} \bar{D}^0) = (0.80 \pm 0.20 \pm 0.10) \times 10^{-4}$, assumed to be equal for both charged and neutral modes.

NODE=M176WD0
NODE=M176WD0

NODE=M176WD0;LINKAGE=AU

X(3872) DECAY MODES

NODE=M176215;NODE=M176

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $\pi^+ \pi^- J/\psi(1S)$	>2.6 %
Γ_3 $\rho^0 J/\psi(1S)$	
Γ_4 $\omega J/\psi(1S)$	>1.9 %
Γ_5 $D^0 \bar{D}^0 \pi^0$	> 3.2×10^{-3}
Γ_6 $\bar{D}^{*0} D^0$	> 5×10^{-3}
Γ_7 $\gamma \gamma$	
Γ_8 $D^0 \bar{D}^0$	
Γ_9 $D^+ D^-$	
Γ_{10} $\gamma \chi_{c1}$	
Γ_{11} $\eta J/\psi$	
Γ_{12} $\gamma J/\psi$	> 9×10^{-3}
Γ_{13} $\gamma \psi(2S)$	>3.0 %

DESIG=1
DESIG=2
DESIG=10
DESIG=13
DESIG=8
DESIG=12
DESIG=5
DESIG=6
DESIG=7
DESIG=3
DESIG=4
DESIG=9
DESIG=11

X(3872) PARTIAL WIDTHS

NODE=M176220

$\Gamma(e^+ e^-)$ **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=M176W1
NODE=M176W1

NODE=M176W1;LINKAGE=A

X(3872) $\Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

NODE=M176230

$\Gamma(\pi^+ \pi^- J/\psi(1S)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ **$\Gamma_2 \Gamma_1/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

< 6.2	90	^{17,18} AUBERT	05D	BABR $10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 8.3	90	¹⁸ DOBBS	05	CLE3 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
<10	90	¹⁹ YUAN	04	RVUE $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

¹⁷ Using $B(X(3872) \rightarrow J/\psi \pi^+ \pi^-) \cdot B(J/\psi \rightarrow \mu^+ \mu^-) \cdot \Gamma(X(3872) \rightarrow e^+ e^-) < 0.37$ eV from AUBERT 05D and $B(J/\psi \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$ from the PDG 04.

¹⁸ Assuming X(3872) has $J^{PC} = 1^{--}$.

¹⁹ Using BAI 98E data on $e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.88 \pm 0.10)\%$.

NODE=M176G1
NODE=M176G1

NODE=M176G1;LINKAGE=AU

NODE=M176G1;LINKAGE=DO
NODE=M176G1;LINKAGE=A

X(3872) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M176232

$\Gamma(\gamma\gamma) \times \Gamma(\pi^+ \pi^- J/\psi(1S))/\Gamma_{\text{total}}$ **$\Gamma_7 \Gamma_2/\Gamma$**

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=M176H1
NODE=M176H1

NODE=M176H1;LINKAGE=DO

X(3872) BRANCHING RATIOS

$\Gamma(\pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
>0.026	93 ± 17	21 AUBERT	08Y BABR	$B \rightarrow X(3872)K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.04	30	22 AUBERT	05R BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
>0.04	36 ± 7	23 CHOI	03 BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
21 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				
22 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.				
23 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$, $B(B^+ \rightarrow \psi(2S)K^+) = (6.39 \pm 0.33) \times 10^{-4}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+ \pi^-) = (33.6 \pm 0.4) \times 10^{-2}$.				

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	24 DEL-AMO-SA..10B	BABR	$B^+ \rightarrow \omega J/\psi K^+$
24 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	DOCUMENT ID	TECN	COMMENT
0.8 ± 0.3	25 DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
25 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
>3.2 × 10⁻³	17 ± 5	26 GOKHROO	06 BELL	$B^+ \rightarrow D^0 \bar{D}^0 \pi^0 K^+$
26 GOKHROO 06 reports $[\Gamma(X(3872) \rightarrow D^0 \bar{D}^0 \pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.02 \pm 0.31^{+0.21}_{-0.29}) \times 10^{-6}$ 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
>5 × 10⁻³	27 ± 6	27 AUBERT	08B BABR	$B^+ \rightarrow \bar{D}^{*0} D^0 K^+$
27 AUBERT 08B reports $[\Gamma(X(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (1.67 \pm 0.36 \pm 0.47) \times 10^{-6}$ 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=AU

$\Gamma(D^0 \bar{D}^0 \pi^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
seen	28 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	$B \rightarrow D^0 \bar{D}^0 \pi^0 K$
28 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	DOCUMENT ID	TECN	COMMENT
not seen	CHISTOV	04 BELL	$B \rightarrow K D^0 \bar{D}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			

NODE=M176R3
NODE=M176R3

$\Gamma(D^+ D^-)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_9/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

CHISTOV 04 BELL $B \rightarrow K D^+ D^-$ NODE=M176R4
NODE=M176R4 $\Gamma(\gamma \chi_{c1})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{10}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.89 90 CHOI 03 BELL $B \rightarrow K \pi^+ \pi^- J/\psi$ NODE=M176R1
NODE=M176R1 $\Gamma(\eta J/\psi)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{11}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • 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_{12}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

>9 $\times 10^{-3}$ 23 $\pm$ 6 29 AUBERT 09B BABR $B^+ \rightarrow \gamma J/\psi K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.010 19 30 AUBERT,BE 06M BABR $B^+ \rightarrow \gamma J/\psi K^+$

29 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 $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R7;LINKAGE=AB

30 Superseded by AUBERT 09B. AUBERT,BE 06M reports $[\Gamma(X(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow X(3872)K^+)] = (3.3 \pm 1.0 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow X(3872)K^+) < 3.2 \times 10^{-4}$.

NODE=M176R7;LINKAGE=AU

 $\Gamma(\gamma \psi(2S))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

>0.030 25 $\pm$ 7 31 AUBERT 09B BABR $B^+ \rightarrow \gamma \psi(2S) K^+$

31 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=AU

 $\Gamma(\gamma \psi(2S))/\Gamma(\gamma J/\psi)$ Γ_{13}/Γ_{12}

VALUE	DOCUMENT ID	TECN	COMMENT

3.4 $\pm$ 1.4 AUBERT 09B BABR $B^+ \rightarrow \gamma c \bar{c} K'$ NODE=M176R11
NODE=M176R11

X(3872) REFERENCES

NODE=M176

AAIJ	12H	arXiv:1112.5310	R. Aaij <i>et al.</i>	(LHCb Collab.)
CHOI	11	PR D84 052004	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
AUSHEV	10	PR D81 031103R	T. Aushev <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	10B	PR D82 011101R	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AALTONEN	09AU	PRL 103 152001	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AUBERT	09B	PRL 102 132001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08B	PR D77 011102R	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08Y	PR D77 111101R	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABULENCIA	07E	PRL 98 132002	A. Abulencia <i>et al.</i>	(CDF Collab.)
AUBERT	06	PR D73 011101R	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06M	PR D74 071101R	B. Aubert <i>et al.</i>	(BABAR Collab.)
GOKHROO	06	PRL 97 162002	G. Gokhroo <i>et al.</i>	(BELLE Collab.)
AUBERT	05B	PR D71 031501R	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	05R	PR D71 071103R	B. Aubert <i>et al.</i>	(BABAR Collab.)
DOBBS	05	PRL 94 032004	S. Dobbs <i>et al.</i>	(CLEO Collab.)
ABAZOV	04F	PRL 93 162002	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ACOSTA	04	PRL 93 072001	D. Acosta <i>et al.</i>	(CDF Collab.)
AUBERT	04Y	PRL 93 041801	B. Aubert <i>et al.</i>	(BaBar Collab.)
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
YUAN	04	PL B579 74	C.Z. Yuan <i>et al.</i>	
CHOI	03	PRL 91 262001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)
ANTONIAZZI	94	PR D50 4258	L. Antoniazzi <i>et al.</i>	(E705 Collab.)

REFID=54056
REFID=53934
REFID=53225
REFID=53362
REFID=53098
REFID=52722
REFID=52120
REFID=52265
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REFID=50200
REFID=49742
REFID=49997
REFID=50002
REFID=49653
REFID=49677
REFID=49628
REFID=46339
REFID=44074

X(3915)

$I^G(J^{PC}) = 0^+(?^{?+})$

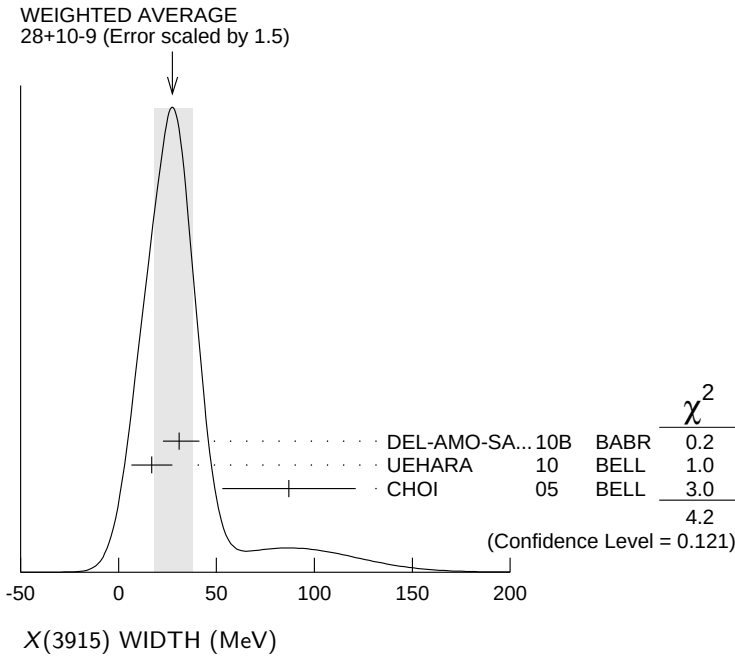
OMITTED FROM SUMMARY TABLE
Observed in $\omega J/\psi$, thus $C = +$. May be the same state as $\chi_{c2}(2P)$.

X(3915) MASS

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT
3917.4± 2.7 OUR AVERAGE				
3919.1 ^{+3.8} _{-3.5} ± 2.0		DEL-AMO-SA00B	BABR	$B \rightarrow \omega J/\psi K$
3915 ± 3 ± 2	49 ± 15	¹ UEHARA	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- \omega J/\psi$
3943 ± 11 ± 13	58 ± 11	² 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		² AUBERT	08W	BABR Superseded by DEL-AMO-SANCHEZ 10B
¹ May be $\chi_{c2}(2P)$.				
² $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.				

X(3915) WIDTH

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT
28 ⁺¹⁰ ₋₉ OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.				
31 ⁺¹⁰ ₋₈ ± 2.0		DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$
17±10± 3	49 ± 15	³ UEHARA	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- \omega J/\psi$
87±22±26	58 ± 11	⁴ 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		⁴ AUBERT	08W	BABR Superseded by DEL-AMO-SANCHEZ 10B
³ May be $\chi_{c2}(2P)$.				
⁴ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.				



X(3915) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega J/\psi$	seen
Γ_2 $\bar{D}^{*0} D^0$	
Γ_3 $\gamma\gamma$	seen

NODE=M159

NODE=M159

NODE=M159M

NODE=M159M

NODE=M159M;LINKAGE=UE
NODE=M159M;LINKAGE=CH

NODE=M159W

NODE=M159W

NODE=M159W;LINKAGE=UE
NODE=M159W;LINKAGE=CH

NODE=M159215;NODE=M159

DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=3
DESIG=2

X(3915) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M159220

$\Gamma(\omega J/\psi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		$\Gamma_1\Gamma_3/\Gamma$	
VALUE (eV)	EVT5	DOCUMENT ID	TECN COMMENT
18± 5±2	49 ± 15	^{5,6} 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. • • •			
61±17±8	49 ± 15	^{5,7} UEHARA	10 BELL 10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
⁵ May be $\chi_{c2}(2P)$.			
⁶ For $J^P = 2^+$, helicity-2.			
⁷ For $J^P = 0^+$.			

NODE=M159G01
NODE=M159G01

OCCUR=2

NODE=M159G01;LINKAGE=UE
NODE=M159G01;LINKAGE=UR
NODE=M159G01;LINKAGE=UH**X(3915) BRANCHING RATIOS**

NODE=M159225

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$		Γ_3/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT
seen	⁸ UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
⁸ May be $\chi_{c2}(2P)$.			

NODE=M159R01
NODE=M159R01

NODE=M159R01;LINKAGE=UE

$\Gamma(\omega J/\psi)/\Gamma(\bar{D}^{*0}D^0)$		Γ_1/Γ_2	
VALUE	CL%	DOCUMENT ID	TECN COMMENT
>0.71	90	⁹ AUSHEV	10 BELL $B \rightarrow \bar{D}^{*0}D^0 K$
⁹ By combining the upper limit $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow D^{*0}\bar{D}^0) < 0.67 \times 10^{-4}$ from AUSHEV 10 with the average of CHOI 05 and AUBERT 08W measurements $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$.			

NODE=M159R02
NODE=M159R02

NODE=M159R02;LINKAGE=AU

$\Gamma(\omega J/\psi)/\Gamma_{\text{total}}$		Γ_1/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹⁰ DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$
seen	¹¹ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
¹⁰ DEL-AMO-SANCHEZ 10B reports $B(B^\pm \rightarrow X(3915)K^\pm) \times B(X(3915) \rightarrow J/\psi\omega) = (3.0^{+0.7+0.5}_{-0.6-0.3}) \times 10^{-5}$ and $B(B^0 \rightarrow X(3915)K^0) \times B(X(3915) \rightarrow J/\psi\omega) = (2.1 \pm 0.9 \pm 0.3) \times 10^{-5}$.			
¹¹ CHOI 05 reports $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow J/\psi\omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$.			

NODE=M159R03
NODE=M159R03

NODE=M159R03;LINKAGE=DE

NODE=M159R03;LINKAGE=CH

X(3915) REFERENCES

NODE=M159

AUSHEV	10	PR D81 031103R	T. Aushev <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	10B	PR D82 011101R	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
UEHARA	10	PRL 104 092001	S. Uehara <i>et al.</i>	(BELLE Collab.)
AUBERT	08W	PRL 101 082001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHOI	05	PRL 94 182002	S.-K. Choi <i>et al.</i>	(BELLE Collab.)

REFID=53225
REFID=53362
REFID=53232
REFID=52263
REFID=50737

$\chi_{c2}(2P)$

$$J^{PC} = 0^{+}(2^{+}+)$$

NODE=M050

$\chi_{c2}(2P)$ MASS

NODE=M050M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3927.2±2.6 OUR AVERAGE				
3926.7±2.7±1.1	76 ± 17	AUBERT	10G BABR	10.6 $e^{+}e^{-} \rightarrow e^{+}e^{-}D\bar{D}$
3929 ±5 ±2	64	UEHARA	06 BELL	10.6 $e^{+}e^{-} \rightarrow e^{+}e^{-}D\bar{D}$

NODE=M050M

$\chi_{c2}(2P)$ WIDTH

NODE=M050W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
24 ± 6 OUR AVERAGE				
21.3± 6.8±3.6	76 ± 17	AUBERT	10G BABR	10.6 $e^{+}e^{-} \rightarrow e^{+}e^{-}D\bar{D}$
29 ±10 ±2	64	UEHARA	06 BELL	10.6 $e^{+}e^{-} \rightarrow e^{+}e^{-}D\bar{D}$

NODE=M050W

$\chi_{c2}(2P)$ DECAY MODES

NODE=M050215;NODE=M050

Mode	
Γ_1	$\gamma\gamma$
Γ_2	$K\bar{K}\pi$
Γ_3	$K^{+}K^{-}\pi^{+}\pi^{-}\pi^0$
Γ_4	$D\bar{D}$
Γ_5	$D^{+}D^{-}$
Γ_6	$D^0\bar{D}^0$

DESIG=1

DESIG=5

DESIG=6

DESIG=2

DESIG=3

DESIG=4

$\chi_{c2}(2P)$ 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=M050G1

NODE=M050G1;LINKAGE=UE

$\chi_{c2}(2P)$ 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

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=16751

REFID=53357

REFID=51039

X(3940)

$$I^G(J^{PC}) = ?^?(?^{??})$$

OMITTED FROM SUMMARY TABLE

Reported by ABE 07, observed in $e^+e^- \rightarrow J/\psi X$.**X(3940) MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$3942^{+7}_{-6} \pm 6$	52	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3943 \pm 6 \pm 6$	25	¹ ABE	07	BELL $e^+e^- \rightarrow J/\psi X$
3936 ± 14	266	² ABE	07	BELL $e^+e^- \rightarrow J/\psi(c\bar{c})$
¹ From a fit to $D^{*+}D^-$ and $D^{*0}\bar{D}^0$ events.				
² From the inclusive fit. Not independent of the exclusive measurement by ABE 07.				

X(3940) WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$37^{+26}_{-15} \pm 8$		52	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<52	90	25	ABE	07	BELL $e^+e^- \rightarrow J/\psi X$

X(3940) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\bar{D}^* + \text{c.c.}$	seen
Γ_2 $D\bar{D}$	not seen
Γ_3 $J/\psi\omega$	not seen

X(3940) BRANCHING RATIOS **$\Gamma(D\bar{D}^* + \text{c.c.})/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>0.45	90	25	^{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/c ² may consist of several states.					

 $\Gamma(D\bar{D})/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.41	90	^{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/c ² may consist of several states.				

 $\Gamma(J/\psi\omega)/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.26	90	^{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/c ² may consist of several states.				

X(3940) REFERENCES

PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M029

NODE=M029

NODE=M029M

NODE=M029M

OCCUR=2

NODE=M029M;LINKAGE=EB

NODE=M029M;LINKAGE=EM

NODE=M029W

NODE=M029W

NODE=M029215;NODE=M029

DESIG=1;OUR EVAL;→ NOT CHECKED ←

DESIG=2;OUR EVAL;→ NOT CHECKED ←

DESIG=3;OUR EVAL;→ NOT CHECKED ←

NODE=M029225

NODE=M029R01

NODE=M029R01

NODE=M029R01;LINKAGE=AB

NODE=M029R01;LINKAGE=AE

NODE=M029R02

NODE=M029R02

NODE=M029R02;LINKAGE=AB

NODE=M029R02;LINKAGE=AE

NODE=M029R03

NODE=M029R03

NODE=M029R03;LINKAGE=AB

NODE=M029R03;LINKAGE=AE

NODE=M029

REFID=52302

REFID=51627

$\psi(4040)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

NODE=M072

 $\psi(4040)$ MASS

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^-
¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.			
² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
³ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁴ From a fit to BES (BAI 02C) data.			

NODE=M072M

NODE=M072M

→ NOT CHECKED ←

OCCUR=2

NODE=M072M;LINKAGE=AB

NODE=M072M;LINKAGE=MO

NODE=M072M;LINKAGE=ST

NODE=M072M;LINKAGE=SE

 $\psi(4040)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
80 $\pm$ 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^-
⁵ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.			
⁶ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
⁷ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁸ From a fit to BES (BAI 02C) data.			

NODE=M072W

NODE=M072W

→ NOT CHECKED ←

OCCUR=2

NODE=M072W;LINKAGE=AB

NODE=M072W;LINKAGE=MO

NODE=M072W;LINKAGE=ST

NODE=M072W;LINKAGE=SE

 $\psi(4040)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M072215;NODE=M072

NODE=M072

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$(1.07 \pm 0.16) \times 10^{-5}$	DESIG=5
Γ_2 $D\bar{D}$	seen	DESIG=17;OUR EST;→ NOT CHECKED ←
Γ_3 $D^0\bar{D}^0$	seen	DESIG=1
Γ_4 D^+D^-	seen	DESIG=18
Γ_5 $D^*\bar{D} + \text{c.c.}$	seen	DESIG=19;OUR EST;→ NOT CHECKED ←
Γ_6 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	DESIG=2
Γ_7 $D^*(2010)^+D^- + \text{c.c.}$	seen	DESIG=20
Γ_8 $D^*\bar{D}^*$	seen	DESIG=21;OUR EST;→ NOT CHECKED ←
Γ_9 $D^*(2007)^0\bar{D}^*(2007)^0$	seen	DESIG=3
Γ_{10} $D^*(2010)^+D^*(2010)^-$	seen	DESIG=22
Γ_{11} $D\bar{D}\pi$ (excl. $D^*\bar{D}$)		DESIG=23
Γ_{12} $D^0D^-\pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0\bar{D}^0 + \text{c.c.}$, $D^*(2010)^+D^- + \text{c.c.}$)	not seen	DESIG=24
Γ_{13} $D\bar{D}^*\pi$ (excl. $D^*\bar{D}^*$)	not seen	DESIG=25

Γ_{14}	$D^0 \bar{D}^{*-} \pi^+ + \text{c.c. (excl. } D^{*+}(2010) D^{*-}(2010) \text{)}$	seen				DESIG=26
Γ_{15}	$D_s^+ D_s^-$	seen				DESIG=27
Γ_{16}	$J/\psi(1S) \text{ hadrons}$					DESIG=4
Γ_{17}	$J/\psi \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%		DESIG=7
Γ_{18}	$J/\psi \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%		DESIG=8
Γ_{19}	$J/\psi \eta$	< 7	$\times 10^{-3}$	90%		DESIG=9
Γ_{20}	$J/\psi \pi^0$	< 2	$\times 10^{-3}$	90%		DESIG=10
Γ_{21}	$J/\psi \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%		DESIG=11
Γ_{22}	$\chi_{c1} \gamma$	< 1.1	%	90%		DESIG=12
Γ_{23}	$\chi_{c2} \gamma$	< 1.7	%	90%		DESIG=13
Γ_{24}	$\chi_{c1} \pi^+ \pi^- \pi^0$	< 1.1	%	90%		DESIG=14
Γ_{25}	$\chi_{c2} \pi^+ \pi^- \pi^0$	< 3.2	%	90%		DESIG=15
Γ_{26}	$h_c(1P) \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%		DESIG=28
Γ_{27}	$\phi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%		DESIG=16
Γ_{28}	$\mu^+ \mu^-$					DESIG=6

$\psi(4040)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$ Γ_1

VALUE (keV) DOCUMENT ID TECN COMMENT

0.86 ± 0.07 OUR ESTIMATE

0.83 ± 0.20 ⁹ ABLIKIM 08D BES2 $e^+ e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 to 1.4 ¹⁰ MO 10 RVUE $e^+ e^- \rightarrow \text{hadrons}$

0.88 ± 0.11 ¹¹ SETH 05A RVUE $e^+ e^- \rightarrow \text{hadrons}$

0.91 ± 0.13 ¹² SETH 05A RVUE $e^+ e^- \rightarrow \text{hadrons}$

0.75 ± 0.15 BRANDELIK 78C DASP $e^+ e^-$

⁹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.

¹⁰ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different $e^+ e^-$ partial widths. We quote only the range of values.

¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.

¹² From a fit to BES (BAI 02C) data.

NODE=M072220

NODE=M072W5

NODE=M072W5

→ NOT CHECKED ←

OCCUR=2

NODE=M072W5;LINKAGE=AB

NODE=M072W5;LINKAGE=MO

NODE=M072W5;LINKAGE=ST

NODE=M072W5;LINKAGE=SE

$\psi(4040)$ BRANCHING RATIOS

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 1.0 FELDMAN 77 MRK1 $e^+ e^-$

$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE DOCUMENT ID TECN COMMENT

seen AUBERT 09M BABR $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

seen CRONIN-HEN..09 CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$

seen PAKHLOVA 08 BELL $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

NODE=M072R14

NODE=M072R14

$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE DOCUMENT ID TECN COMMENT

seen AUBERT 09M BABR $e^+ e^- \rightarrow D^+ D^- \gamma$

seen CRONIN-HEN..09 CLEO $e^+ e^- \rightarrow D^+ D^-$

seen PAKHLOVA 08 BELL $e^+ e^- \rightarrow D^+ D^- \gamma$

NODE=M072R15

NODE=M072R15

$\Gamma(D\bar{D})/\Gamma(D^* \bar{D} + \text{c.c.})$ Γ_2/Γ_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

$$\Gamma(D^0 \bar{D}^0)/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$$

 Γ_3/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
0.05±0.03	¹³ GOLDHABER 77	MRK1	$e^+ e^-$

¹³ Phase-space factor (p^3) explicitly removed.

 NODE=M072R1
 NODE=M072R1

NODE=M072R;LINKAGE=P

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$

 NODE=M072R16
 NODE=M072R16

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$
seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$

 NODE=M072R17
 NODE=M072R17

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$$

 Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
0.95±0.09±0.10	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	¹⁴ GOLDHABER 77	MRK1	$e^+ e^-$

¹⁴ Phase-space factor (p^3) explicitly removed.

 NODE=M072R2
 NODE=M072R2

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

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

 Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

 NODE=M072R20
 NODE=M072R20

$$\Gamma(D \bar{D}^* \pi (\text{excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$$

 Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$

 NODE=M072R21
 NODE=M072R21

$$\Gamma(D^0 \bar{D}^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$$

 Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

 NODE=M072R22
 NODE=M072R22

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$$

 Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$

 NODE=M072R23
 NODE=M072R23

$$\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$$

 Γ_{17}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN 06	CLEO	3.97–4.06 $e^+ e^- \rightarrow \text{hadrons}$

 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
$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<7	90	COAN	06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons
$\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$					Γ_{20}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<2	90	COAN	06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons
$\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_{21}/Γ
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
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
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
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
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
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<3	90	15 PEDLAR	11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

¹⁵ 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.

$\psi(4040)$ REFERENCES

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 091101R	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 011103R	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=M072R02
NODE=M072R02

NODE=M072R03
NODE=M072R03

NODE=M072R04
NODE=M072R04

NODE=M072R05
NODE=M072R05

NODE=M072R06
NODE=M072R06

NODE=M072R07
NODE=M072R07

NODE=M072R08
NODE=M072R08

NODE=M072R09
NODE=M072R09

NODE=M072R24
NODE=M072R24

NODE=M072R24;LINKAGE=PE

NODE=M072R10
NODE=M072R10

NODE=M072

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

NODE=M191

$X(4050)^\pm$

$I(J^P) = ?(?^?)$

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

$X(4050)^\pm$ MASS

NODE=M191M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4051 \pm 14^{+20}_{-41}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M191M

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191M;LINKAGE=MI

$X(4050)^\pm$ WIDTH

NODE=M191W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
82^{+21+47}_{-17-22}	² MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M191W

² From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191W;LINKAGE=MI

$X(4050)^\pm$ DECAY MODES

NODE=M191215;NODE=M191

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\chi_{c1}(1P)$	seen

DESIG=1

$X(4050)^\pm$ BRANCHING RATIOS

NODE=M191225

$\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	
seen	³ MIZUK 08 BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
not seen	⁴ LEES 12B BABR $B \rightarrow K\pi\chi_{c1}(1P)$
³ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^-\chi_{c1}(1P)) \times B(X(4050)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (3.0^{+1.5+3.7}_{-0.8-1.6}) \times 10^{-5}$.	
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

NODE=M191

LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

REFID=54042
REFID=52535

X(4140)

$I^G(J^{PC}) = 0^+(?^{?+})$

OMITTED FROM SUMMARY TABLE

Needs confirmation.
Seen by AALTONEN 09AH in the $B^+ \rightarrow XK^+, X \rightarrow J/\psi\phi$. Not
seen by SHEN 10 in $\gamma\gamma \rightarrow J/\psi\phi$.

NODE=M193

NODE=M193

X(4140) MASS

VALUE (MeV)	EVT5	DOCUMENT ID	TECN	COMMENT
4143.0±2.9±1.2	14 ± 5	¹ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi\phi K^+$

¹ Statistical significance of 3.8 σ .

NODE=M193M

NODE=M193M

NODE=M193M;LINKAGE=AA

X(4140) WIDTH

VALUE (MeV)	EVT5	DOCUMENT ID	TECN	COMMENT
11.7 ^{+8.3} _{-5.0} ±3.7	14 ± 5	² AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi\phi K^+$

² Statistical significance of 3.8 σ .

NODE=M193W

NODE=M193W

NODE=M193W;LINKAGE=AA

X(4140) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	not seen

DESIG=1

DESIG=2

NODE=M193215;NODE=M193

X(4140) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$				$\Gamma_2\Gamma_1/\Gamma$	
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<41	90	³ SHEN	10 BELL	10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6	90	⁴ SHEN	10 BELL	10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
³ For $J^P = 0^+$. ⁴ For $J^P = 2^+$.					

NODE=M193220

NODE=M193G01
NODE=M193G01

OCCUR=2

NODE=M193G01;LINKAGE=S0
NODE=M193G01;LINKAGE=S2

X(4140) BRANCHING RATIOS

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE	EVT5	DOCUMENT ID	TECN	COMMENT	
seen	14 ± 5	⁵ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi\phi K^+$	

⁵ Statistical significance of 3.8 σ .

NODE=M193225

NODE=M193R01
NODE=M193R01

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

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=53235
REFID=52968

$\psi(4160)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M025

 $\psi(4160)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4153 $\pm$ 3 OUR ESTIMATE			
4191.7 $\pm$ 6.5	¹ ABLIKIM	08D BES2	$e^{+}e^{-} \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4193 $\pm$ 7	² MO	10 RVUE	$e^{+}e^{-} \rightarrow$ hadrons
4151 $\pm$ 4	³ SETH	05A RVUE	$e^{+}e^{-} \rightarrow$ hadrons
4155 $\pm$ 5	⁴ SETH	05A RVUE	$e^{+}e^{-} \rightarrow$ hadrons
4159 $\pm$ 20	BRANDELIK	78C DASP	$e^{+}e^{-}$
¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^{\circ}$.			
² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
³ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁴ From a fit to BES (BAI 02C) data.			

NODE=M025M

NODE=M025M

→ NOT CHECKED ←

OCCUR=2

NODE=M025M;LINKAGE=AB

NODE=M025M;LINKAGE=MO

NODE=M025M;LINKAGE=ST

NODE=M025M;LINKAGE=SE

 $\psi(4160)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
103 $\pm$ 8 OUR ESTIMATE			
71.8 $\pm$ 12.3	⁵ ABLIKIM	08D BES2	$e^{+}e^{-} \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
79 $\pm$ 14	⁶ MO	10 RVUE	$e^{+}e^{-} \rightarrow$ hadrons
107 $\pm$ 10	⁷ SETH	05A RVUE	$e^{+}e^{-} \rightarrow$ hadrons
107 $\pm$ 16	⁸ SETH	05A RVUE	$e^{+}e^{-} \rightarrow$ hadrons
78 $\pm$ 20	BRANDELIK	78C DASP	$e^{+}e^{-}$
⁵ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^{\circ}$.			
⁶ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
⁷ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁸ From a fit to BES (BAI 02C) data.			

NODE=M025W

NODE=M025W

→ NOT CHECKED ←

OCCUR=2

NODE=M025W;LINKAGE=AB

NODE=M025W;LINKAGE=MO

NODE=M025W;LINKAGE=ST

NODE=M025W;LINKAGE=SE

 $\psi(4160)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M025215;NODE=M025

NODE=M025

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $e^{+}e^{-}$	$(8.1 \pm 0.9) \times 10^{-6}$	
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} $D^0D^{-}\pi^{+} + \text{c.c. (excl. } D^{*}(2007)^0\bar{D}^0 + \text{c.c., } D^{*}(2010)^{+}D^{-} + \text{c.c.)}$	not seen	
Γ_{12} $D\bar{D}^{*}\pi + \text{c.c. (excl. } D^{*}\bar{D}^{*})$	seen	

DESIG=1

DESIG=15;OUR EVAL;
→ NOT CHECKED ←
DESIG=16

DESIG=17

DESIG=18;OUR EVAL;
→ NOT CHECKED ←
DESIG=19

DESIG=20

DESIG=21;OUR EVAL;
→ NOT CHECKED ←
DESIG=22

DESIG=23

DESIG=24

DESIG=25

Γ_{13}	$D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-)$	not seen			DESIG=26
Γ_{14}	$D_s^+ D_s^-$	not seen			DESIG=27
Γ_{15}	$D_s^{*+} D_s^- + \text{c.c.}$	seen			DESIG=28
Γ_{16}	$J/\psi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	DESIG=2
Γ_{17}	$J/\psi \pi^0 \pi^0$	< 3	$\times 10^{-3}$	90%	DESIG=3
Γ_{18}	$J/\psi K^+ K^-$	< 2	$\times 10^{-3}$	90%	DESIG=4
Γ_{19}	$J/\psi \eta$	< 8	$\times 10^{-3}$	90%	DESIG=5
Γ_{20}	$J/\psi \pi^0$	< 1	$\times 10^{-3}$	90%	DESIG=6
Γ_{21}	$J/\psi \eta'$	< 5	$\times 10^{-3}$	90%	DESIG=7
Γ_{22}	$J/\psi \pi^+ \pi^- \pi^0$	< 1	$\times 10^{-3}$	90%	DESIG=8
Γ_{23}	$\psi(2S) \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%	DESIG=9
Γ_{24}	$\chi_{c1} \gamma$	< 7	$\times 10^{-3}$	90%	DESIG=10
Γ_{25}	$\chi_{c2} \gamma$	< 1.3	%	90%	DESIG=11
Γ_{26}	$\chi_{c1} \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%	DESIG=12
Γ_{27}	$\chi_{c2} \pi^+ \pi^- \pi^0$	< 8	$\times 10^{-3}$	90%	DESIG=13
Γ_{28}	$h_c(1P) \pi^+ \pi^-$	< 5	$\times 10^{-3}$	90%	DESIG=29
Γ_{29}	$h_c(1P) \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%	DESIG=30
Γ_{30}	$h_c(1P) \eta$	< 2	$\times 10^{-3}$	90%	DESIG=31
Γ_{31}	$h_c(1P) \pi^0$	< 4	$\times 10^{-4}$	90%	DESIG=32
Γ_{32}	$\phi \pi^+ \pi^-$	< 2	$\times 10^{-3}$	90%	DESIG=14

 $\psi(4160)$ PARTIAL WIDTHS

NODE=M025220

 $\Gamma(e^+ e^-)$ **Γ_1**

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

 0.83 ± 0.07 OUR ESTIMATE **0.48 ± 0.22** ⁹ ABLIKIM 08D BES2 $e^+ e^- \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.4 to 1.1

¹⁰ MO 10 RVUE $e^+ e^- \rightarrow$ hadrons0.83 $\pm$ 0.08¹¹ SETH 05A RVUE $e^+ e^- \rightarrow$ hadrons0.84 $\pm$ 0.13¹² SETH 05A RVUE $e^+ e^- \rightarrow$ hadrons0.77 $\pm$ 0.23BRANDELIK 78C DASP $e^+ e^-$

OCCUR=2

⁹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

NODE=M025W1;LINKAGE=AB

¹⁰ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different $e^+ e^-$ partial widths. We quote only the range of values.

NODE=M025W1;LINKAGE=MO

¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M025W1;LINKAGE=ST

¹² From a fit to BES (BAI 02C) data.

NODE=M025W1;LINKAGE=SE

 $\psi(4160)$ BRANCHING RATIOS

NODE=M025225

 $\Gamma(D\bar{D})/\Gamma(D^* \bar{D}^*)$ **Γ_2/Γ_8**

VALUE

DOCUMENT ID

TECN

COMMENT

 $0.02 \pm 0.03 \pm 0.02$ AUBERT 09M BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$ NODE=M025R14
NODE=M025R14 **$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE

DOCUMENT ID

TECN

COMMENT

seen

CRONIN-HEN..09 CLEO $e^+ e^- \rightarrow D^0 \bar{D}^0$

seen

PAKHOVA 08 BELL $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$ NODE=M025R16
NODE=M025R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT 09M BABR $e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$ **$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$** **$\Gamma_4/\Gamma$**

VALUE

DOCUMENT ID

TECN

COMMENT

seen

CRONIN-HEN..09 CLEO $e^+ e^- \rightarrow D^+ D^-$

seen

PAKHOVA 08 BELL $e^+ e^- \rightarrow D^+ D^- \gamma$ NODE=M025R17
NODE=M025R17

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AUBERT 09M BABR $e^+ e^- \rightarrow D^+ D^- \gamma$

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$

NODE=M025R18
NODE=M025R18

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$
seen	PAKHLOVA	07 BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$

NODE=M025R19
NODE=M025R19

$$\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(D^* \bar{D}^*)$$

 Γ_5/Γ_8

VALUE	DOCUMENT ID	TECN	COMMENT
$0.34 \pm 0.14 \pm 0.05$	AUBERT	09M BABR	$e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M025R15
NODE=M025R15

$$\Gamma(D^*(2007)^0 \bar{D}^{*0}(2007)^0)/\Gamma_{\text{total}}$$

 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=M025R20
NODE=M025R20

$$\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}}$$

 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=M025R21
NODE=M025R21

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

 Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	08A BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M025R22
NODE=M025R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$$

 Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$

NODE=M025R23
NODE=M025R23

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$$

 Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	09 BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M025R24
NODE=M025R24

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$$

 Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	11 BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$

NODE=M025R25
NODE=M025R25

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{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=M025R26
NODE=M025R26

$$\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$$

 Γ_{16}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN	06 CLEO	4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R01
NODE=M025R01

$$\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$$

 Γ_{17}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN	06 CLEO	4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R02
NODE=M025R02

$$\Gamma(J/\psi K^+ K^-)/\Gamma_{\text{total}}$$

 Γ_{18}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06 CLEO	4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R03
NODE=M025R03

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R04
NODE=M025R04

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R05
NODE=M025R05

 $\Gamma(J/\psi\eta')/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R06
NODE=M025R06

 $\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R07
NODE=M025R07

 $\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R08
NODE=M025R08

 $\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R09
NODE=M025R09

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R10
NODE=M025R10

 $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R11
NODE=M025R11

 $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R12
NODE=M025R12

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	13 PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

NODE=M025R27
NODE=M025R27

¹³ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 15.6 \pm 2.3 \pm 1.9 \pm 3.0$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R27;LINKAGE=PE

 $\Gamma(h_c(1P)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	14 PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^0\pi^0$

NODE=M025R28
NODE=M025R28

¹⁴ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0\pi^0) = 3.0 \pm 3.3 \pm 1.1 \pm 0.6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R28;LINKAGE=PE

 $\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	15 PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\eta$

NODE=M025R29
NODE=M025R29

¹⁵ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\eta) = 4.7 \pm 1.7 \pm 1.0 \pm 0.9$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R29;LINKAGE=PE

 $\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	16 PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^0$

NODE=M025R30
NODE=M025R30

¹⁶ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0) = -0.7 \pm 1.8 \pm 0.7 \pm 0.1$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R30;LINKAGE=PE

$\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{32}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<2	90	COAN	06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R13
NODE=M025R13

$\psi(4160)$ REFERENCES

NODE=M025

PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101R	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 011103R	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)
SETH	05A	PR D72 017501	K.K. Seth	
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)

REFID=53638
REFID=16787
REFID=53532
REFID=53540
REFID=52724
REFID=53114
REFID=53143
REFID=52142
REFID=52132
REFID=52134
REFID=51628
REFID=51075
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232

$X(4160)$

$I^G(J^{PC}) = ?^?(?^{??})$

NODE=M190

OMITTED FROM SUMMARY TABLE
Seen by PAKHLOV 08 in $e^+e^- \rightarrow J/\psi X$, $X \rightarrow D^*\bar{D}^*$

NODE=M190

$X(4160)$ MASS

NODE=M190M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4156^{+25}_{-20} \pm 15$	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M190M

$X(4160)$ WIDTH

NODE=M190W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$139^{+111}_{-61} \pm 21$	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M190W

$X(4160)$ DECAY MODES

NODE=M190215;NODE=M190

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D\bar{D}$	not seen
$\Gamma_2 \quad D^*\bar{D} + \text{c.c.}$	not seen
$\Gamma_3 \quad D^*\bar{D}^*$	seen

DESIG=1;OUR EVAL;→ NOT CHECKED ←
DESIG=2;OUR EVAL;→ NOT CHECKED ←
DESIG=3;OUR EVAL;→ NOT CHECKED ←

$X(4160)$ BRANCHING RATIOS

NODE=M190225

$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$					Γ_1/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.09	90	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$	
$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$					Γ_2/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.22	90	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$	

NODE=M190R01
NODE=M190R01

NODE=M190R02
NODE=M190R02

$X(4160)$ REFERENCES

NODE=M190

PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)

REFID=52302

NODE=M192

$X(4250)^\pm$

$I(J^P) = ?(?^?)$

OMITTED FROM SUMMARY TABLE

Observed by MIZUK 08 in the $\pi^+\chi_{c1}(1P)$ invariant mass distribution in $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$ decays. Not seen by LEES 12B in this same mode after accounting for $K\pi$ resonant mass and angular structure.

NODE=M192

$X(4250)^\pm$ MASS

NODE=M192M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4248^{+44+180}_{-29-35}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M192M

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192M;LINKAGE=MI

$X(4250)^\pm$ WIDTH

NODE=M192W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$177^{+54+316}_{-39-61}$	² MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M192W

² From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192W;LINKAGE=MI

$X(4250)^\pm$ DECAY MODES

NODE=M192215;NODE=M192

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\chi_{c1}(1P)$	seen

DESIG=1

$X(4250)^\pm$ BRANCHING RATIOS

NODE=M192225

$\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	
seen	³ MIZUK 08 BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
not seen	⁴ LEES 12B BABR $B \rightarrow K\pi\chi_{c1}(1P)$
³ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^-\chi_{c1}(1P)) \times B(X(4250)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (4.0^{+2.3+19.7}_{-0.9-0.5}) \times 10^{-5}$.	
⁴ With a product branching fraction limit of $B(\bar{B}^0 \rightarrow X(4250)^+K^-) \times B(X(4250)^+ \rightarrow \chi_{c1}\pi^+) < 4.0 \times 10^{-5}$ at 90% CL.	

NODE=M192R01
NODE=M192R01

NODE=M192R01;LINKAGE=MI

NODE=M192R01;LINKAGE=LE

$X(4250)^\pm$ REFERENCES

NODE=M192

LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

REFID=54042
REFID=52535

X(4260)

$$I^G(J^{PC}) = ?^?(1^{--})$$

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by AUBERT,B 05I, HE 06B, and YUAN 07, and in e^+e^- collisions at $\sqrt{s} \approx 4.26$ GeV by COAN 06. Possibly seen by AUBERT 06 in $B^- \rightarrow K^- \pi^+ \pi^- J/\psi$. See also the mini-review under the X(3872). (See the index for the page number.)

NODE=M074

NODE=M074

X(4260) MASS

NODE=M074M

NODE=M074M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$4263 \pm \frac{8}{9}$ OUR AVERAGE		Error includes scale factor of 1.1.		
$4247 \pm 12 \pm_{-32}^{+17}$		¹ YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$4284 \pm_{-16}^{+17} \pm 4$	13.6	HE	06B CLEO	9.4–10.6 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$4259 \pm 8 \pm_{-6}^{+2}$	125	² 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. Two interfering resonances are not excluded.

NODE=M074M;LINKAGE=YU

NODE=M074M;LINKAGE=AU

X(4260) WIDTH

NODE=M074W

NODE=M074W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
95 ± 14 OUR AVERAGE				
$108 \pm 19 \pm 10$		³ YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$73 \pm_{-25}^{+39} \pm 5$	13.6	HE	06B CLEO	9.4–10.6 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$88 \pm 23 \pm_{-4}^{+6}$	125	⁴ AUBERT,B	05I BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

³ From a two-resonance fit.⁴ From a single-resonance fit. Two interfering resonances are not excluded.

NODE=M074W;LINKAGE=YU

NODE=M074W;LINKAGE=AU

X(4260) DECAY MODES

NODE=M074215;NODE=M074

NODE=M074

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)
Γ_1 e^+e^-	
Γ_2 $J/\psi \pi^+ \pi^-$	seen
Γ_3 $J/\psi \pi^0 \pi^0$	seen
Γ_4 $J/\psi K^+ K^-$	seen
Γ_5 $J/\psi \eta$	not seen
Γ_6 $J/\psi \pi^0$	not seen
Γ_7 $J/\psi \eta'$	not seen
Γ_8 $J/\psi \pi^+ \pi^- \pi^0$	not seen
Γ_9 $J/\psi \eta \eta$	not seen
Γ_{10} $\psi(2S) \pi^+ \pi^-$	not seen
Γ_{11} $\psi(2S) \eta$	not seen
Γ_{12} $\chi_{c0} \omega$	not seen
Γ_{13} $\chi_{c1} \gamma$	not seen
Γ_{14} $\chi_{c2} \gamma$	not seen
Γ_{15} $\chi_{c1} \pi^+ \pi^- \pi^0$	not seen
Γ_{16} $\chi_{c2} \pi^+ \pi^- \pi^0$	not seen
Γ_{17} $h_c(1P) \pi^+ \pi^-$	not seen
Γ_{18} $\phi \pi^+ \pi^-$	not seen
Γ_{19} $\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	not seen
Γ_{20} $D\bar{D}$	not seen

DESIG=1

DESIG=2;OUR EVAL;→ NOT CHECKED ←

DESIG=4;OUR EVAL;→ NOT CHECKED ←

DESIG=5;OUR EVAL;→ NOT CHECKED ←

DESIG=6;OUR EVAL;→ NOT CHECKED ←

DESIG=7;OUR EVAL;→ NOT CHECKED ←

DESIG=8;OUR EVAL;→ NOT CHECKED ←

DESIG=9;OUR EVAL;→ NOT CHECKED ←

DESIG=10;OUR EVAL;

→ NOT CHECKED ←

DESIG=11;OUR EVAL;

→ NOT CHECKED ←

DESIG=12;OUR EVAL;

→ NOT CHECKED ←

DESIG=13;OUR EVAL;

→ NOT CHECKED ←

DESIG=14;OUR EVAL;

→ NOT CHECKED ←

DESIG=15;OUR EVAL;

→ NOT CHECKED ←

DESIG=16;OUR EVAL;

→ NOT CHECKED ←

DESIG=17;OUR EVAL;

→ NOT CHECKED ←

DESIG=40;OUR EVAL;

→ NOT CHECKED ←

DESIG=18;OUR EVAL;

→ NOT CHECKED ←

DESIG=22;OUR EVAL;

→ NOT CHECKED ←

DESIG=19;OUR EVAL;

→ NOT CHECKED ←

Γ ₂₁	$D^0 \bar{D}^0$	seen	DESIG=31
Γ ₂₂	$D^+ D^-$	seen	DESIG=32
Γ ₂₃	$D^* \bar{D}^* + c.c.$	seen	DESIG=23; OUR EVAL; → NOT CHECKED ←
Γ ₂₄	$D^*(2007)^0 \bar{D}^0 + c.c.$	seen	DESIG=33
Γ ₂₅	$D^*(2010)^+ D^- + c.c.$	seen	DESIG=34
Γ ₂₆	$D^* \bar{D}^*$	not seen	DESIG=24; OUR EVAL; → NOT CHECKED ←
Γ ₂₇	$D^*(2007)^0 \bar{D}^*(2007)^0$	seen	DESIG=35
Γ ₂₈	$D^*(2010)^+ D^*(2010)^-$	seen	DESIG=36
Γ ₂₉	$D \bar{D} \pi + c.c.$		DESIG=37
Γ ₃₀	$D^0 D^- \pi^+ + c.c. \text{ (excl. } D^*(2007)^0 \bar{D}^{*0} + c.c., D^*(2010)^+ D^- + c.c.)$	not seen	DESIG=38
Γ ₃₁	$D \bar{D}^* \pi + c.c. \text{ (excl. } D^* \bar{D}^*)$	seen	DESIG=25
Γ ₃₂	$D^0 D^{*-} \pi^+ + c.c. \text{ (excl. } D^*(2010)^+ D^*(2010)^-)$	not seen	DESIG=39
Γ ₃₃	$D^0 D^*(2010)^- \pi^+ + c.c.$	not seen	DESIG=30; OUR EVAL; → NOT CHECKED ←
Γ ₃₄	$D^* \bar{D}^* \pi$	seen	DESIG=26
Γ ₃₅	$D_s^+ D_s^-$	seen	DESIG=27
Γ ₃₆	$D_s^{*+} D_s^- + c.c.$	seen	DESIG=28
Γ ₃₇	$D_s^{*+} D_s^{*-}$	seen	DESIG=29
Γ ₃₈	$p \bar{p}$	not seen	DESIG=3; OUR EVAL; → NOT CHECKED ←
Γ ₃₉	$K_S^0 K^\pm \pi^\mp$	not seen	DESIG=20; OUR EVAL; → NOT CHECKED ←
Γ ₄₀	$K^+ K^- \pi^0$	not seen	DESIG=21; OUR EVAL; → NOT CHECKED ←

$X(4260) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

$\Gamma(J/\psi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_2 \Gamma_1 / \Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	

5.9^{+1.2}_{-0.9} OUR AVERAGE

6.0 ± 1.2 ^{+4.7} _{-0.5}	⁵ YUAN	07	BELL	10.58 e ⁺ e ⁻ → γ π ⁺ π ⁻ J/ψ
8.9 ^{+3.9} _{-3.1} ± 1.8	8.1 HE	06B	CLEO	9.4–10.6 e ⁺ e ⁻ → γ π ⁺ π ⁻ J/ψ
5.5 ± 1.0 ^{+0.8} _{-0.7}	125 ⁶ AUBERT, B	05I	BABR	10.58 e ⁺ e ⁻ → γ π ⁺ π ⁻ J/ψ
• • • We do not use the following data for averages, fits, limits, etc. • • •				
20.6 ± 2.3 ^{+9.1} _{-1.7}	⁷ YUAN	07	BELL	10.58 e ⁺ e ⁻ → γ π ⁺ π ⁻ J/ψ

⁵ Solution I of two equivalent solutions in a fit using two interfering resonances.

⁶ From a single-resonance fit. Two interfering resonances are not excluded.

⁷ Solution II of two equivalent solutions in a fit using two interfering resonances.

$\Gamma(J/\psi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_4 \Gamma_1 / \Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2	90	⁸ YUAN	08	BELL	e ⁺ e ⁻ → γ K ⁺ K ⁻ J/ψ

⁸ From a fit of the broad K⁺ K⁻ J/ψ enhancement including a coherent X(4260) amplitude with mass and width from YUAN 07.

$\Gamma(\psi(2S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_{10} \Gamma_1 / \Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.3	90	⁹ LIU	08H	RVUE	10.58 e ⁺ e ⁻ → ψ(2S) π ⁺ π ⁻ γ
7.4 ^{+2.1} _{-1.7}		¹⁰ LIU	08H	RVUE	10.58 e ⁺ e ⁻ → ψ(2S) π ⁺ π ⁻ γ

⁹ For constructive interference with the X(4360) in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

¹⁰ For destructive interference with the X(4360) in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{18}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.4	90	AUBERT,BE	06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M074230

NODE=M074G1
NODE=M074G1

OCCUR=2

NODE=M074G1; LINKAGE=YU
NODE=M074G1; LINKAGE=AU
NODE=M074G1; LINKAGE=YA

NODE=M074G3
NODE=M074G3

NODE=M074G3; LINKAGE=YU

NODE=M074G7
NODE=M074G7

OCCUR=2

NODE=M074G7; LINKAGE=LI

NODE=M074G7; LINKAGE=LU

NODE=M074G2
NODE=M074G2

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{19} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.29	90	¹¹ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
¹¹ AUBERT 07AK reports $[\Gamma(X(4260) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(X(4260) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] < 0.14 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = 48.9 \times 10^{-2}$.				

NODE=M074G6
NODE=M074G6

NODE=M074G6;LINKAGE=AU

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{39} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M074G4
NODE=M074G4

$$\Gamma(K^+ K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{40} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$

NODE=M074G5
NODE=M074G5

X(4260) BRANCHING RATIOS

NODE=M074240

$$\Gamma(h_c(1P) \pi^+ \pi^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{17} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹² PEDLAR	11 CLEO	$e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-$
¹² At $\sqrt{s} = 4260 \text{ MeV}$, PEDLAR 11 measures $\sigma(e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-) = 32 \pm 17 \pm 6 \text{ pb}$, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.				

NODE=M074R25
NODE=M074R25

NODE=M074R25;LINKAGE=PE

$$\Gamma(D \bar{D}) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{20} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹³ AUBERT	07BE BABR	$e^+ e^- \rightarrow D \bar{D} \gamma$
<4.0				
	90	CRONIN-HEN..09	CLEO	$e^+ e^-$
¹³ Using $4259 \pm 10 \text{ MeV}$ for the mass and $88 \pm 24 \text{ MeV}$ for the width of $X(4260)$.				

NODE=M074R2
NODE=M074R2

NODE=M074R2;LINKAGE=AU

$$\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}} \quad \Gamma_{21} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^0\bar{D}^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$
not seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$

NODE=M074R12
NODE=M074R12

$$\Gamma(D^+ D^-) / \Gamma_{\text{total}} \quad \Gamma_{22} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^+D^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^+D^-\gamma$
not seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^+D^-\gamma$

NODE=M074R13
NODE=M074R13

$$\Gamma(D^* \bar{D} + \text{c.c.}) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{23} / \Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<34	90	AUBERT	09M BABR	$e^+ e^- \rightarrow \gamma D^* \bar{D}$
<45				
	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R03
NODE=M074R03

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{24} / \Gamma$$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$

NODE=M074R14
NODE=M074R14

$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{25}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$
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_{26}/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_{27}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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_{28}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$
seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M074R18
NODE=M074R18

 $\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$
 Γ_{30}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M074R16
NODE=M074R16

 $\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$
 Γ_{31}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D} \pi$

NODE=M074R22
NODE=M074R22

 $\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma(J/\psi \pi^+ \pi^-)$
 Γ_{31}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R05
NODE=M074R05

 $\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$
 Γ_{32}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M074R23
NODE=M074R23

 $\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-)$
 Γ_{33}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R10
NODE=M074R10

 $\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$
 $\Gamma_{33}/\Gamma \times \Gamma_1/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42 × 10⁻⁶	90	14 PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R11
NODE=M074R11

¹⁴ Using 4263⁺⁸₋₉ MeV for the mass of X(4260).

NODE=M074R11;LINKAGE=PA

 $\Gamma(D^* \bar{D}^* \pi)/\Gamma_{\text{total}}$
 Γ_{34}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D}^* \pi$

NODE=M074R24
NODE=M074R24

 $\Gamma(D^* \bar{D}^* \pi)/\Gamma(J/\psi \pi^+ \pi^-)$
 Γ_{34}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R06
NODE=M074R06

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{35}/Γ
seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$	
seen	CRONIN-HEN...09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$	
• • • 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

$$\Gamma(D_s^+ D_s^-)/\Gamma(J/\psi \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{35}/Γ_2
<0.7	95	DEL-AMO-SA...10N	BABR	$10.6 e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.3	90	CRONIN-HEN...09	CLEO	$e^+ e^-$	

NODE=M074R07
NODE=M074R07

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{36}/Γ
seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$	
seen	CRONIN-HEN...09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$	

NODE=M074R20
NODE=M074R20

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{36}/Γ_2
< 0.8	90	CRONIN-HEN...09	CLEO	$e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<44	95	DEL-AMO-SA...10N	BABR	$10.6 e^+ e^-$	

NODE=M074R08
NODE=M074R08

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{37}/Γ
seen	CRONIN-HEN...09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$	
not seen	DEL-AMO-SA...10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$	

NODE=M074R21
NODE=M074R21

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma(J/\psi \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{37}/Γ_2
< 9.5	90	CRONIN-HEN...09	CLEO	$e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<30	95	DEL-AMO-SA...10N	BABR	$10.6 e^+ e^-$	

NODE=M074R09
NODE=M074R09

$$\Gamma(p\bar{p})/\Gamma(J/\psi \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	COMMENT	Γ_{38}/Γ_2
<0.13	90	¹⁵ AUBERT 06B	$e^+ e^- \rightarrow p\bar{p} \gamma$	

NODE=M074R1
NODE=M074R1

¹⁵ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of X(4260).

NODE=M074R1;LINKAGE=AU

X(4260) REFERENCES

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 091101R	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 011103R	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 011105R	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 111105R	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 011101R	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 091103R	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 091104R	Q. He <i>et al.</i>	(CLEO Collab.)
AUBERT,B 05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M074

REFID=53638
REFID=16787
REFID=53532
REFID=52724
REFID=53114
REFID=53143
REFID=52242
REFID=52296
REFID=52132
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REFID=51628
REFID=51959
REFID=51960
REFID=51017
REFID=51026
REFID=51511
REFID=51075
REFID=51523
REFID=50776

X(4350)

$I^G(J^{PC}) = 0^+(?^{?+})$

OMITTED FROM SUMMARY TABLE
Seen by SHEN 10 in the $\gamma\gamma \rightarrow J/\psi\phi$. Needs confirmation.

X(4350) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4350.6^{+4.6}_{-5.1} \pm 0.7$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$
¹ Statistical significance of 3.2 σ .				

X(4350) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$13^{+18}_{-9} \pm 4$	$8.8^{+4.2}_{-3.2}$	² SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$
² Statistical significance of 3.2 σ .				

X(4350) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	seen

X(4350) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$				$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$6.7^{+3.2}_{-2.4} \pm 1.1$	$8.8^{+4.2}_{-3.2}$	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 .				

X(4350) BRANCHING RATIOS

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	⁵ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
⁵ Statistical significance of 3.2 σ .				
$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	⁶ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
⁶ Statistical significance of 3.2 σ .				

X(4350) REFERENCES

SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(BELLE Collab.)

NODE=M194

NODE=M194

NODE=M194M

NODE=M194M

NODE=M194M;LINKAGE=SH

NODE=M194W

NODE=M194W

NODE=M194W;LINKAGE=SH

NODE=M194215;NODE=M194

DESIG=1

DESIG=2

NODE=M194220

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2

NODE=M194225

NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

NODE=M194R02
NODE=M194R02

NODE=M194R02;LINKAGE=SH

NODE=M194

REFID=53235

X(4360)

$$J^{PC} = ?(1^{--})$$

OMITTED FROM SUMMARY TABLE

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by AUBERT 07S and WANG 07D. See also the review under the X(3872) particle listings. (See the index for the page number.)

X(4360) MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4361$\pm$9$\pm$9	¹ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4355 $^{+9}_{-10}\pm 9$	² LIU	08H RVUE	10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
4324 $\pm$ 24	³ AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

¹ From a two-resonance fit.² From a combined fit of AUBERT 07S and WANG 07D data with two resonances.³ From a single-resonance fit. Systematic errors not estimated.**X(4360) WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
74$\pm$15$\pm$10	⁴ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
103 $^{+17}_{-15}\pm 11$	⁵ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
172 $\pm$ 33	⁶ AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

⁴ From a two-resonance fit.⁵ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.⁶ From a single-resonance fit. Systematic errors not estimated.**X(4360) DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	seen
Γ_2 $\psi(2S)\pi^+\pi^-$	
Γ_3 $D^0D^{*-}\pi^+$	

X(4360) $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$11.1^{+1.3}_{-1.2}$	⁷ LIU	08H RVUE	$10.58\ e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$	
12.3 ± 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	$10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	

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.**X(4360) BRANCHING RATIOS**

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S) \pi^+ \pi^-)$					Γ_3/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<8	90	PAKHLOVA	09	BELL	$e^+ e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181

NODE=M181

NODE=M181M

NODE=M181M

NODE=M181M;LINKAGE=WA

NODE=M181M;LINKAGE=LI

NODE=M181M;LINKAGE=AU

NODE=M181W

NODE=M181W

NODE=M181W;LINKAGE=WA

NODE=M181W;LINKAGE=LI

NODE=M181W;LINKAGE=AU

NODE=M181215;NODE=M181

DESIG=1

DESIG=2;OUR EVAL; $\rightarrow$ NOT CHECKED $\leftarrow$

DESIG=3

NODE=M181230

NODE=M181G1

NODE=M181G1

OCCUR=2

OCCUR=2

NODE=M181G1;LINKAGE=LI

NODE=M181G1;LINKAGE=LU

NODE=M181G1;LINKAGE=WA

NODE=M181G1;LINKAGE=WN

NODE=M181225

NODE=M181R01

NODE=M181R01

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$					$\Gamma_3/\Gamma \times \Gamma_1/\Gamma$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<0.72 \times 10^{-6}$	90	¹¹ PAKHLOVA	09 BELL	$e^+ e^- \rightarrow X(4360) \rightarrow D^0 D^{*-} \pi^+$	

¹¹ Using $4355^{+9}_{-10} \pm 9$ MeV for the mass of $X(4360)$.

NODE=M181R02
NODE=M181R02

NODE=M181R02;LINKAGE=PA

X(4360) REFERENCES

PAKHLOVA	09	PR D80 091101R	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

NODE=M181

REFID=53143
REFID=52296
REFID=51724
REFID=51959

NODE=M073

$\psi(4415)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

$\psi(4415)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4421 $\pm$ 4 OUR ESTIMATE			
4415.1 $\pm$ 7.9	¹ ABLIKIM	08D BES2	$e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4412 $\pm$ 15	² MO	10 RVUE	$e^+ e^- \rightarrow$ hadrons
4411 $\pm$ 7	³ PAKHLOVA	08A BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 $\pm$ 6	⁴ SETH	05A RVUE	$e^+ e^- \rightarrow$ hadrons
4429 $\pm$ 9	⁵ SETH	05A RVUE	$e^+ e^- \rightarrow$ hadrons
4417 $\pm$ 10	BRANDELIK	78C DASP	$e^+ e^-$
4414 $\pm$ 7	SIEGRIST	76 MRK1	$e^+ e^-$

¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

³ Systematic uncertainties not estimated.

⁴ From a fit to Crystal Ball (OSTERHELD 86) data.

⁵ From a fit to BES (BAI 02C) data.

NODE=M073M

NODE=M073M
→ NOT CHECKED ←

OCCUR=2

NODE=M073M;LINKAGE=AB

NODE=M073M;LINKAGE=MO

NODE=M073M;LINKAGE=NS
NODE=M073M;LINKAGE=ST
NODE=M073M;LINKAGE=SE

$\psi(4415)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
62 $\pm$ 20 OUR ESTIMATE			
71.5 $\pm$ 19.0	⁶ ABLIKIM	08D BES2	$e^+ e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
118 $\pm$ 32	⁷ MO	10 RVUE	$e^+ e^- \rightarrow$ hadrons
77 $\pm$ 20	⁸ PAKHLOVA	08A BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$
119 $\pm$ 16	⁹ SETH	05A RVUE	$e^+ e^- \rightarrow$ hadrons
118 $\pm$ 35	¹⁰ SETH	05A RVUE	$e^+ e^- \rightarrow$ hadrons
66 $\pm$ 15	BRANDELIK	78C DASP	$e^+ e^-$
33 $\pm$ 10	SIEGRIST	76 MRK1	$e^+ e^-$

⁶ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

⁷ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

⁸ Systematic uncertainties not estimated.

⁹ From a fit to Crystal Ball (OSTERHELD 86) data.

¹⁰ From a fit to BES (BAI 02C) data.

NODE=M073W

NODE=M073W
→ NOT CHECKED ←

OCCUR=2

NODE=M073W;LINKAGE=AB

NODE=M073W;LINKAGE=MO

NODE=M073W;LINKAGE=NS
NODE=M073W;LINKAGE=ST
NODE=M073W;LINKAGE=SE

$\psi(4415)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle's central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

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	
Γ_9 $D^*(2010)^+D^*(2010)^- + \text{c.c.}$	seen	
Γ_{10} $D^0D^-\pi^+$ (excl. $D^*(2007)^0\bar{D}^0$ +c.c., $D^*(2010)^+D^-$ +c.c.)	$< 2.3 \%$	90%
Γ_{11} $D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.}$	$(10 \pm 4) \%$	
Γ_{12} $D^0D^{*-}\pi^+ + \text{c.c.}$	$< 11 \%$	90%
Γ_{13} $D_s^+D_s^-$	not seen	
Γ_{14} $D_s^{*+}D_s^- + \text{c.c.}$	seen	
Γ_{15} $D_s^{*+}D_s^{*-}$	not seen	
Γ_{16} e^+e^-	$(9.4 \pm 3.2) \times 10^{-6}$	

NODE=M073215;NODE=M073

NODE=M073

DESIG=7;OUR EVAL;→ NOT CHECKED ←

DESIG=8

DESIG=9

DESIG=10;OUR EVAL;
→ NOT CHECKED ←
DESIG=11

DESIG=12

DESIG=13;OUR EVAL;
→ NOT CHECKED ←
DESIG=14

DESIG=15

DESIG=4

DESIG=5

DESIG=6

DESIG=16

DESIG=17

DESIG=18

DESIG=1

 $\psi(4415)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$ VALUE (keV)	DOCUMENT ID	TECN	COMMENT	Γ_{16}
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=M073220

NODE=M073W1

NODE=M073W1

→ NOT CHECKED ←

OCCUR=2

NODE=M073W1;LINKAGE=AB

NODE=M073W1;LINKAGE=MO

NODE=M073W1;LINKAGE=ST

NODE=M073W1;LINKAGE=SE

 $\psi(4415)$ BRANCHING RATIOS

$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$	
$\Gamma(D^+D^-)/\Gamma_{\text{total}}$ VALUE	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
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=M073225

NODE=M073R04

NODE=M073R04

NODE=M073R05

NODE=M073R05

$$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_7
0.14±0.12±0.03	AUBERT	09M	BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

NODE=M073R02
NODE=M073R02

$$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
seen	AUBERT	09M	BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$

NODE=M073R06
NODE=M073R06

$$\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
seen	AUBERT	09M	BABR	$e^+e^- \rightarrow D^{*+}D^-\gamma$
seen	PAKHLOVA	07	BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$

NODE=M073R07
NODE=M073R07

$$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_7
0.17±0.25±0.03	AUBERT	09M	BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

NODE=M073R03
NODE=M073R03

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ
seen	AUBERT	09M	BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$

NODE=M073R08
NODE=M073R08

$$\Gamma(D^*(2010)^+D^*(2010)^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ
seen	AUBERT	09M	BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	PAKHLOVA	07	BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

NODE=M073R09
NODE=M073R09

$$\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE (units 10 ⁻²)	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ
10.5±2.4±3.8	15 PAKHLOVA	08A	BELL	10.6 $e^+e^- \rightarrow D^0D^-\pi^+\gamma$

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

$$\Gamma(D^0D^-\pi^+ (\text{excl. } D^*(2007)^0\bar{D}^0 + \text{c.c.}, D^*(2010)^+D^- + \text{c.c.})/$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{10}/Γ_{11}
<0.22	90	16 PAKHLOVA	08A	BELL	10.6 $e^+e^- \rightarrow D^0D^-\pi^+\gamma$

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

$$\Gamma(D^0D^{*-}\pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{12}/\Gamma \times \Gamma_{16}/\Gamma$
<0.99 × 10⁻⁶	90	17 PAKHLOVA	09	BELL	$e^+e^- \rightarrow D^0D^{*-}\pi^+$

NODE=M073R01
NODE=M073R01

¹⁷ Using 4421 ± 4 MeV for the mass of $\psi(4415)$.

NODE=M073R01;LINKAGE=PA

$$\Gamma(D_s^+D_s^-)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ
not seen	PAKHLOVA	11	BELL	$e^+e^- \rightarrow D_s^+D_s^-\gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^+D_s^-\gamma$	

NODE=M073R10
NODE=M073R10

$$\Gamma(D_s^{*+}D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{14}/Γ
seen	PAKHLOVA	11	BELL	$e^+e^- \rightarrow D_s^{*+}D_s^-\gamma$
seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^{*+}D_s^-\gamma$	

NODE=M073R11
NODE=M073R11

$$\Gamma(D_s^{*+}D_s^{*-})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{15}/Γ
not seen	PAKHLOVA	11	BELL	$e^+e^- \rightarrow D_s^{*+}D_s^{*-}\gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^{*+}D_s^{*-}\gamma$	

NODE=M073R12
NODE=M073R12

$\psi(4415)$ REFERENCES

PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	09	PR D80 091101R	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 011103R	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
SETH	05A	PR D72 017501	K.K. Seth	
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)
SIEGRIST	76	PRL 36 700	J.L. Siegrist <i>et al.</i>	(LBL, SLAC)

NODE=M073

REFID=53638
REFID=53532
REFID=53540
REFID=52724
REFID=53143
REFID=52142
REFID=52132
REFID=52134
REFID=51628
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232
REFID=22243

 $X(4430)^\pm$

$$I(J^P) = ?(??)$$

OMITTED FROM SUMMARY TABLE

Seen by CHOI 08 in $B \rightarrow K\pi^+\psi(2S)$ decays and confirmed by reanalysis of the same data sample in MIZUK 09. Not seen by AUBERT 09AA.

NODE=M195

NODE=M195

 $X(4430)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4443^{+15+19}_{-12-13}	¹ MIZUK	09	BELL $B \rightarrow K\pi^+\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$4433 \pm 4 \pm 2$	² CHOI	08	BELL $B \rightarrow K\pi^+\psi(2S)$
¹ From a Dalitz plot analysis.			
² Superseded by MIZUK 09.			

NODE=M195M

NODE=M195M

NODE=M195M;LINKAGE=MI
NODE=M195M;LINKAGE=CH

 $X(4430)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
107^{+86+74}_{-43-56}	³ MIZUK	09	BELL $B \rightarrow K\pi^+\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
45^{+18+30}_{-13-13}	⁴ CHOI	08	BELL $B \rightarrow K\pi^+\psi(2S)$
³ From a Dalitz plot analysis.			
⁴ Superseded by MIZUK 09.			

NODE=M195W

NODE=M195W

NODE=M195W;LINKAGE=MI
NODE=M195W;LINKAGE=CH

 $X(4430)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+\psi(2S)$	seen
Γ_2 π^+J/ψ	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	⁵ MIZUK	09	BELL $B \rightarrow K\pi^+\psi(2S)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	⁶ AUBERT	09AA	BABR $B \rightarrow K\pi^+\psi(2S)$	
⁵ Measured a product of branching fractions $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+\psi(2S)) = (3.2^{+1.8+5.3}_{-0.9-1.6}) \times 10^{-5}$.				
⁶ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+\psi(2S)) < 4.7 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+\psi(2S)) < 3.1 \times 10^{-5}$ at 95% CL.				

NODE=M195225

NODE=M195R01
NODE=M195R01

NODE=M195R01;LINKAGE=MI

NODE=M195R01;LINKAGE=AU

$\Gamma(\pi^+ J/\psi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	⁷ AUBERT	09AA BABR	$B \rightarrow K \pi^+ J/\psi$
⁷ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 1.5 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- X(4430)^+) \times B(X(4430)^+ \rightarrow \pi^+ J/\psi) < 0.4 \times 10^{-5}$ at 95% CL.			

NODE=M195R02
 NODE=M195R02

NODE=M195R02;LINKAGE=AU

 $X(4430)^\pm$ REFERENCES

AUBERT	09AA	PR D79 112001	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIZUK	09	PR D80 031104R	R. Mizuk <i>et al.</i>	(BELLE Collab.)
CHOI	08	PRL 100 142001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)

NODE=M195

REFID=52940
 REFID=52960
 REFID=52178

NODE=M189

 $X(4660)$

$$J^G(J^{PC}) = ?^?(1^{--})$$

OMITTED FROM SUMMARY TABLE

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by WANG 07D. Also obtained in a combined fit of WANG 07D and AUBERT 07S. See also the review under the $X(3872)$ particle listings. (See the index for the page number.)

NODE=M189

 $X(4660)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4664 \pm 11 \pm 5$	WANG	07D BELL	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$4661^{+9}_{-8} \pm 6$	¹ LIU	08H RVUE	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$

¹ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M189M

NODE=M189M

NODE=M189M;LINKAGE=LI

 $X(4660)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$48 \pm 15 \pm 3$	WANG	07D BELL	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$42^{+17}_{-12} \pm 6$	² LIU	08H RVUE	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$

² From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M189W

NODE=M189W

NODE=M189W;LINKAGE=LI

 $X(4660)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	seen
Γ_2 $\psi(2S) \pi^+ \pi^-$	
Γ_3 $D^0 D^{*-} \pi^+$	

DESIG=1

DESIG=2;OUR EVAL;→ NOT CHECKED ←

DESIG=3

NODE=M189215;NODE=M189

 $X(4660) \Gamma(i) \Gamma(e^+ e^-)/\Gamma(\text{total})$ $\Gamma(\psi(2S) \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_2 \Gamma_1/\Gamma$

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	$10.58 e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$

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=M189230

NODE=M189G1
 NODE=M189G1

OCCUR=2

OCCUR=2

NODE=M189G1;LINKAGE=LI
 NODE=M189G1;LINKAGE=LU
 NODE=M189G1;LINKAGE=WA
 NODE=M189G1;LINKAGE=WN

X(4660) BRANCHING RATIOS

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S) \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	PAKHLOVA	09	BELL $e^+ e^- \rightarrow X(4660) \rightarrow D^0 D^{*-} \pi^+$

NODE=M189225

NODE=M189R01
NODE=M189R01

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.37 × 10⁻⁶	90	⁷ PAKHLOVA	09	BELL $e^+ e^- \rightarrow X(4660) \rightarrow D^0 D^{*-} \pi^+$

NODE=M189R02
NODE=M189R02⁷ Using $4664 \pm 11 \pm 5$ MeV for the mass of X(4660).

NODE=M189R02;LINKAGE=PA

X(4660) REFERENCES

PAKHLOVA	09	PR D80 091101R	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

NODE=M189

REFID=53143
REFID=52296
REFID=51724
REFID=51959 **$b\bar{b}$ MESONS**

NODE=MXXX030

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M849

A REVIEW GOES HERE – Check our WWW List of Reviews

NODE=M849

 $\eta_b(1S)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

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
9391.0 ± 2.8 OUR AVERAGE				
[9390.9 ± 2.8 MeV OUR 2011 AVERAGE]				
9391.8 ± 6.6 ± 2.0	2.3 ± 0.5k	¹ BONVICINI	10	CLEO $\Upsilon(3S) \rightarrow \gamma X$
9394.2 ⁺ _{-4.8} ± 2.0	13 ± 5k	¹ AUBERT	09AQ	BABR $\Upsilon(2S) \rightarrow \gamma X$
9388.9 ⁺ _{-2.3} ± 2.7	19 ± 3k	¹ AUBERT	08v	BABR $\Upsilon(3S) \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9300 ± 20 ± 20 HEISTER 02D ALEP 181–209 $e^+ e^-$ ¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass difference measurements.NODE=M171M
NEW

NODE=M171M;LINKAGE=AU

 $m_{\Upsilon(1S)} - m_{\eta_b}$

NODE=M171M2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
69.3 ± 2.8 OUR AVERAGE				
68.5 ± 6.6 ± 2.0	2.3 ± 0.5k	² BONVICINI	10	CLEO $\Upsilon(3S) \rightarrow \gamma X$
66.1 ⁺ _{-4.8} ± 2.0	13 ± 5k	² AUBERT	09AQ	BABR $\Upsilon(2S) \rightarrow \gamma X$
71.4 ⁺ _{-3.1} ± 2.7	19 ± 3k	² AUBERT	08v	BABR $\Upsilon(3S) \rightarrow \gamma X$

NODE=M171M2

² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass measurements.

γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
920.6^{+2.8}_{-3.2} OUR AVERAGE				
918.6 $\pm$ 6.0 $\pm$ 1.9	2.3 $\pm$ 0.5k	³ BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
921.2 ^{+2.1} _{-2.8} $\pm$ 2.4	19 $\pm$ 3k	³ AUBERT	08v BABR	$\Upsilon(3S) \rightarrow \gamma X$

³ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
609.3^{+4.6}_{-4.5}$\pm$1.9	13 $\pm$ 5k	⁴ AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$

⁴ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

$\eta_b(1S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $3h^+3h^-$	not seen	
Γ_2 $2h^+2h^-$	not seen	
Γ_3 $4h^+4h^-$		
Γ_4 $\gamma\gamma$	not seen	
Γ_5 $\mu^+\mu^-$	$<9 \times 10^{-3}$	90%
Γ_6 $\tau^+\tau^-$	$<8\%$	90%

$\eta_b(1S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(3h^+3h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_4/\Gamma$

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^-

$\Gamma(2h^+2h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_4/\Gamma$

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^-

$\Gamma(4h^+4h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_4/\Gamma$

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^-

$\eta_b(1S)$ BRANCHING RATIOS

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9 \times 10^{-3}$	90	⁵ AUBERT	09Z BABR	$e^+e^- \rightarrow \Upsilon(2S, 3S) \rightarrow \gamma\eta_b$

⁵ 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.

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8 \times 10^{-2}$	90	AUBERT	09P BABR	$e^+e^- \rightarrow \gamma\tau^+\tau^-$

NODE=M171M2;LINKAGE=AU

NODE=M171DM

NODE=M171DM

NODE=M171DM;LINKAGE=BO

NODE=M171U2S

NODE=M171U2S

NODE=M171U2S;LINKAGE=AU

NODE=M171225;NODE=M171

DESIG=1;OUR EST;→ NOT CHECKED ←
DESIG=2;OUR EST;→ NOT CHECKED ←
DESIG=4
DESIG=3;OUR EST;→ NOT CHECKED ←
DESIG=5
DESIG=6

NODE=M171230

NODE=M171G1
NODE=M171G1

NODE=M171G2
NODE=M171G2

NODE=M171G3
NODE=M171G3

NODE=M171235

NODE=M171R01
NODE=M171R01

NODE=M171R01;LINKAGE=AU

NODE=M171R02
NODE=M171R02

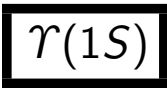
$\eta_b(1S)$ REFERENCES

BONVICINI	10	PR D81 031104R	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABDALLAH	06	PL B634 340	J.M. Abdallah <i>et al.</i>	(DELPHI Collab.)
HEISTER	02D	PL B530 56	A. Heister <i>et al.</i>	(ALEPH Collab.)

NODE=M171

REFID=53231
REFID=53106
REFID=53062
REFID=52930
REFID=52262
REFID=51042
REFID=48577

NODE=M049



$$J^G(J^{PC}) = 0^-(1^--)$$

$\Upsilon(1S)$ MASS

NODE=M049M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
9460.30±0.26 OUR AVERAGE	Error includes scale factor of 3.3.		
9460.51±0.09±0.05	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
9459.97±0.11±0.07	MACKAY 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
9460.60±0.09±0.05	^{2,3} BARU 92B	REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.59±0.12	BARU 86	REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.6 ±0.4	^{3,4} ARTAMONOV 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).			
² Superseding BARU 86.			
³ Superseded by ARTAMONOV 00.			
⁴ Value includes data of ARTAMONOV 82.			

NODE=M049M

NODE=M049M;LINKAGE=AR
NODE=M049M;LINKAGE=A
NODE=M049M;LINKAGE=RZ
NODE=M049M;LINKAGE=G

$\Upsilon(1S)$ WIDTH

NODE=M049W

VALUE (keV)	DOCUMENT ID
54.02±1.25 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M049W
→ NOT CHECKED ←

$\Upsilon(1S)$ DECAY MODES

NODE=M049215;NODE=M049

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \tau^+ \tau^-$	(2.50±0.07) %	
$\Gamma_2 \quad e^+ e^-$	(2.48±0.07) %	
$\Gamma_3 \quad \mu^+ \mu^-$	(2.48±0.05) %	
Hadronic decays		
$\Gamma_4 \quad g g g$	(81.7 ±0.7) %	
$\Gamma_5 \quad \gamma g g$	(2.21±0.22) %	
$\Gamma_6 \quad \eta'(958) \text{ anything}$	(2.94±0.24) %	
$\Gamma_7 \quad J/\psi(1S) \text{ anything}$	(6.5 ±0.7) × 10 ⁻⁴	
$\Gamma_8 \quad \chi_{c0} \text{ anything}$	< 5 × 10 ⁻³	90%
$\Gamma_9 \quad \chi_{c1} \text{ anything}$	(2.3 ±0.7) × 10 ⁻⁴	
$\Gamma_{10} \quad \chi_{c2} \text{ anything}$	(3.4 ±1.0) × 10 ⁻⁴	
$\Gamma_{11} \quad \psi(2S) \text{ anything}$	(2.7 ±0.9) × 10 ⁻⁴	
$\Gamma_{12} \quad \rho \pi$	< 2 × 10 ⁻⁴	90%
$\Gamma_{13} \quad \pi^+ \pi^-$	< 5 × 10 ⁻⁴	90%
$\Gamma_{14} \quad K^+ K^-$	< 5 × 10 ⁻⁴	90%
$\Gamma_{15} \quad p \bar{p}$	< 5 × 10 ⁻⁴	90%
$\Gamma_{16} \quad \pi^0 \pi^+ \pi^-$	< 1.84 × 10 ⁻⁵	90%
$\Gamma_{17} \quad D^*(2010)^\pm \text{ anything}$	(2.52±0.20) %	
$\Gamma_{18} \quad \bar{d} \text{ anything}$	(2.86±0.28) × 10 ⁻⁵	

DESIG=3
DESIG=2
DESIG=1

NODE=M049;CLUMP=A
DESIG=117
DESIG=118
DESIG=73
DESIG=12
DESIG=5
DESIG=6
DESIG=7
DESIG=8
DESIG=11
DESIG=23
DESIG=24
DESIG=25
DESIG=72
DESIG=30
DESIG=107

Radiative decays

Γ ₁₉	$\gamma \pi^+ \pi^-$	$(6.3 \pm 1.8) \times 10^{-5}$		NODE=M049;CLUMP=B
Γ ₂₀	$\gamma \pi^0 \pi^0$	$(1.7 \pm 0.7) \times 10^{-5}$		DESIG=70
Γ ₂₁	$\gamma \pi^0 \eta$	$< 2.4 \times 10^{-6}$	90%	DESIG=71
Γ ₂₂	$\gamma K^+ K^-$	[a] $(1.14 \pm 0.13) \times 10^{-5}$		DESIG=111
Γ ₂₃	$\gamma p \bar{p}$	[b] $< 6 \times 10^{-6}$	90%	DESIG=102
Γ ₂₄	$\gamma 2h^+ 2h^-$	$(7.0 \pm 1.5) \times 10^{-4}$		DESIG=103
Γ ₂₅	$\gamma 3h^+ 3h^-$	$(5.4 \pm 2.0) \times 10^{-4}$		DESIG=20
Γ ₂₆	$\gamma 4h^+ 4h^-$	$(7.4 \pm 3.5) \times 10^{-4}$		DESIG=21
Γ ₂₇	$\gamma \pi^+ \pi^- K^+ K^-$	$(2.9 \pm 0.9) \times 10^{-4}$		DESIG=22
Γ ₂₈	$\gamma 2\pi^+ 2\pi^-$	$(2.5 \pm 0.9) \times 10^{-4}$		DESIG=14
Γ ₂₉	$\gamma 3\pi^+ 3\pi^-$	$(2.5 \pm 1.2) \times 10^{-4}$		DESIG=13
Γ ₃₀	$\gamma 2\pi^+ 2\pi^- K^+ K^-$	$(2.4 \pm 1.2) \times 10^{-4}$		DESIG=17
Γ ₃₁	$\gamma \pi^+ \pi^- p \bar{p}$	$(1.5 \pm 0.6) \times 10^{-4}$		DESIG=18
Γ ₃₂	$\gamma 2\pi^+ 2\pi^- p \bar{p}$	$(4 \pm 6) \times 10^{-5}$		DESIG=15
Γ ₃₃	$\gamma 2K^+ 2K^-$	$(2.0 \pm 2.0) \times 10^{-5}$		DESIG=19
Γ ₃₄	$\gamma \eta'(958)$	$< 1.9 \times 10^{-6}$	90%	DESIG=16
Γ ₃₅	$\gamma \eta$	$< 1.0 \times 10^{-6}$	90%	DESIG=55
Γ ₃₆	$\gamma f_0(980)$	$< 3 \times 10^{-5}$	90%	DESIG=54
Γ ₃₇	$\gamma f_2'(1525)$	$(3.8 \pm 0.9) \times 10^{-5}$		DESIG=105
Γ ₃₈	$\gamma f_2(1270)$	$(1.01 \pm 0.09) \times 10^{-4}$		DESIG=52
Γ ₃₉	$\gamma \eta(1405)$	$< 8.2 \times 10^{-5}$	90%	DESIG=51
Γ ₄₀	$\gamma f_0(1500)$	$< 1.5 \times 10^{-5}$	90%	DESIG=65
Γ ₄₁	$\gamma f_0(1710)$	$< 2.6 \times 10^{-4}$	90%	DESIG=108
Γ ₄₂	$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$	$< 7 \times 10^{-6}$	90%	DESIG=53
Γ ₄₃	$\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0$	$< 1.4 \times 10^{-6}$	90%	DESIG=112
Γ ₄₄	$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	$< 1.8 \times 10^{-6}$	90%	DESIG=109
Γ ₄₅	$\gamma f_4(2050)$	$< 5.3 \times 10^{-5}$	90%	DESIG=110
Γ ₄₆	$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$	$< 2 \times 10^{-4}$	90%	DESIG=104
Γ ₄₇	$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$	$< 8 \times 10^{-7}$	90%	DESIG=69
Γ ₄₈	$\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-$	$< 6 \times 10^{-7}$	90%	DESIG=60
Γ ₄₉	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$< 1.1 \times 10^{-6}$	90%	DESIG=61
Γ ₅₀	$\gamma \eta(2225) \rightarrow \gamma \phi \phi$	$< 3 \times 10^{-3}$	90%	DESIG=62
Γ ₅₁	$\gamma \eta_c(1S)$	$< 5.7 \times 10^{-5}$	90%	DESIG=68
Γ ₅₂	$\gamma \chi_{c0}$	$< 6.5 \times 10^{-4}$	90%	DESIG=119
Γ ₅₃	$\gamma \chi_{c1}$	$< 2.3 \times 10^{-5}$	90%	DESIG=120
Γ ₅₄	$\gamma \chi_{c2}$	$< 7.6 \times 10^{-6}$	90%	DESIG=121
Γ ₅₅	$\gamma X(3872) \rightarrow \pi^+ \pi^- J/\psi$	$< 1.6 \times 10^{-6}$	90%	DESIG=122
Γ ₅₆	$\gamma X(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi$	$< 2.8 \times 10^{-6}$	90%	DESIG=123
Γ ₅₇	$\gamma X(3915) \rightarrow \omega J/\psi$	$< 3.0 \times 10^{-6}$	90%	DESIG=124
Γ ₅₈	$\gamma X(4140) \rightarrow \phi J/\psi$	$< 2.2 \times 10^{-6}$	90%	DESIG=125
Γ ₅₉	γX	[c] $< 4.5 \times 10^{-6}$	90%	DESIG=126
Γ ₆₀	$\gamma X \bar{X} (m_X < 3.1 \text{ GeV})$	[d] $< 1 \times 10^{-3}$	90%	DESIG=66
Γ ₆₁	$\gamma X \bar{X} (m_X < 4.5 \text{ GeV})$	[e] $< 2.4 \times 10^{-4}$	90%	DESIG=67
Γ ₆₂	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[f] $< 1.78 \times 10^{-4}$	95%	DESIG=127
Γ ₆₃	$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	[g] $< 9 \times 10^{-6}$	90%	DESIG=113
Γ ₆₄	$\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$	[a] $< 5.0 \times 10^{-5}$	90%	DESIG=114

Lepton Family number (LF) violating modes

Γ ₆₅	$\mu^\pm \tau^\mp$	LF $< 6.0 \times 10^{-6}$	95%	NODE=M049;CLUMP=C

Other decays

Γ ₆₆	invisible	$< 3.0 \times 10^{-4}$	90%	NODE=M049;CLUMP=D

[a] $2m_\tau < M(\tau^+ \tau^-) < 7500 \text{ MeV}$ [b] $2 < m_{K^+ K^-} < 3 \text{ GeV}$ [c] $X = \text{scalar with } m < 8.0 \text{ GeV}$ [d] $X \bar{X} = \text{vectors with } m < 3.1 \text{ GeV}$ [e] $X \text{ and } \bar{X} = \text{zero spin with } m < 4.5 \text{ GeV}$ [f] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$ [g] $201 < M(\mu^+ \mu^-) < 3565 \text{ MeV}$

LINKAGE=E49

LINKAGE=G49

LINKAGE=A49

LINKAGE=B49

LINKAGE=F49

LINKAGE=C49

LINKAGE=D49

$\Upsilon(1S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

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

 $e^+ e^- \rightarrow \text{hadrons}$ 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
NODE=M049G2NODE=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 EVALUATIONNODE=M049W2
NODE=M049W2
→ NOT CHECKED ← $\Upsilon(1S)$ 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

 $e^+ e^- \rightarrow \tau^+ \tau^-$ 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.⁹ Using $B(\Upsilon(1S) \rightarrow ee) = B(\Upsilon(1S) \rightarrow \mu\mu) = 0.0256$; not used for width evaluations.

NODE=M049R3;LINKAGE=BE

NODE=M049R3;LINKAGE=A

 $\Gamma(e^+ e^-) / \Gamma_{\text{total}}$ Γ_2 / Γ VALUE (units 10^{-2})

EVTs

DOCUMENT ID

TECN

COMMENT

2.38±0.11 OUR AVERAGE

2.29±0.08±0.11

ALEXANDER

98

CLE2

 $\Upsilon(2S) \rightarrow \pi^+ \pi^- e^+ e^-$

2.42±0.14±0.14

307

ALBRECHT

87

ARG

 $\Upsilon(2S) \rightarrow \pi^+ \pi^- e^+ e^-$

2.8 ±0.3 ±0.2

826

BESSON

84

CLEO

 $\Upsilon(2S) \rightarrow \pi^+ \pi^- e^+ e^-$

5.1 ±3.0

BERGER

80C

PLUT

 $e^+ e^- \rightarrow e^+ e^-$ NODE=M049R2
NODE=M049R2 $\Gamma(\mu^+ \mu^-) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE

EVTs

DOCUMENT ID

TECN

COMMENT

0.0248±0.0005 OUR AVERAGE

0.0249±0.0002±0.0007

345k

ADAMS

05

CLEO

 $e^+ e^- \rightarrow \mu^+ \mu^-$

0.0249±0.0008±0.0013

ALEXANDER

98

CLE2

 $\Upsilon(2S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$

0.0212±0.0020±0.0010

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

 $\Upsilon(2S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$ NODE=M049R1
NODE=M049R1

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 $\begin{smallmatrix} +0.034 \\ -0.014 \end{smallmatrix}$		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

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 $e^+ e^- \rightarrow \Upsilon(1S)$

NODE=M049R43
NODE=M049R43

¹¹ Allows any number of extra photons with total energy < 500 MeV.

NODE=M049R43;LINKAGE=DE

$\Gamma(g g g)/\Gamma_{\text{total}}$

Γ_4/Γ

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
81.7±0.7	20M	¹² BESSION	06A	CLEO $\Upsilon(1S) \rightarrow \text{hadrons}$

NODE=M049R35
NODE=M049R35

¹² Calculated using the value $\Gamma(\gamma g g)/\Gamma(g g g) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ 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 $\Gamma(\gamma g g)/\Gamma_{\text{total}}$ measurement of BESSION 06A.

NODE=M049R35;LINKAGE=BE

$\Gamma(\gamma g g)/\Gamma_{\text{total}}$

Γ_5/Γ

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.60	400k	¹³ BESSION	06A	CLEO $\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$

NODE=M049R36
NODE=M049R36

¹³ Calculated using BESSION 06A values of $\Gamma(\gamma g g)/\Gamma(g g g) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ 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 BESSION 06A.

NODE=M049R36;LINKAGE=BE

$\Gamma(\gamma g g)/\Gamma(g g g)$

Γ_5/Γ_4

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
2.70±0.01±0.27	20M	BESSION	06A	CLEO $\Upsilon(1S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M049R37
NODE=M049R37

$\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$

Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0294±0.0024 OUR AVERAGE			
0.030 ±0.002 ±0.002	AQUINES	06A	CLE3 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$
0.028 ±0.004 ±0.002	ARTUSO	03	CLE2 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$

NODE=M049R73
NODE=M049R73

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

Γ_7/Γ

VALUE (units 10 ⁻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 $e^+ e^- \rightarrow \mu^+ \mu^- X$

NODE=M049R12
NODE=M049R12

• • • 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±0.08±0.06	52 ± 12	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R26
NODE=M049R26

$\Gamma(\chi_{c2} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$

Γ_{10}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.52±0.12±0.09	47 ± 11	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R27
NODE=M049R27

$\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{11}/Γ_7

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
$0.41 \pm 0.11 \pm 0.08$	42 ± 11	BRIERE	04 CLEO	$e^+ e^- \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M049R28
 NODE=M049R28

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2	90	FULTON	90B	$\Upsilon(1S) \rightarrow \rho^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 10	90	BLINOV	90 MD1	$\Upsilon(1S) \rightarrow \rho^0 \pi^0$
< 21	90	NICZYPORUK	83 LENA	$\Upsilon(1S) \rightarrow \rho^0 \pi^0$

NODE=M049R11
 NODE=M049R11

 $\Gamma(\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5	90	BARU	92 MD1	$\Upsilon(1S) \rightarrow \pi^+ \pi^-$

NODE=M049R57
 NODE=M049R57

 $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5	90	BARU	92 MD1	$\Upsilon(1S) \rightarrow K^+ K^-$

NODE=M049R58
 NODE=M049R58

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5	90	¹⁵ BARU	96 MD1	$\Upsilon(1S) \rightarrow p\bar{p}$

NODE=M049R59
 NODE=M049R59

¹⁵ Supersedes BARU 92 in this node.

NODE=M049R59;LINKAGE=A

 $\Gamma(\pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.84	90	ANASTASSOV	99 CLE2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R72
 NODE=M049R72

 $\Gamma(D^*(2010)^\pm \text{ anything})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$25.2 \pm 1.3 \pm 1.5$	$\approx 2k$	¹⁶	AUBERT	10C BABR	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 19	90	¹⁷	ALBRECHT	92J ARG	$e^+ e^- \rightarrow D^0 \pi^\pm X$

NODE=M049R32
 NODE=M049R32

¹⁶ For $x_p > 0.1$.

¹⁷ For $x_p > 0.2$.

NODE=M049R32;LINKAGE=AU

NODE=M049R32;LINKAGE=B

 $\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.86 \pm 0.19 \pm 0.21$	455	ASNER	07 CLEO	$e^+ e^- \rightarrow \bar{d} X$

NODE=M049R33
 NODE=M049R33

 $\Gamma(ggg, \gamma g g \rightarrow \bar{d} \text{ anything})/\Gamma(ggg, \gamma g g \rightarrow \text{anything})$

NODE=M049R34
 NODE=M049R34

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.36 \pm 0.23 \pm 0.25$	455	ASNER	07 CLEO	$e^+ e^- \rightarrow \bar{d} X$

 $\Gamma(\gamma \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$6.3 \pm 1.2 \pm 1.3$	¹⁸ ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R70
 NODE=M049R70

¹⁸ For $m_{\pi\pi} > 1 \text{ GeV}$.

NODE=M049R70;LINKAGE=A

 $\Gamma(\gamma \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.7 \pm 0.6 \pm 0.3$	¹⁹ ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R71
 NODE=M049R71

¹⁹ For $m_{\pi\pi} > 1 \text{ GeV}$.

NODE=M049R71;LINKAGE=A

 $\Gamma(\gamma \pi^0 \eta)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.4	90	²⁰ BESSON	07A CLEO	$e^+ e^- \rightarrow \Upsilon(1S)$

NODE=M049R47
 NODE=M049R47

²⁰ BESSON 07A obtained this limit for $0.7 < m_{\pi^0 \eta} < 3 \text{ GeV}$.

NODE=M049R47;LINKAGE=BE

$\Gamma(\gamma K^+ K^-)/\Gamma_{\text{total}}$ $(2 < m_{K^+ K^-} < 3 \text{ GeV})$ Γ_{22}/Γ

NODE=M049R24

VALUE (units 10^{-5}) CL% **$1.14 \pm 0.08 \pm 0.10$**

90

DOCUMENT IDTECNCOMMENT

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$ NODE=M049R24
NODE=M049R24 $\Gamma(\gamma p \bar{p})/\Gamma_{\text{total}}$ $(2 < m_{p \bar{p}} < 3 \text{ GeV})$ Γ_{23}/Γ

NODE=M049R29

VALUE (units 10^{-5}) CL% **< 0.6**

90

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma p \bar{p}$ NODE=M049R29
NODE=M049R29 $\Gamma(\gamma 2h^+ 2h^-)/\Gamma_{\text{total}}$ Γ_{24}/Γ NODE=M049R20
NODE=M049R20VALUE (units 10^{-4}) EVTS **$7.0 \pm 1.1 \pm 1.0$** 80 ± 12

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma 3h^+ 3h^-)/\Gamma_{\text{total}}$ Γ_{25}/Γ NODE=M049R21
NODE=M049R21VALUE (units 10^{-4}) EVTS **$5.4 \pm 1.5 \pm 1.3$** 39 ± 11

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma 4h^+ 4h^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ NODE=M049R22
NODE=M049R22VALUE (units 10^{-4}) EVTS **$7.4 \pm 2.5 \pm 2.5$** 36 ± 12

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ NODE=M049R14
NODE=M049R14VALUE (units 10^{-4}) EVTS **$2.9 \pm 0.7 \pm 0.6$** 29 ± 8

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ NODE=M049R13
NODE=M049R13VALUE (units 10^{-4}) EVTS **$2.5 \pm 0.7 \pm 0.5$** 26 ± 7

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ NODE=M049R17
NODE=M049R17VALUE (units 10^{-4}) EVTS **$2.5 \pm 0.9 \pm 0.8$** 17 ± 5

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ NODE=M049R18
NODE=M049R18VALUE (units 10^{-4}) EVTS **$2.4 \pm 0.9 \pm 0.8$** 18 ± 7

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma \pi^+ \pi^- p \bar{p})/\Gamma_{\text{total}}$ Γ_{31}/Γ NODE=M049R15
NODE=M049R15VALUE (units 10^{-4}) EVTS **$1.5 \pm 0.5 \pm 0.3$** 22 ± 6

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma 2\pi^+ 2\pi^- p \bar{p})/\Gamma_{\text{total}}$ Γ_{32}/Γ NODE=M049R19
NODE=M049R19VALUE (units 10^{-4}) EVTS **$0.4 \pm 0.4 \pm 0.4$** 7 ± 6

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ NODE=M049R16
NODE=M049R16VALUE (units 10^{-4}) EVTS **0.2 ± 0.2** 2 ± 2

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ $\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$ Γ_{34}/Γ NODE=M049R55
NODE=M049R55VALUE (units 10^{-6}) CL% **< 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

 $\Upsilon(1S) \rightarrow \gamma \eta' \rightarrow \gamma \eta \pi^+ \pi^-$ $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$ Γ_{35}/Γ NODE=M049R54
NODE=M049R54VALUE (units 10^{-6}) CL% **< 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

 $\Upsilon(1S) \rightarrow \gamma \eta$

$\Gamma(\gamma f_0(980))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	²¹ ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
²¹ 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_{37}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.9 OUR AVERAGE					
[($3.7^{+1.2}_{-1.1}$) $\times 10^{-5}$ OUR 2011 AVERAGE]					

NODE=M049R52
 NODE=M049R52
 NEW

$4.0 \pm 1.4 \pm 0.1$	17 ± 5	²² 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	²³ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<19.4	90	²³ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

²² 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 $B(f'_2(1525) \rightarrow K\bar{K}) = 4 B(f'_2(1525) \rightarrow K_S^0 K_S^0)$.

²³ Assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.71$.

NODE=M049R52;LINKAGE=BE

NODE=M049R52;LINKAGE=D

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
10.1 ± 0.9 OUR AVERAGE				
$10.5 \pm 1.6^{+1.9}_{-1.8}$		²⁴ BESSON	07A CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$
$10.2 \pm 0.8 \pm 0.7$		ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
$8.1 \pm 2.3^{+2.9}_{-2.7}$		²⁵ ANASTASSOV	99 CLE2	$e^+ e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90	²⁵ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<13	90	²⁵ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<81	90	SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$

²⁴ Using $B(f_2(1270) \rightarrow \pi^0 \pi^0) = B(f_2(1270) \rightarrow \pi\pi)/3$ and $B(f_2(1270) \rightarrow \pi\pi) = (0.845^{+0.025}_{-0.012})\%$.

²⁵ 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_{39}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	²⁶ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^\pm \pi^\mp K_S^0$
²⁶ Includes unknown branching ratio of $\eta(1405) \rightarrow K^\pm \pi^\mp K_S^0$.				

NODE=M049R23
 NODE=M049R23

NODE=M049R23;LINKAGE=J

 $\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	²⁷ 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	²⁸ BESSON	07A CLEO	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \eta \eta$
²⁷ Using $B(f_0(1500) \rightarrow \pi^0 \pi^0) = B(f_0(1500) \rightarrow \pi\pi)/3$ and $B(f_0(1500) \rightarrow \pi\pi) = (0.349 \pm 0.023)\%$.				

²⁸ 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_{41}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.6	90	²⁹ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 6.3	90	²⁹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<19	90	²⁹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K_S^0 K_S^0$
< 8	90	³⁰ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<24	90	³¹ SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$

²⁹ Assuming $B(f_0(1710) \rightarrow K\bar{K}) = 0.38$.

³⁰ Assuming $B(f_0(1710) \rightarrow \pi\pi) = 0.04$.

³¹ 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_{42}/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_{43}/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_{44}/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_{45}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.3	90	³² ATHAR 06	CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

NODE=M049R30
NODE=M049R30

³² Assuming $B(f_4(2050) \rightarrow \pi \pi) = 0.17$.

NODE=M049R30;LINKAGE=AT

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K^+ K^-) / \Gamma_{\text{total}}$ Γ_{46}/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_{47}/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_{48}/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_{49}/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_{50}/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_{51}/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_{52}/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_{53}/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_{54}/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_{55}/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_{56}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	90	SHEN	10A	BELL $\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R68
NODE=M049R68

 $\Gamma(\gamma X(3915) \rightarrow \omega J/\psi) / \Gamma_{\text{total}}$ Γ_{57}/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_{58}/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_{59}/Γ

(X = scalar with $m < 8.0$ GeV)

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.5 (CL = 90%)		[$< 3 \times 10^{-5}$ (CL = 90%) OUR 2011 BEST LIMIT]		

< 4.5 90 ³³ DEL-AMO-SA..11J BABR $e^+ e^- \rightarrow \gamma + X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30 90 ³⁴ BALEST 95 CLEO $e^+ e^- \rightarrow \gamma + X$

³³ For a noninteracting scalar X with mass $m < 8.0$ GeV.

³⁴ 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_{60}/Γ

($X \bar{X}$ = vectors with $m < 3.1$ GeV)

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	³⁵ BALEST	95	CLEO $e^+ e^- \rightarrow \gamma + X \bar{X}$

³⁵ 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_{61}/Γ

X and $\bar{X}$ = zero spin with $m < 4.5$ GeV

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	³⁶ DEL-AMO-SA..11J	BABR	$e^+ e^- \rightarrow \gamma + X \bar{X}$

³⁶ 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_{62}/Γ

($1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.78	95	ROSNER	07A	CLEO $e^+ e^- \rightarrow \gamma X$

NODE=M049R64
NODE=M049R64
NODE=M049R64

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-) / \Gamma_{\text{total}}$ Γ_{63}/Γ

($201 < M(\mu^+ \mu^-) < 3565 \text{ MeV}$)

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	³⁷ LOVE	08	CLEO $e^+ e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

³⁷ For a narrow scalar or pseudoscalar a_1^0 with $201 < M(\mu^+ \mu^-) < 3565 \text{ MeV}$, excluding J/ψ . Measured 90% CL limits as a function of $M(\mu^+ \mu^-)$ range from $1-9 \times 10^{-6}$.

NODE=M049R65
NODE=M049R65
NODE=M049R65

NODE=M049R65;LINKAGE=LO

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-) / \Gamma_{\text{total}}$ Γ_{64}/Γ

($2m_\tau < M(\tau^+ \tau^-) < 7500 \text{ MeV}$)

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	³⁸ LOVE	08	CLEO $e^+ e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

³⁸ For a narrow scalar or pseudoscalar a_1^0 with $2m_\tau < M(\tau^+ \tau^-) < 7500 \text{ MeV}$. Measured 90% CL limits as a function of $M(\tau^+ \tau^-)$ range from $1-5 \times 10^{-5}$.

NODE=M049R66
NODE=M049R66
NODE=M049R66

NODE=M049R66;LINKAGE=LO

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M049230

 $\Gamma(\mu^\pm \tau^\mp) / \Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	95	LOVE	08A	CLEO $e^+ e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M049R67
NODE=M049R67

OTHER DECAYS

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.0	90	AUBERT	09AX BABR	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<39	90	RUBIN	07 CLEO	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
<25	90	TAJIMA	07 BELL	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

NODE=M049235

NODE=M049R10
NODE=M049R10 $\Upsilon(1S)$ REFERENCES

NODE=M049

BESSON	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 051504R	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
BESSON	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
BESSON	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
BESSON	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
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
BESSON	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

→ NOT CHECKED ←

 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%

NODE=M076215;NODE=M076

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

 $\chi_{b0}(1P)$ BRANCHING RATIOS $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ 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
$2.4 \pm 1.2 \pm 0.2$	9	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 16 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $= (9 \pm 4 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M076R12
 NODE=M076R12

NODE=M076R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 17 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 37 \times 10^{-6}$ 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

 $\chi_{b0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M076230

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{15}^{\Upsilon(2S)}/\Gamma_{15}^{\Upsilon(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-3}$	90	20 LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$ 20 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}} < 4.6\%$ using $B(\Upsilon(4S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4)\%$.

NODE=M076B02
 NODE=M076B02

NODE=M076B02;LINKAGE=LE

 $B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
$1.63 \pm 0.24 \pm 0.15$	87	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M076B01
 NODE=M076B01

 $\chi_{b0}(1P)$ REFERENCES

NODE=M076

KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)	REFID=22290
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
KLOPFEN...	83	PRL 51 160	C. Klopstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)	REFID=22286

$\chi_{b1}(1P)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 1$ from SKWARNICKI 87.

NODE=M077

NODE=M077

 $\chi_{b1}(1P)$ MASS

VALUE (MeV)

DOCUMENT ID

9892.78 ± 0.26 ± 0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

NODE=M077M

NODE=M077M

→ NOT CHECKED ←

 γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

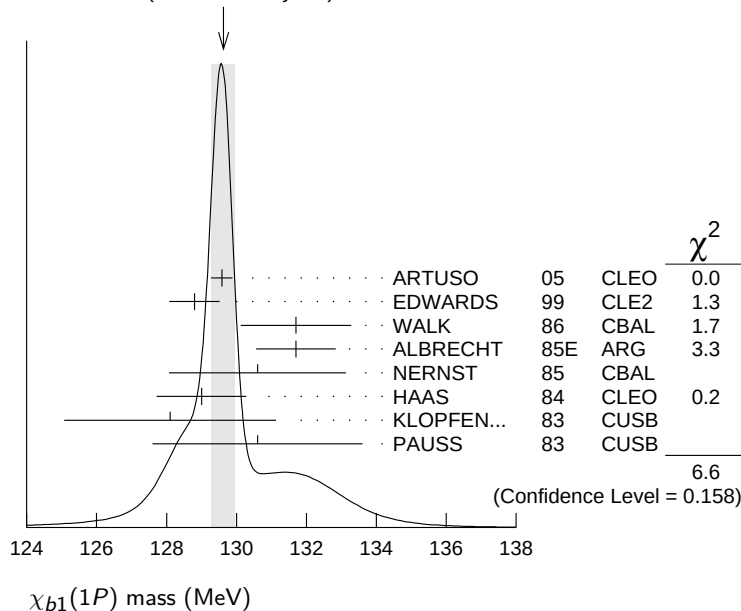
129.63 ± 0.33 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

129.58 ± 0.09 ± 0.29	ARTUSO	05	CLEO	$\Upsilon(2S) \rightarrow \gamma X$
128.8 ± 0.4 ± 0.6	EDWARDS	99	CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
131.7 ± 0.9 ± 1.3	WALK	86	CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
131.7 ± 0.3 ± 1.1	ALBRECHT	85E	ARG	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
130.6 ± 0.8 ± 2.4	NERNST	85	CBAL	$\Upsilon(2S) \rightarrow \gamma X$
129 ± 0.8 ± 1	HAAS	84	CLEO	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
128.1 ± 0.4 ± 3.0	KLOPFEN...	83	CUSB	$\Upsilon(2S) \rightarrow \gamma X$
130.6 ± 3.0	PAUSS	83	CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M077DM

NODE=M077DM

WEIGHTED AVERAGE
129.63 ± 0.33 (Error scaled by 1.3)

 **$\chi_{b1}(1P)$ DECAY MODES**

NODE=M077215;NODE=M077

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(1S)$	(33.9 ± 2.2) %	DESIG=1
Γ_2 $D^0 X$	(12.6 ± 2.2) %	DESIG=2
Γ_3 $\pi^+ \pi^- K^+ K^- \pi^0$	(2.0 ± 0.6) × 10 ⁻⁴	DESIG=3
Γ_4 $2\pi^+ \pi^- K^- K_S^0$	(1.3 ± 0.5) × 10 ⁻⁴	DESIG=4
Γ_5 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 6 × 10 ⁻⁴	DESIG=5
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	(8.0 ± 2.5) × 10 ⁻⁴	DESIG=6
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.5 ± 0.5) × 10 ⁻⁴	DESIG=7
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(3.5 ± 1.2) × 10 ⁻⁴	DESIG=8

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

Γ_9	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(8.6 \pm 3.2) \times 10^{-4}$	DESIG=9
Γ_{10}	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$(9.3 \pm 3.3) \times 10^{-4}$	DESIG=10
Γ_{11}	$3\pi^+ 3\pi^-$	$(1.9 \pm 0.6) \times 10^{-4}$	DESIG=11
Γ_{12}	$3\pi^+ 3\pi^- 2\pi^0$	$(1.7 \pm 0.5) \times 10^{-3}$	DESIG=12
Γ_{13}	$3\pi^+ 3\pi^- K^+ K^-$	$(2.6 \pm 0.8) \times 10^{-4}$	DESIG=13
Γ_{14}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(7.5 \pm 2.6) \times 10^{-4}$	DESIG=14
Γ_{15}	$4\pi^+ 4\pi^-$	$(2.6 \pm 0.9) \times 10^{-4}$	DESIG=15
Γ_{16}	$4\pi^+ 4\pi^- 2\pi^0$	$(1.4 \pm 0.6) \times 10^{-3}$	DESIG=16

$\chi_{b1}(1P)$ BRANCHING RATIOS

NODE=M077220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.339 ± 0.022 OUR AVERAGE				
[0.35 ± 0.08 OUR 2011 AVERAGE]				
0.331 ± 0.018 ± 0.017	3222	^{1,2} KORNICER	11	CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
0.350 ± 0.023 ± 0.018	13k	³ LEES	11J	BABR $\Upsilon(2S) \rightarrow X \gamma$
0.32 ± 0.06 ± 0.07		WALK	86	CBAL $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.47 ± 0.18		KLOPFEN...	83	CUSB $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

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
 NODE=M077R1
 NEW

NODE=M077R1;LINKAGE=KA
 NODE=M077R1;LINKAGE=KR

NODE=M077R1;LINKAGE=LE

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6 ± 1.9 ± 1.1	2310	⁴ BRIERE	08	CLEO $\Upsilon(2S) \rightarrow \gamma D^0 X$

⁴ For $p_{D^0} > 2.5$ GeV/c.

NODE=M077R01
 NODE=M077R01

NODE=M077R01;LINKAGE=BR

$\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0 ± 0.6 ± 0.1	18	⁵ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁵ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (14 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R02
 NODE=M077R02

NODE=M077R02;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3 ± 0.5 ± 0.1	11	⁶ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁶ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (9 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R03
 NODE=M077R03

NODE=M077R03;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6	90	⁷ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

⁷ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $< 42 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

NODE=M077R04
 NODE=M077R04

NODE=M077R04;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.0 \pm 2.4 \pm 0.4$	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	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
¹² ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ $= (64 \pm 16 \pm 16) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$ $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R09
 NODE=M077R09

NODE=M077R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.9 \pm 0.6 \pm 0.1$	25	¹³ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
¹³ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ $= (13 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$ $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R10
 NODE=M077R10

NODE=M077R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$17 \pm 5 \pm 1$	56	¹⁴ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
¹⁴ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ $= (119 \pm 18 \pm 32) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$ $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R11
 NODE=M077R11

NODE=M077R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.6 \pm 0.8 \pm 0.1$	21	¹⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
¹⁵ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ $= (18 \pm 4 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$ $= (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R12
 NODE=M077R12

NODE=M077R12;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.5 \pm 2.6 \pm 0.4$	28	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
16 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (52 \pm 11 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R13
 NODE=M077R13

NODE=M077R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.6 \pm 0.9 \pm 0.1$	24	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
17 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (18 \pm 4 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R14
 NODE=M077R14

NODE=M077R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$14 \pm 5 \pm 1$	26	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
18 ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (96 \pm 24 \pm 29) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R15
 NODE=M077R15

NODE=M077R15;LINKAGE=AS

 $\chi_{b1}(1P)$ Cross-Particle Branching Ratios

NODE=M077230

$$\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{13}^{\Upsilon(2S)}/\Gamma^{\Upsilon(2S)}$$

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

KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.) J
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

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

$h_b(1P)$

$$J^{PC} = ?^?(1^{+-})$$

Quantum numbers are quark model predictions, $C = -$ established by $\eta_b \gamma$ decay.

NODE=M204

NODE=M204

 $h_b(1P)$ MASS

NODE=M204M

NODE=M204M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9898.7$\pm$1.4 OUR AVERAGE				
9910 $\pm 6 \pm 11$		¹ AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- + X$
9898.2 $^{+1.1+1.0}_{-1.0-1.1}$	50.0k	ADACHI	12 BELL	$10.86 e^+ e^- \rightarrow \pi^+ \pi^- \text{MM}$
9902 $\pm 4 \pm 2$	10.8k	LEES	11K BABR	$\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$

¹ The mass barycenter of the merged lineshapes from $J = 0, 1$, and 2 states, assuming a hyperfine splitting of 12 MeV.

NODE=M204M;LINKAGE=AA

 $h_b(1P)$ DECAY MODES

NODE=M204215;NODE=M204

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta_b(1S) \gamma$	seen

DESIG=1

 $h_b(1P)$ BRANCHING RATIOS

NODE=M204225

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$					Γ_1/Γ
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
seen	10.8k	LEES	11k	BABR	$\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$

NODE=M204R01
NODE=M204R01 **$h_b(1P)$ REFERENCES**

NODE=M204

AAD	12A	PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)

REFID=54037
REFID=53962
REFID=53937

NODE=M078

 $\chi_{b2}(1P)$

$$J^{PC} = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 2$ from SKWARNICKI 87.

NODE=M078

 $\chi_{b2}(1P)$ MASS

NODE=M078M

NODE=M078M

→ NOT CHECKED ←

VALUE (MeV)	DOCUMENT ID
9912.21$\pm$0.26$\pm$0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 $\pm$ 0.31 MeV	

 γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M078DM

NODE=M078DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
110.44$\pm$0.29 OUR AVERAGE Error includes scale factor of 1.1.			
110.58 $\pm$ 0.08 $\pm$ 0.30	ARTUSO	05 CLEO	$\Upsilon(2S) \rightarrow \gamma X$
110.8 $\pm 0.3 \pm 0.6$	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
107.0 $\pm 1.1 \pm 1.3$	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
110.6 $\pm 0.3 \pm 0.9$	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
110.4 $\pm 0.8 \pm 2.2$	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
109.5 $\pm 0.7 \pm 1.0$	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
108.2 $\pm 0.3 \pm 2.0$	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$
108.8 ± 4.0	PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

$\chi_{b2}(1P)$ DECAY MODES

NODE=M078215;NODE=M078

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	$(19.1 \pm 1.2) \%$	
$\Gamma_2 \quad D^0 X$	$< 7.9 \%$	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%
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(3.6 \pm 1.5) \times 10^{-4}$	
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	$(8 \pm 4) \times 10^{-5}$	
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	$(1.8 \pm 0.7) \times 10^{-3}$	

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

 $\chi_{b2}(1P)$ BRANCHING RATIOS

NODE=M078220

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.191 ± 0.012 OUR AVERAGE				
$[0.22 \pm 0.04 \text{ OUR 2011 AVERAGE}]$				

$0.186 \pm 0.011 \pm 0.009$ 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

NEW

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 $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] < 36 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = 7.15 \times 10^{-2}$.				

NODE=M078R09
 NODE=M078R09

NODE=M078R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70±0.31±0.03	9	¹⁴ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-$
¹⁴ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (5 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R10
 NODE=M078R10

NODE=M078R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.2±3.6±0.5	34	¹⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$
¹⁵ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (73 \pm 16 \pm 20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R11
 NODE=M078R11

NODE=M078R11;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	16 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
16 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.				

NODE=M078R12
 NODE=M078R12

NODE=M078R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.6 \pm 1.5 \pm 0.2$	14	17 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (26 \pm 8 \pm 7) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R13
 NODE=M078R13

NODE=M078R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.40 \pm 0.04$	7	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

 $\chi_{b2}(1P)$ Cross-Particle Branching Ratios

NODE=M078230

$$\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{14}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

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})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.56 \pm 0.40 \pm 0.41$	126	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M078B02
 NODE=M078B02

 $\chi_{b2}(1P)$ REFERENCES

NODE=M078

KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.)
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopstein <i>et al.</i>	(CUSP Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

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

$\Upsilon(2S)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

NODE=M052

 $\Upsilon(2S)$ MASS

NODE=M052M

VALUE (GeV)	DOCUMENT ID	TECN	COMMENT
10.02326±0.00031 OUR AVERAGE			
10.0235 ±0.0005	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
10.0231 ±0.0004	BARBER 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.0236 ±0.0005	^{2,3} BARU	86B REDE	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BARU 86B using new electron mass (COHEN 87).			
² Reanalysis of ARTAMONOV 84.			
³ Superseded by ARTAMONOV 00.			

NODE=M052M

NODE=M052M;LINKAGE=AR
 NODE=M052M;LINKAGE=C
 NODE=M052M;LINKAGE=RZ

 $m_{\Upsilon(3S)} - m_{\Upsilon(2S)}$

NODE=M052DM3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50±0.02±0.13	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M052DM3

 $\Upsilon(2S)$ WIDTH

NODE=M052W

VALUE (keV)	DOCUMENT ID
31.98±2.63 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M052W
 → NOT CHECKED ←

 $\Upsilon(2S)$ DECAY MODES

NODE=M052215;NODE=M052

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \Upsilon(1S)\pi^+\pi^-$	(17.92± 0.26) %	
$\Gamma_2 \quad \Upsilon(1S)\pi^0\pi^0$	(8.6 ± 0.4) %	
$\Gamma_3 \quad \tau^+\tau^-$	(2.00± 0.21) %	
$\Gamma_4 \quad \mu^+\mu^-$	(1.93± 0.17) %	S=2.2
$\Gamma_5 \quad e^+e^-$	(1.91± 0.16) %	
$\Gamma_6 \quad \Upsilon(1S)\pi^0$	< 1.8 × 10 ⁻⁴	CL=90%
$\Gamma_7 \quad \Upsilon(1S)\eta$	(2.34± 0.31) × 10 ⁻⁴	
$\Gamma_8 \quad J/\psi(1S) \text{ anything}$	< 6 × 10 ⁻³	CL=90%
$\Gamma_9 \quad d \text{ anything}$	(3.4 ± 0.6) × 10 ⁻⁵	
$\Gamma_{10} \quad \text{hadrons}$	(94 ±11) %	
$\Gamma_{11} \quad gg$	(58.8 ± 1.2) %	
$\Gamma_{12} \quad \gamma gg$	(8.8 ± 1.1) %	

DESIG=4
 DESIG=5
 DESIG=3
 DESIG=1
 DESIG=2
 DESIG=10
 DESIG=6
 DESIG=20
 DESIG=16
 DESIG=101
 DESIG=105
 DESIG=106

Radiative decays

NODE=M052;CLUMP=A

$\Gamma_{13} \quad \gamma\chi_{b1}(1P)$	(6.9 ± 0.4) %	
$\Gamma_{14} \quad \gamma\chi_{b2}(1P)$	(7.15± 0.35) %	
$\Gamma_{15} \quad \gamma\chi_{b0}(1P)$	(3.8 ± 0.4) %	
$\Gamma_{16} \quad \gamma f_0(1710)$	< 5.9 × 10 ⁻⁴	CL=90%
$\Gamma_{17} \quad \gamma f'_2(1525)$	< 5.3 × 10 ⁻⁴	CL=90%
$\Gamma_{18} \quad \gamma f_2(1270)$	< 2.41 × 10 ⁻⁴	CL=90%
$\Gamma_{19} \quad \gamma f_J(2220)$		
$\Gamma_{20} \quad \gamma\eta_c(1S)$	< 2.7 × 10 ⁻⁵	CL=90%
$\Gamma_{21} \quad \gamma\chi_{c0}$	< 1.0 × 10 ⁻⁴	CL=90%
$\Gamma_{22} \quad \gamma\chi_{c1}$	< 3.6 × 10 ⁻⁶	CL=90%
$\Gamma_{23} \quad \gamma\chi_{c2}$	< 1.5 × 10 ⁻⁵	CL=90%
$\Gamma_{24} \quad \gamma X(3872) \rightarrow \pi^+\pi^- J/\psi$	< 8 × 10 ⁻⁷	CL=90%
$\Gamma_{25} \quad \gamma X(3872) \rightarrow \pi^+\pi^-\pi^0 J/\psi$	< 2.4 × 10 ⁻⁶	CL=90%
$\Gamma_{26} \quad \gamma X(3915) \rightarrow \omega J/\psi$	< 2.8 × 10 ⁻⁶	CL=90%
$\Gamma_{27} \quad \gamma X(4140) \rightarrow \phi J/\psi$	< 1.2 × 10 ⁻⁶	CL=90%
$\Gamma_{28} \quad \gamma X(4350) \rightarrow \phi J/\psi$	< 1.3 × 10 ⁻⁶	CL=90%
$\Gamma_{29} \quad \gamma\eta_b(1S)$	(3.9 ± 1.5) × 10 ⁻⁴	
$\Gamma_{30} \quad \gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[a] < 1.95 × 10 ⁻⁴	CL=95%
$\Gamma_{31} \quad \gamma A^0 \rightarrow \gamma \text{hadrons}$	< 8 × 10 ⁻⁵	CL=90%

DESIG=8
 DESIG=7
 DESIG=9
 DESIG=13
 DESIG=12
 DESIG=11
 DESIG=14
 DESIG=111
 DESIG=112
 DESIG=113
 DESIG=114
 DESIG=115
 DESIG=116
 DESIG=117
 DESIG=118
 DESIG=119
 DESIG=102
 DESIG=103
 DESIG=108

Lepton Family number (LF) violating modes

$\Gamma_{32} e^{\pm} \tau^{\mp}$	LF	< 3.2	$\times 10^{-6}$	CL=90%
$\Gamma_{33} \mu^{\pm} \tau^{\mp}$	LF	< 3.3	$\times 10^{-6}$	CL=90%

NODE=M052;CLUMP=B

DESIG=107

DESIG=104

[a] 1.5 GeV < m_X < 5.0 GeV

LINKAGE=C52

 $\Upsilon(2S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

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	⁴ AUBERT	08BP BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$

NODE=M052G03
NODE=M052G03⁴ 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	⁵ ROSNER	06	CLEO $10.0 e^+ e^- \rightarrow \text{hadrons}$
0.552 ± 0.031 ± 0.017	⁵ BARU	96	MD1 $e^+ e^- \rightarrow \text{hadrons}$
0.54 ± 0.04 ± 0.02	⁵ JAKUBOWSKI	88	CBAL $e^+ e^- \rightarrow \text{hadrons}$
0.58 ± 0.03 ± 0.04	⁶ GILES	84B	CLEO $e^+ e^- \rightarrow \text{hadrons}$
0.60 ± 0.12 ± 0.07	⁶ ALBRECHT	82	DASP $e^+ e^- \rightarrow \text{hadrons}$
0.54 ± 0.07 ^{+0.09} _{-0.05}	⁶ NICZYPORUK	81C	LENA $e^+ e^- \rightarrow \text{hadrons}$
0.41 ± 0.18	⁶ BOCK	80	CNTR $e^+ e^- \rightarrow \text{hadrons}$

NODE=M052G2
NODE=M052G2⁵ Radiative corrections evaluated following KURAEV 85.⁶ Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.NODE=M052G2;LINKAGE=P
NODE=M052G2;LINKAGE=R **$\Upsilon(2S)$ PARTIAL WIDTHS**

NODE=M052220

 $\Gamma(e^+ e^-)$ **Γ_5**

VALUE (keV)	DOCUMENT ID
0.612 ± 0.011 OUR EVALUATION	

NODE=M052W2
NODE=M052W2

→ NOT CHECKED ←

 $\Upsilon(2S)$ BRANCHING RATIOS

NODE=M052225

 $\Gamma(\Upsilon(1S) \pi^+ \pi^-) / \Gamma_{\text{total}}$ **Γ_1 / Γ**

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
17.92 ± 0.26 OUR AVERAGE				
[(18.1 ± 0.4) × 10 ⁻² OUR 2011 AVERAGE]				
16.8 ± 1.1 ± 1.3	906k	⁷ LEES	11C	BABR $e^+ e^- \rightarrow \pi^+ \pi^- X$
17.80 ± 0.05 ± 0.37	170k	⁸ LEES	11L	BABR $\Upsilon(2S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$
18.02 ± 0.02 ± 0.61	851k	⁹ BHARI	09	CLEO $e^+ e^- \rightarrow \pi^+ \pi^- \text{MM}$
17.22 ± 0.17 ± 0.75	11.8K	¹⁰ AUBERT	08BP	BABR $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$
19.2 ± 0.2 ± 1.0	52.6k	¹¹ 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		BESSION	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

NEW

⁷ 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.⁸ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.⁹ A weighted average of the inclusive and exclusive results.¹⁰ 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.¹¹ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R4;LINKAGE=ES

NODE=M052R4;LINKAGE=LE
NODE=M052R4;LINKAGE=BH
NODE=M052R4;LINKAGE=AU

NODE=M052R4;LINKAGE=T

$\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6 ± 0.4 OUR AVERAGE				
8.43 ± 0.16 ± 0.42	38k	¹² BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.2 ± 0.6 ± 0.8	275	¹³ ALEXANDER	98 CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.5 ± 1.9 ± 1.9	25	ALBRECHT	87 ARG	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
8.0 ± 1.5		GELPHMAN	85 CBAL	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
10.3 ± 2.3		FONSECA	84 CUSB	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

¹² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.¹³ 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 ± 0.037	¹⁴ BHARI	09 CLEO	$e^+e^- \rightarrow \Upsilon(2S)$

¹⁴ Not independent of other values reported by BHARI 09.NODE=M052R21
NODE=M052R21

NODE=M052R21;LINKAGE=BH

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_3/Γ

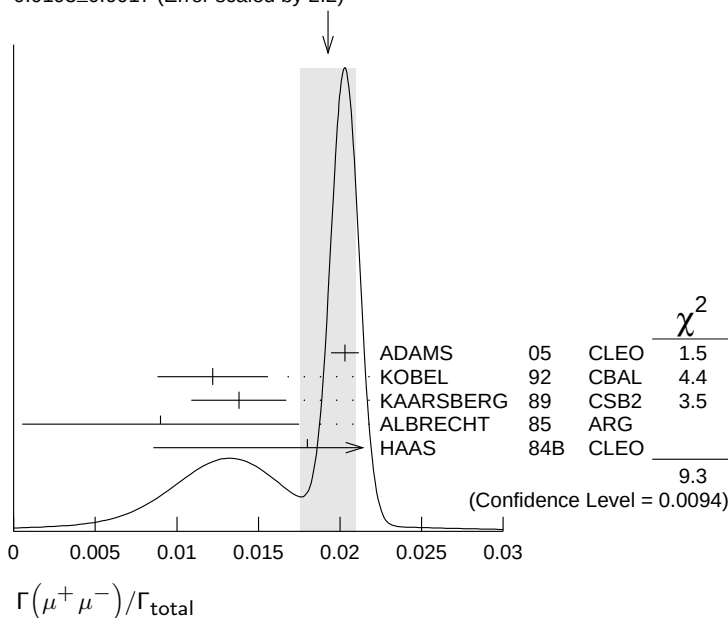
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00 ± 0.21 OUR AVERAGE				
2.00 ± 0.12 ± 0.18	22k	¹⁵ BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(2S) \rightarrow \tau^+\tau^-$
1.7 ± 1.5 ± 0.6		HAAS	84B CLEO	$e^+e^- \rightarrow \tau^+\tau^-$

¹⁵ BESSON 07 reports $[\Gamma(\Upsilon(2S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = 1.04 \pm 0.04 \pm 0.05$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M052R3
NODE=M052R3

NODE=M052R3;LINKAGE=BE

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.0193 ± 0.0017 OUR AVERAGE					Error includes scale factor of 2.2. See the ideogram below.
0.0203 ± 0.0003 ± 0.0008		120k	ADAMS	05 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0122 ± 0.0028 ± 0.0019			¹⁶ KOBEL	92 CBAL	$e^+e^- \rightarrow \mu^+\mu^-$
0.0138 ± 0.0025 ± 0.0015			KAARSBERG	89 CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
0.009 ± 0.006 ± 0.006			¹⁷ ALBRECHT	85 ARG	$e^+e^- \rightarrow \mu^+\mu^-$
0.018 ± 0.008 ± 0.005			HAAS	84B CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
< 0.038		90	NICZYPORUK	81C LENA	$e^+e^- \rightarrow \mu^+\mu^-$

¹⁶ Taking into account interference between the resonance and continuum.¹⁷ Re-evaluated using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 0.026$.NODE=M052R1
NODE=M052R1NODE=M052R1;LINKAGE=A
NODE=M052R1;LINKAGE=RWEIGHTED AVERAGE
0.0193 ± 0.0017 (Error scaled by 2.2)

$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
1.04±0.04±0.05	22k	BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(2S)$

 Γ_3/Γ_4

NODE=M052R17
 NODE=M052R17

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.18	90	18 HE	08A	CLEO $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.1	90	ALEXANDER	98	CLE2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<8	90	LURZ	87	CBAL $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

 Γ_6/Γ

NODE=M052R10
 NODE=M052R10

¹⁸ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M052R10;LINKAGE=HE

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.34±0.31 OUR AVERAGE					
[(0.21 ^{+0.08} _{-0.07}) × 10 ⁻³ OUR 2011 AVERAGE]					
2.39±0.31±0.14	112	¹⁹ LEES	11L	BABR	$\Upsilon(2S) \rightarrow \ell^+\ell^-\eta$
2.1 ^{+0.7} _{-0.6} ±0.3	14	²⁰ HE	08A	CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

 Γ_7/Γ

NODE=M052R6
 NODE=M052R6
 NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 9	90	^{19,21} 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	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, \pi^+\pi^-\pi^0)$

¹⁹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

²⁰ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

²¹ Using $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

NODE=M052R6;LINKAGE=AU

NODE=M052R6;LINKAGE=HE
 NODE=M052R6;LINKAGE=UB

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
1.35±0.17±0.08		²² LEES	11L	BABR $\Upsilon(2S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\mu^+\mu^-$
<5.2	90	²³ AUBERT	08BP	BABR $e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

 Γ_7/Γ_1

NODE=M052R22
 NODE=M052R22

²² Not independent of other values reported by LEES 11L.

²³ Not independent of other values reported by AUBERT 08BP.

NODE=M052R22;LINKAGE=LE
 NODE=M052R22;LINKAGE=AU

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.006	90	MASCHMANN	90	CBAL $e^+e^- \rightarrow \text{hadrons}$

 Γ_8/Γ

NODE=M052R16
 NODE=M052R16

 $\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.37±0.50±0.25	58	ASNER	07	CLEO $e^+e^- \rightarrow \bar{d}X$

 Γ_9/Γ

NODE=M052R18
 NODE=M052R18

 $\Gamma(ggg)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
58.8±1.2	6M	²⁴ BESSON	06A	CLEO $\Upsilon(2S) \rightarrow \text{hadrons}$

 Γ_{11}/Γ

NODE=M052R01
 NODE=M052R01

²⁴ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ from BESSON 06A and PDG 08 values of $B(\pi^+\pi^-\Upsilon(1S)) = (18.1 \pm 0.4)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (8.6 \pm 0.4)\%$, $B(\mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R01;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
8.79±1.05	100k	²⁵ BESSON	06A	CLEO $\Upsilon(2S) \rightarrow \gamma + \text{hadrons}$

 Γ_{12}/Γ

NODE=M052R02
 NODE=M052R02

²⁵ Calculated using BESSON 06A values of $\Gamma(\gamma gg)/\Gamma(ggg) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ and $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R02;LINKAGE=BE

$\Gamma(\gamma g g)/\Gamma(g g g)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.18 \pm 0.04 \pm 0.47$	6M	BESSON	06A CLEO	$\Upsilon(2S) \rightarrow (\gamma +) \text{ hadrons}$

 Γ_{12}/Γ_{11}

NODE=M052R03
 NODE=M052R03

 $\Gamma(\gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$

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	$e^+ e^- \rightarrow \gamma X$

 Γ_{13}/Γ

NODE=M052R8
 NODE=M052R8

 $\Gamma(\gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$

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	$e^+ e^- \rightarrow \gamma X$

 Γ_{14}/Γ

NODE=M052R7
 NODE=M052R7

 $\Gamma(\gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.038 ± 0.004 OUR AVERAGE				
$0.0375 \pm 0.0012 \pm 0.0047$	198k	ARTUSO	05 CLEO	$e^+ e^- \rightarrow \gamma X$
$0.034 \pm 0.005 \pm 0.006$		EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
$0.064 \pm 0.014 \pm 0.016$		ALBRECHT	85E ARG	$e^+ e^- \rightarrow \gamma \text{ conv. } X$
$0.036 \pm 0.008 \pm 0.009$		NERNST	85 CBAL	$e^+ e^- \rightarrow \gamma X$
$0.044 \pm 0.023 \pm 0.009$		HAAS	84 CLEO	$e^+ e^- \rightarrow \gamma \text{ conv. } X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.035 ± 0.014		KLOPFEN...	83 CUSB	$e^+ e^- \rightarrow \gamma X$

 Γ_{15}/Γ

NODE=M052R9
 NODE=M052R9

 $\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<59	90	²⁶ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 5.9	90	²⁷ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$
²⁶ Re-evaluated assuming $B(f_0(1710) \rightarrow K^+ K^-) = 0.19$.				
²⁷ Includes unknown branching ratio of $f_0(1710) \rightarrow \pi^+ \pi^-$.				

 Γ_{16}/Γ

NODE=M052R13
 NODE=M052R13

OCCUR=2

NODE=M052R13;LINKAGE=M
 NODE=M052R13;LINKAGE=N

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<53	90	²⁸ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$
²⁸ Re-evaluated assuming $B(f'_2(1525) \rightarrow K \bar{K}) = 0.71$.				

 Γ_{17}/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	²⁹ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$
²⁹ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.				

 Γ_{18}/Γ

NODE=M052R11
 NODE=M052R11

NODE=M052R11;LINKAGE=K

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6.8	90	³⁰ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$
³⁰ Includes unknown branching ratio of $f_J(2220) \rightarrow K^+ K^-$.				

 Γ_{19}/Γ

NODE=M052R14
 NODE=M052R14

NODE=M052R14;LINKAGE=S

$\Gamma(\gamma\eta_b(1S))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVS	DOCUMENT ID	TECN	COMMENT	Γ_{29}/Γ
$3.9 \pm 1.1^{+1.1}_{-0.9}$		$13 \pm 5k$	³¹ AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R15
NODE=M052R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90		LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$	
< 8.4	90		³¹ BONVICINI	10 CLEO	$\Upsilon(2S) \rightarrow \gamma X$	
< 5.1	90		³² ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$	

³¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.

³² Superseded by BONVICINI 10.

NODE=M052R15;LINKAGE=BO
NODE=M052R15;LINKAGE=SU

 $\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{20}/Γ
$<2.7 \times 10^{-5}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R31
NODE=M052R31

 $\Gamma(\gamma X_{c0})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{21}/Γ
$<1.0 \times 10^{-4}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R32
NODE=M052R32

 $\Gamma(\gamma X_{c1})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{22}/Γ
$<3.6 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R33
NODE=M052R33

 $\Gamma(\gamma X_{c2})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{23}/Γ
$<1.5 \times 10^{-5}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R34
NODE=M052R34

 $\Gamma(\gamma X(3872) \rightarrow \pi^+\pi^- J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{24}/Γ
$<0.8 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R35
NODE=M052R35

 $\Gamma(\gamma X(3872) \rightarrow \pi^+\pi^-\pi^0 J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{25}/Γ
$<2.4 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R36
NODE=M052R36

 $\Gamma(\gamma X(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{26}/Γ
$<2.8 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R37
NODE=M052R37

 $\Gamma(\gamma X(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{27}/Γ
$<1.2 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R38
NODE=M052R38

 $\Gamma(\gamma X(4350) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{28}/Γ
$<1.3 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$	

NODE=M052R39
NODE=M052R39

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$

($1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{30}/Γ
<1.95	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$	

NODE=M052R19
NODE=M052R19
NODE=M052R19

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$

($0.3 \text{ GeV} < m_{A^0} < 7 \text{ GeV}$)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{31}/Γ
$<8 \times 10^{-5}$	90	³³ LEES	11H BABR	$\Upsilon(2S) \rightarrow \gamma \text{hadrons}$	

NODE=M052R06
NODE=M052R06
NODE=M052R06

³³ 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

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M052230

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{32}/Γ
<3.2	90	LEES	10B BABR	$e^+e^- \rightarrow e^\pm \tau^\mp$	

NODE=M052R04
NODE=M052R04

$\Gamma(\mu^\pm\tau^\mp)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.3	90	LEES	10B BABR	$e^+e^- \rightarrow \mu^\pm\tau^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<14.4	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm\tau^\mp$

NODE=M052R20
 NODE=M052R20

 $\tau(2S)$ Cross-Particle Branching Ratios

NODE=M052240

 $B(\tau(2S) \rightarrow \pi^+\pi^-) \times B(\tau(3S) \rightarrow \tau(2S)X)$

NODE=M052R05
 NODE=M052R05

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.78 \pm 0.02 \pm 0.11$	906k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

 $\tau(2S)$ REFERENCES

NODE=M052

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 031104R	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
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52587
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
BESSON	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
BESSON	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)	REFID=44651
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)	REFID=41861
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)	REFID=41224
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40731
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	REFID=40733
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)	REFID=40034
Editors: A. Ali and P. Soeding, World Scientific, Singapore					
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.)	REFID=40742
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40016
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
LURZ	87	ZPHY C36 383	B. Lurz <i>et al.</i>	(Crystal Ball Collab.)	REFID=40021
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
ALBRECHT	85	ZPHY C28 45	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22334
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
GELPHMAN	85	PR D32 2893	D. Gelphman <i>et al.</i>	(Crystal Ball Collab.)	REFID=22336
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
BARBER	84	PL 135B 498	D.P. Barber <i>et al.</i>	(DESY, ARGUS Collab.+)	REFID=22327
BESSON	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22279
FONSECA	84	NP B242 31	V. Fonseca <i>et al.</i>	(CUSB Collab.)	REFID=22329
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
HAAS	84B	PR D30 1996	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22332
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)	REFID=22270
NICZYPORUK	81B	PL 100B 95	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22319
NICZYPORUK	81C	PL 99B 169	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22318
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)	REFID=22264

$\Upsilon(1D)$

$I^G(J^{PC}) = 0^-(2^{--})$

First observed by BONVICINI 04 in the decay to $\gamma\gamma \Upsilon(1S)$ and confirmed by DEL-AMO-SANCHEZ 10R in the decay to $\pi^+\pi^-\Upsilon(1S)$.
Data consistent with $J^P = 2^-$. The states with $J = 1$ and 3 also possibly seen, but need confirmation.

NODE=M177

NODE=M177

$\Upsilon(1D)$ MASS

NODE=M177M

NODE=M177M

VALUE (MeV)	EVS	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	$\Upsilon(3S) \rightarrow \gamma X$
10161.1±0.6±1.6	38	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow \gamma X$

$\Upsilon(1D)$ DECAY MODES

NODE=M177215;NODE=M177

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \gamma\gamma \Upsilon(1S)$	seen
$\Gamma_2 \quad \gamma\chi_{bJ}(1P)$	
$\Gamma_3 \quad \eta \Upsilon(1S)$	
$\Gamma_4 \quad \pi^+\pi^-\Upsilon(1S)$	

DESIG=1;OUR EVAL;→ NOT CHECKED ←
DESIG=2
DESIG=3
DESIG=4

$\Upsilon(1D)$ BRANCHING RATIOS

NODE=M177225

$\Gamma(\eta \Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$				Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.25	90	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow \gamma X$

NODE=M177R01
NODE=M177R01

$\Gamma(\pi^+\pi^-\Upsilon(1S))/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE (units 10^{-2})		DOCUMENT ID	TECN	COMMENT

NODE=M177R03
NODE=M177R03

• • • We do not use the following data for averages, fits, limits, etc. • • •
 $0.66^{+0.15}_{-0.14} \pm 0.06$ ¹ DEL-AMO-SA...10R BABR $\Upsilon(3S) \rightarrow \gamma X$
¹ Using theoretical predictions for $B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(1D))$.

NODE=M177R03;LINKAGE=DE

$\Gamma(\pi^+\pi^-\Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$				Γ_4/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	² BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow \gamma X$

² Assuming $J = 2$.

NODE=M177R02
NODE=M177R02

NODE=M177R02;LINKAGE=BO

$\Upsilon(1D)$ REFERENCES

NODE=M177

DEL-AMO-SA... 10R	PR D82 111102	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
BONVICINI 04	PR D70 032001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)

REFID=53634
REFID=49759

$\chi_{b0}(2P)$

$$J^G(J^{PC}) = 0^+(0^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M079

NODE=M079

 $\chi_{b0}(2P)$ MASS

VALUE (GeV)

DOCUMENT ID

10.2325 ± 0.0004 ± 0.0005 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M079M

NODE=M079M

→ NOT CHECKED ←

 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

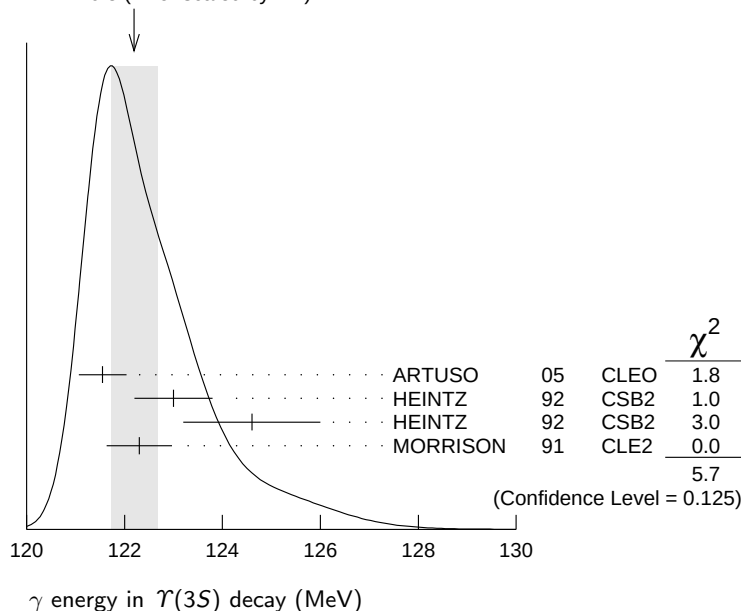
→ NOT CHECKED ←

OCCUR=2

NODE=M079DM;LINKAGE=A

NODE=M079DM;LINKAGE=B

WEIGHTED AVERAGE
122.2 ± 0.5 (Error scaled by 1.4)

 **$\chi_{b0}(2P)$ DECAY MODES**

NODE=M079215;NODE=M079

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(2S)$	$(4.6 \pm 2.1) \%$	DESIG=2
$\Gamma_2 \quad \gamma \Upsilon(1S)$	$(9 \pm 6) \times 10^{-3}$	DESIG=1
$\Gamma_3 \quad D^0 X$	$< 8.2 \%$	90% DESIG=3
$\Gamma_4 \quad \pi^+ \pi^- K^+ K^- \pi^0$	$< 3.4 \times 10^{-5}$	90% DESIG=4
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0$	$< 5 \times 10^{-5}$	90% DESIG=5
$\Gamma_6 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 2.2 \times 10^{-4}$	90% DESIG=6
$\Gamma_7 \quad 2\pi^+ 2\pi^- 2\pi^0$	$< 2.4 \times 10^{-4}$	90% DESIG=7
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^-$	$< 1.5 \times 10^{-4}$	90% DESIG=8

Γ_9	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.2	$\times 10^{-4}$	90%	DESIG=9
Γ_{10}	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 1.1	$\times 10^{-3}$	90%	DESIG=10
Γ_{11}	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=11
Γ_{12}	$3\pi^+ 3\pi^-$	< 7	$\times 10^{-5}$	90%	DESIG=12
Γ_{13}	$3\pi^+ 3\pi^- 2\pi^0$	< 1.2	$\times 10^{-3}$	90%	DESIG=13
Γ_{14}	$3\pi^+ 3\pi^- K^+ K^-$	< 1.5	$\times 10^{-4}$	90%	DESIG=14
Γ_{15}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=15
Γ_{16}	$4\pi^+ 4\pi^-$	< 1.7	$\times 10^{-4}$	90%	DESIG=16
Γ_{17}	$4\pi^+ 4\pi^- 2\pi^0$	< 6	$\times 10^{-4}$	90%	DESIG=17

$\chi_{b0}(2P)$ BRANCHING RATIOS

NODE=M079220

$\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$

 Γ_1/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$0.046 \pm 0.020 \pm 0.007$		³ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

NODE=M079R2
NODE=M079R2

• • • 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;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	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

NODE=M079R1
NODE=M079R1

• • • 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;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	$\Upsilon(3S) \rightarrow \gamma D^0 X$

NODE=M079R01
NODE=M079R01

⁹ For $p_{D^0} > 2.5$ GeV/c.

¹⁰ The authors also present their result as $(4.1 \pm 3.0 \pm 0.4) \times 10^{-2}$.

NODE=M079R01;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	$\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

NODE=M079R02
NODE=M079R02

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;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	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

NODE=M079R03
NODE=M079R03

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;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	13 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
13 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 13×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R04
 NODE=M079R04

NODE=M079R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	14 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
14 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 14×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R05
 NODE=M079R05

NODE=M079R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	15 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
15 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 9×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R06
 NODE=M079R06

NODE=M079R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
16 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 13×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R07
 NODE=M079R07

NODE=M079R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
17 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 63×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R08
 NODE=M079R08

NODE=M079R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
18 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 39×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R09
 NODE=M079R09

NODE=M079R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-$
19 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 4×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R10
 NODE=M079R10

NODE=M079R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$
20 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 72×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R11
 NODE=M079R11

NODE=M079R11;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-K^+K^-$
21 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))]$ < 9×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R12
 NODE=M079R12

NODE=M079R12;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 22 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 43 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R13
 NODE=M079R13

NODE=M079R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 23 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 10 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R14
 NODE=M079R14

NODE=M079R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 24 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 38 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R15
 NODE=M079R15

NODE=M079R15;LINKAGE=AS

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	25 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$ 25 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) < 1.2\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.

NODE=M079B01
 NODE=M079B01

NODE=M079B01;LINKAGE=LE

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_1/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.2	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

VALUE (GeV)	DOCUMENT ID
10.25546±0.00022±0.00050 OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M080M

NODE=M080M
→ NOT CHECKED ←

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$

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.			

NODE=M080M2

NODE=M080M2

NODE=M080M2;LINKAGE=A

γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
99.26±0.22 OUR EVALUATION		Treating systematic errors as correlated		
99.53±0.23 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
99.15±0.07±0.25		ARTUSO	05 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
99 ±1	169	CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
100.1 ±0.4	11147	² HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
100.2 ±0.5	223	³ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
99.5 ±0.1 ±0.5	25759	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$
² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.				
³ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.				

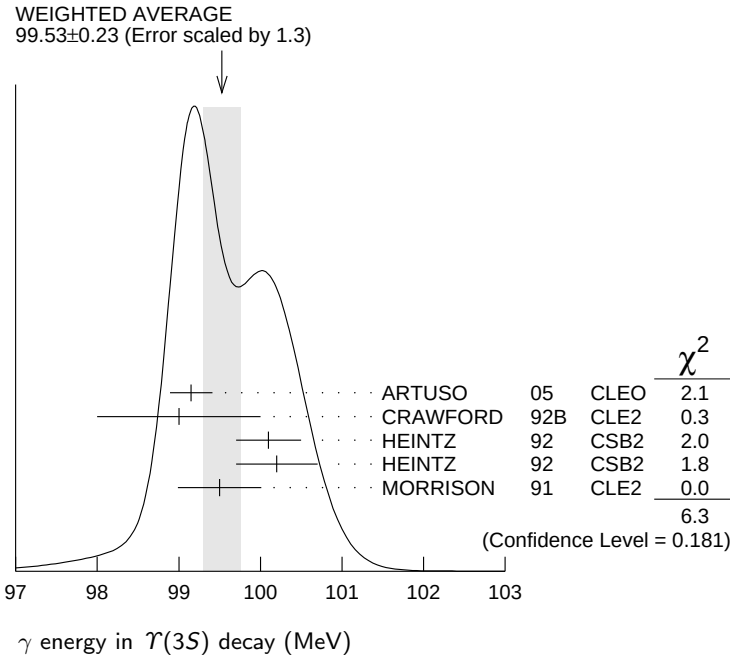
NODE=M080DM

NODE=M080DM
→ NOT CHECKED ←

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
$\Gamma_1 \quad \omega \mathcal{T}(1S)$	$(1.63^{+0.40}_{-0.34})\%$	
$\Gamma_2 \quad \gamma \mathcal{T}(2S)$	$(19.9 \pm 1.9)\%$	
$\Gamma_3 \quad \gamma \mathcal{T}(1S)$	$(9.2 \pm 0.8)\%$	1.1
$\Gamma_4 \quad \pi\pi\chi_{b1}(1P)$	$(9.1 \pm 1.3) \times 10^{-3}$	
$\Gamma_5 \quad D^0 X$	$(8.8 \pm 1.7)\%$	
$\Gamma_6 \quad \pi^+\pi^-K^+K^-\pi^0$	$(3.1 \pm 1.0) \times 10^{-4}$	
$\Gamma_7 \quad 2\pi^+\pi^-K^-K_S^0$	$(1.1 \pm 0.5) \times 10^{-4}$	
$\Gamma_8 \quad 2\pi^+\pi^-K^-K_S^0 2\pi^0$	$(7.7 \pm 3.2) \times 10^{-4}$	
$\Gamma_9 \quad 2\pi^+2\pi^-2\pi^0$	$(5.9 \pm 2.0) \times 10^{-4}$	
$\Gamma_{10} \quad 2\pi^+2\pi^-K^+K^-$	$(10 \pm 4) \times 10^{-5}$	
$\Gamma_{11} \quad 2\pi^+2\pi^-K^+K^-\pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$	
$\Gamma_{12} \quad 2\pi^+2\pi^-K^+K^-2\pi^0$	$(10 \pm 4) \times 10^{-4}$	
$\Gamma_{13} \quad 3\pi^+2\pi^-K^-K_S^0\pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$	
$\Gamma_{14} \quad 3\pi^+3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$	
$\Gamma_{15} \quad 3\pi^+3\pi^-2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	
$\Gamma_{16} \quad 3\pi^+3\pi^-K^+K^-$	$(2.0 \pm 0.8) \times 10^{-4}$	
$\Gamma_{17} \quad 3\pi^+3\pi^-K^+K^-\pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$	
$\Gamma_{18} \quad 4\pi^+4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$	
$\Gamma_{19} \quad 4\pi^+4\pi^-2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$	

DESIG=3

DESIG=2

DESIG=1

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

 $\chi_{b1}(2P)$ 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				
[0.21 $\pm$ 0.04 OUR 2011 AVERAGE Scale factor = 1.5]				
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

NEW

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. [0.085 $\pm$ 0.013 OUR 2011 AVERAGE Scale factor = 1.3]				
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

NEW

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[(8.6 ± 3.1) × 10⁻³ OUR 2011 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 $\Gamma(\chi_{b1}(2P) \rightarrow \pi\pi\chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ 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
 NEW

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
$5.5 \pm 1.7 \pm 0.5$	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

$$\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_{19}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
19±7±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

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
12.4±0.3±0.6	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M080B01
 NODE=M080B01

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_2/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
2.4±0.1±0.2	4.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M080B02
 NODE=M080B02

$$B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X)$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.16±0.07±0.12	31k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M080R16
 NODE=M080R16

$$B(\chi_{b2}(2P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(2P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
1.109±0.007±0.040	BRIERE	07 CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

NODE=M080R20
 NODE=M080R20

$$B(\chi_{b0}(2P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(2P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
1.082±0.025±0.060	BRIERE	07 CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

NODE=M080R21
 NODE=M080R21

$\chi_{b1}(2P)$ REFERENCES

NODE=M080

LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51887
CRAWFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)	REFID=50997
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
CRONIN-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

$h_b(2P)$

$$J^{PC} = ?^?(1^{+-})$$

OMITTED FROM SUMMARY TABLE

Quantum numbers are quark model predictions.

 $h_b(2P)$ MASS

VALUE (GeV)	EVTS	DOCUMENT ID	TECN	COMMENT

10.2598^{+0.0015}_{-0.0012} OUR AVERAGE

10.246 ± 0.05	± 0.018	¹ AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- + X$
10.2598 ± 0.0006	^{+0.0014} _{-0.0010} 83.9k	ADACHI	12 BELL	10.86 $e^+ e^- \rightarrow \pi^+ \pi^-$ MM

¹ The mass barycenter of the merged lineshapes from $J = 0, 1$, and 2 states, assuming a hyperfine splitting of 12 MeV.

 $h_b(2P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	not seen

 $h_b(2P)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$	Γ_1/Γ
not seen	83.9k

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	83.9k	ADACHI	12 BELL	10.86 $e^+ e^- \rightarrow \pi^+ \pi^-$ MM

 $h_b(2P)$ REFERENCES

AAD	12A	PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)

 $\chi_{b2}(2P)$

$$J^{PC} = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

 $\chi_{b2}(2P)$ MASS

VALUE (GeV)	DOCUMENT ID
10.26865 ± 0.00022 ± 0.00050 OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

 $m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
13.5 ± 0.4 ± 0.5	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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
86.19 ± 0.22 OUR EVALUATION				Treating systematic errors as correlated
86.40 ± 0.18 OUR AVERAGE				
86.04 ± 0.06 ± 0.27		ARTUSO	05 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
86 ± 1	101	CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
86.7 ± 0.4	10319	² HEINTZ	92 CSB2	$e^+ e^- \rightarrow \gamma X$
86.9 ± 0.4	157	³ HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
86.4 ± 0.1 ± 0.4	30741	MORRISON	91 CLE2	$e^+ e^- \rightarrow \gamma X$

NODE=M205

NODE=M205

NODE=M205M

NODE=M205M

NODE=M205M;LINKAGE=AA

NODE=M205215;NODE=M205

DESIG=1

NODE=M205225

NODE=M205R01
NODE=M205R01

NODE=M205

REFID=54037
REFID=53962

NODE=M081

NODE=M081

NODE=M081M

NODE=M081M
→ NOT CHECKED ←

NODE=M081M2

NODE=M081M2

NODE=M081M2;LINKAGE=A

NODE=M081DM

NODE=M081DM
→ NOT CHECKED ←

OCCUR=2

²A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.

³A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M081DM;LINKAGE=A

NODE=M081DM;LINKAGE=B

$\chi_{b2}(2P)$ DECAY MODES

NODE=M081215;NODE=M081

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \omega \Upsilon(1S)$	$(1.10^{+0.34}_{-0.30})\%$	
$\Gamma_2 \quad \gamma \Upsilon(2S)$	$(10.6 \pm 2.6)\%$	S=2.0
$\Gamma_3 \quad \gamma \Upsilon(1S)$	$(7.0 \pm 0.7)\%$	
$\Gamma_4 \quad \pi\pi\chi_{b2}(1P)$	$(5.1 \pm 0.9) \times 10^{-3}$	
$\Gamma_5 \quad D^0 X$	$< 2.4\%$	CL=90%
$\Gamma_6 \quad \pi^+\pi^-K^+K^-\pi^0$	$< 1.1 \times 10^{-4}$	CL=90%
$\Gamma_7 \quad 2\pi^+\pi^-K^-K_S^0$	$< 9 \times 10^{-5}$	CL=90%
$\Gamma_8 \quad 2\pi^+\pi^-K^-K_S^02\pi^0$	$< 7 \times 10^{-4}$	CL=90%
$\Gamma_9 \quad 2\pi^+2\pi^-2\pi^0$	$(3.9 \pm 1.6) \times 10^{-4}$	
$\Gamma_{10} \quad 2\pi^+2\pi^-K^+K^-$	$(9 \pm 4) \times 10^{-5}$	
$\Gamma_{11} \quad 2\pi^+2\pi^-K^+K^-\pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$	
$\Gamma_{12} \quad 2\pi^+2\pi^-K^+K^-2\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$	
$\Gamma_{13} \quad 3\pi^+2\pi^-K^-K_S^0\pi^0$	$< 4 \times 10^{-4}$	CL=90%
$\Gamma_{14} \quad 3\pi^+3\pi^-$	$(9 \pm 4) \times 10^{-5}$	
$\Gamma_{15} \quad 3\pi^+3\pi^-2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	
$\Gamma_{16} \quad 3\pi^+3\pi^-K^+K^-$	$(1.4 \pm 0.7) \times 10^{-4}$	
$\Gamma_{17} \quad 3\pi^+3\pi^-K^+K^-\pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$	
$\Gamma_{18} \quad 4\pi^+4\pi^-$	$(9 \pm 5) \times 10^{-5}$	
$\Gamma_{19} \quad 4\pi^+4\pi^-2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$	

DESIG=3

DESIG=2

DESIG=1

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

$\chi_{b2}(2P)$ BRANCHING RATIOS

NODE=M081220

$\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE (units 10^{-2})	EVTS
$1.10^{+0.32+0.11}_{-0.28-0.10}$	$20.1^{+5.8}_{-5.1}$
	4 CRONIN-HEN..04 CLE3 $\Upsilon(3S) \rightarrow \gamma\omega \Upsilon(1S)$

NODE=M081R3
NODE=M081R3

⁴Using $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = (11.4 \pm 0.8)\%$ 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
0.106$\pm$0.026 OUR AVERAGE	Error includes scale factor of 2.0. See the ideogram below.
	[0.162 $\pm$ 0.024 OUR 2011 AVERAGE]
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
NEW

⁵LEES 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.

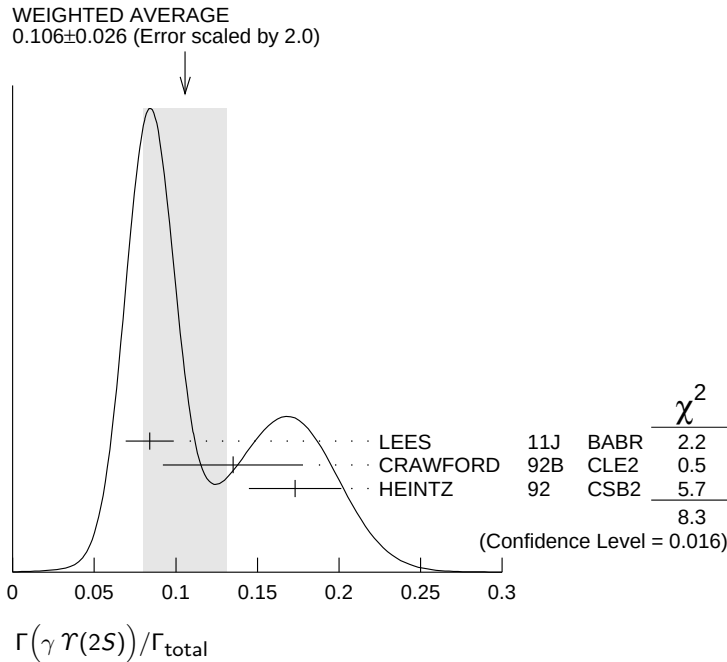
NODE=M081R2;LINKAGE=LE

⁶Using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma\gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (4.98 \pm 0.94 \pm 0.62) \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$.

NODE=M081R2;LINKAGE=B

⁷Using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$, $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = (11.1 \pm 0.5 \pm 0.4)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M081R2;LINKAGE=C



$\Gamma(\gamma\Upsilon(1S))/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
0.070±0.007 OUR AVERAGE					
[0.071 ± 0.010 OUR 2011 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	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$	

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.

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 $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$.

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
NODE=M081R1
NEW

NODE=M081R1;LINKAGE=LE

NODE=M081R1;LINKAGE=B

NODE=M081R1;LINKAGE=C

$\Gamma(\pi\pi\chi_{b2}(1P))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ
5.1±0.9 OUR AVERAGE					
[(6.0 ± 2.1) × 10 ⁻³ OUR 2011 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	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$	

¹¹ (0.64 ± 0.05 ± 0.08) × 10⁻³. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)\gamma) = (13.1 \pm 1.6) \times 10^{-2}$.

¹² CAWLFIELD 06 quote $\Gamma(\chi_{b2}(2P) \rightarrow \pi\pi\chi_{b1}(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M081R4
NODE=M081R4
NEW

NODE=M081R4;LINKAGE=LE

NODE=M081R4;LINKAGE=CA

$\Gamma(D^0X)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
<2.4 × 10⁻²	90	13,14 BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0X$	

¹³ For $p_{D^0} > 2.5$ GeV/c.

¹⁴ The authors also present their result as $(0.2 \pm 1.4 \pm 0.1) \times 10^{-2}$.

NODE=M081R01
NODE=M081R01

NODE=M081R01;LINKAGE=BR
NODE=M081R01;LINKAGE=RI

$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
<1.1	90	¹⁵ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$	

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
NODE=M081R02

NODE=M081R02;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$
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
 NODE=M081R03

NODE=M081R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
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
 NODE=M081R04

NODE=M081R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.9 \pm 1.6 \pm 0.5$	23	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
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
 NODE=M081R05

NODE=M081R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.9 \pm 0.4 \pm 0.1$	11	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
$2.4 \pm 1.0 \pm 0.3$	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
$4.7 \pm 2.2 \pm 0.6$	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
$0.9 \pm 0.4 \pm 0.1$	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
$12 \pm 4 \pm 1$	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
$1.4 \pm 0.7 \pm 0.2$	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
$4.2 \pm 1.7 \pm 0.5$	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	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
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
 NODE=M081R14

NODE=M081R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$13 \pm 5 \pm 2$	27	²⁸ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
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
 NODE=M081R15

NODE=M081R15;LINKAGE=AS

 $\chi_{b2}(2P)$ Cross-Particle Branching Ratios

NODE=M081230

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}} \times \Gamma_3/\Gamma \times \Gamma_{19}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

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

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}} \times \Gamma_2/\Gamma \times \Gamma_{19}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

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

$$B(\chi_{b2}(2P) \rightarrow \chi_{b2}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X)$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.64 \pm 0.05 \pm 0.08$	17k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

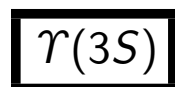
NODE=M081R16
 NODE=M081R16

$\chi_{b2}(2P)$ REFERENCES

LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRONIN-HEN...	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford, 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=M081

REFID=16775
REFID=53936
REFID=52574
REFID=52577
REFID=50997
REFID=50454
REFID=49766
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586



$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M048

 $\Upsilon(3S)$ MASS

NODE=M048M

VALUE (GeV)	DOCUMENT ID	TECN	COMMENT
10.3552$\pm$0.0005	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.3553 $\pm$ 0.0005	^{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$\pm$0.02$\pm$0.13	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M048DM2

 $\Upsilon(3S)$ WIDTH

NODE=M048W

VALUE (keV)	DOCUMENT ID
20.32$\pm$1.85 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M048W
→ NOT CHECKED ←

 $\Upsilon(3S)$ DECAY MODES

NODE=M048215;NODE=M048

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\Upsilon(2S)$ anything	(10.6 $\pm$ 0.8) %	
Γ_2 $\Upsilon(2S)\pi^+\pi^-$	(2.82 $\pm$ 0.18) %	S=1.6
Γ_3 $\Upsilon(2S)\pi^0\pi^0$	(1.85 $\pm$ 0.14) %	
Γ_4 $\Upsilon(2S)\gamma\gamma$	(5.0 $\pm$ 0.7) %	
Γ_5 $\Upsilon(2S)\pi^0$	< 5.1 $\times 10^{-4}$	CL=90%
Γ_6 $\Upsilon(1S)\pi^+\pi^-$	(4.37 $\pm$ 0.08) %	
Γ_7 $\Upsilon(1S)\pi^0\pi^0$	(2.20 $\pm$ 0.13) %	
Γ_8 $\Upsilon(1S)\eta$	< 1 $\times 10^{-4}$	CL=90%
Γ_9 $\Upsilon(1S)\pi^0$	< 7 $\times 10^{-5}$	CL=90%
Γ_{10} $h_b(1P)\pi^0$	< 1.2 $\times 10^{-3}$	CL=90%
Γ_{11} $h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	(4.3 $\pm$ 1.4) $\times 10^{-4}$	
Γ_{12} $h_b(1P)\pi^+\pi^-$	< 1.2 $\times 10^{-4}$	CL=90%
Γ_{13} $\tau^+\tau^-$	(2.29 $\pm$ 0.30) %	
Γ_{14} $\mu^+\mu^-$	(2.18 $\pm$ 0.21) %	S=2.1
Γ_{15} e^+e^-	seen	
Γ_{16} hadrons		
Γ_{17} ggg	(35.7 $\pm$ 2.6) %	
Γ_{18} γgg	(9.7 $\pm$ 1.8) $\times 10^{-3}$	

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;→ NOT CHECKED ←
DESIG=101
DESIG=109
DESIG=110

Radiative decays

Γ_{19}	$\gamma\chi_{b2}(2P)$	$(13.1 \pm 1.6) \%$	$S=3.4$
Γ_{20}	$\gamma\chi_{b1}(2P)$	$(12.6 \pm 1.2) \%$	$S=2.4$
Γ_{21}	$\gamma\chi_{b0}(2P)$	$(5.9 \pm 0.6) \%$	$S=1.4$
Γ_{22}	$\gamma\chi_{b2}(1P)$	$(7.6 \pm 1.4) \times 10^{-3}$	
Γ_{23}	$\gamma A^0 \rightarrow \gamma \text{hadrons}$	$< 8 \times 10^{-5}$	$CL=90\%$
Γ_{24}	$\gamma\chi_{b1}(1P)$	$(1.6 \pm 0.5) \times 10^{-3}$	
Γ_{25}	$\gamma\chi_{b0}(1P)$	$(3.0 \pm 1.1) \times 10^{-3}$	
Γ_{26}	$\gamma\eta_b(2S)$	$< 6.2 \times 10^{-4}$	$CL=90\%$
Γ_{27}	$\gamma\eta_b(1S)$	$(5.1 \pm 0.7) \times 10^{-4}$	
Γ_{28}	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	$[a] < 2.2 \times 10^{-4}$	$CL=95\%$
Γ_{29}	$\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$	$[b] < 1.6 \times 10^{-4}$	$CL=90\%$

NODE=M048;CLUMP=B

DESIG=5

DESIG=6

DESIG=7

DESIG=103

DESIG=115

DESIG=104

DESIG=13

DESIG=14

DESIG=15

DESIG=102

DESIG=108

Lepton Family number (LF) violating modes

Γ_{30}	$e^\pm \tau^\mp$	LF	$< 4.2 \times 10^{-6}$	$CL=90\%$
Γ_{31}	$\mu^\pm \tau^\mp$	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		

NODE=M048G2

NODE=M048G2

0.414 ± 0.007 OUR AVERAGE0.413 ± 0.004 ± 0.006 ROSNER 06 CLEO 10.4 $e^+ e^- \rightarrow \text{hadrons}$ 0.45 ± 0.03 ± 0.03 ⁴ GILES 84B CLEO $e^+ e^- \rightarrow \text{hadrons}$ 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	

NODE=M048G01

NODE=M048G01

18.46 ± 0.27 ± 0.77 6.4K ⁵ AUBERT 08BP BABR $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$ ⁵ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M048G01;LINKAGE=AU

 $\Upsilon(3S)$ PARTIAL WIDTHS

NODE=M048220

$\Gamma(e^+ e^-)$					Γ_{15}
VALUE (keV)	DOCUMENT ID				

NODE=M048W2

NODE=M048W2

→ NOT CHECKED ←

0.443 ± 0.008 OUR EVALUATION **$\Upsilon(3S)$ BRANCHING RATIOS**

NODE=M048225

$\Gamma(\Upsilon(2S) \text{anything}) / \Gamma_{\text{total}}$					Γ_1 / Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	

NODE=M048R8

NODE=M048R8

0.106 ± 0.008 OUR AVERAGE0.1023 ± 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 $e^+ e^- \rightarrow \pi^+ \pi^- X, \pi^+ \pi^- \ell^+ \ell^-$ 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

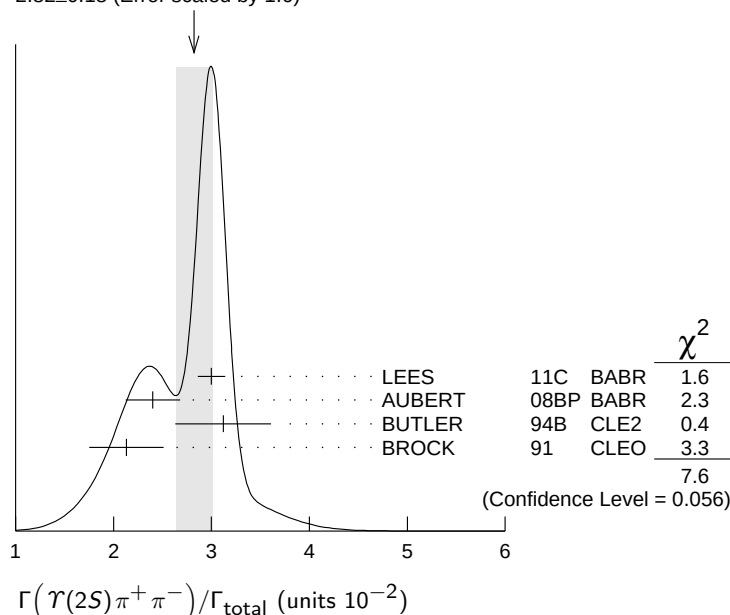
$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

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. [[$(2.45 \pm 0.23) \times 10^{-2}$ OUR 2011 AVERAGE Scale factor = 1.1]
$3.00 \pm 0.02 \pm 0.14$	543k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
$2.40 \pm 0.10 \pm 0.26$	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	$e^+e^- \rightarrow \pi^+\pi^-X,$ $\pi^+\pi^-\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$4.82 \pm 0.65 \pm 0.53$	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 $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.				
¹¹ From the exclusive mode.				
¹² Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.				
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.				

WEIGHTED AVERAGE
 2.82 ± 0.18 (Error scaled by 1.6)

 $\Gamma(\Upsilon(2S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85 ± 0.14 OUR AVERAGE				
$1.82 \pm 0.09 \pm 0.12$	4391	¹⁴ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.16 ± 0.39		^{15,16} BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
$1.7 \pm 0.5 \pm 0.2$	10	¹⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

¹⁴ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.
¹⁵ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$ and assuming $e\mu$ universality.
¹⁶ From the exclusive mode.
¹⁷ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

 $\Gamma(\Upsilon(2S)\gamma\gamma)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0502 ± 0.0069	¹⁸ BUTLER	94B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹⁸ From the exclusive mode.

 $\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.51	90	¹⁹ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹⁹ Authors assume $B(\Upsilon(2S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

NODE=M048R4

NODE=M048R4

NEW

NODE=M048R4;LINKAGE=AU

NODE=M048R;LINKAGE=M

NODE=M048R4;LINKAGE=A

NODE=M048R4;LINKAGE=C

NODE=M048R10

NODE=M048R10

NODE=M048R10;LINKAGE=BH

NODE=M048R;LINKAGE=K

NODE=M048R10;LINKAGE=M

NODE=M048R;LINKAGE=G

NODE=M048R12

NODE=M048R12

NODE=M048R12;LINKAGE=M

NODE=M048R25

NODE=M048R25

NODE=M048R25;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_6/Γ Abbreviation MM in the *COMMENT* field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

4.37±0.08 OUR AVERAGE[(4.40 ± 0.10) × 10⁻² OUR 2011 AVERAGE]

4.32±0.07±0.13	90k	²⁰ LEES	11L BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.01±0.13	190k	²¹ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^+\pi^-$ MM
4.17±0.06±0.19	6.4K	²² AUBERT	08BP BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
4.52±0.35	11830	²³ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$
4.46±0.34±0.50	451	²³ WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.30	11221	²³ BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.9 ±1.0	22	GREEN	82 CLEO	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
3.9 ±1.3	26	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

²⁰ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.²¹ A weighted average of the inclusive and exclusive results.²² Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.²³ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R3

NODE=M048R3
NODE=M048R3

NEW

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ 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=M048R3;LINKAGE=LE

NODE=M048R3;LINKAGE=BH
NODE=M048R3;LINKAGE=AU

NODE=M048R3;LINKAGE=B

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ 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=M048R11NODE=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 (CL = 90%) [$<0.18 \times 10^{-3}$ (CL = 90%) OUR 2011 BEST LIMIT]

<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=M048R9NODE=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 $\times 10^{-3}$	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 $\pm$ 1.1 $\pm$ 0.9	LEES	11K BABR	$\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

NODE=M048R33
NODE=M048R33

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	36 LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18	36 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-X$

<15	36 BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^-X$

36 For $M(h_b(1P)) = 9900$ MeV.

NODE=M048R34
NODE=M048R34

NODE=M048R34;LINKAGE=MH

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.29 $\pm$ 0.21 $\pm$ 0.22	15k	37 BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S) \rightarrow \tau^+\tau^-$

37 BESSON 07 reports $[\Gamma(\Upsilon(3S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(3S) \rightarrow \mu^+\mu^-)] = 1.05 \pm 0.08 \pm 0.05$ which we multiply by our best value $B(\Upsilon(3S) \rightarrow \mu^+\mu^-) = (2.18 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M048R18
NODE=M048R18

NODE=M048R18;LINKAGE=BE

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_{13}/Γ_{14}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.05 $\pm$ 0.08 $\pm$ 0.05	15k	BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

NODE=M048R19
NODE=M048R19

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0218 $\pm$ 0.0021 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.

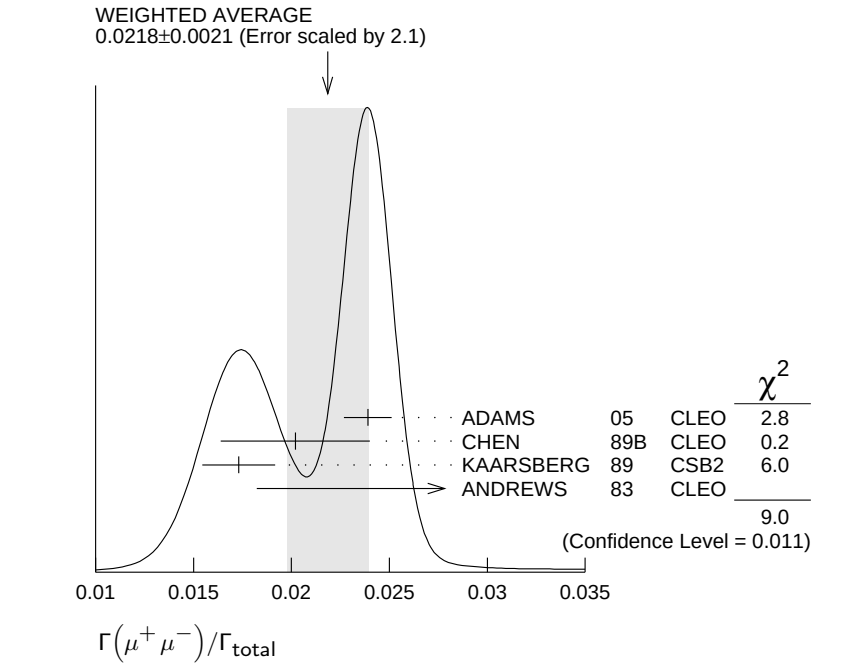
0.0239 $\pm$ 0.0007 $\pm$ 0.0010	81k	ADAMS	05 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$

0.0202 $\pm$ 0.0019 $\pm$ 0.0033		CHEN	89B CLEO	$e^+e^- \rightarrow \mu^+\mu^-$

0.0173 $\pm$ 0.0015 $\pm$ 0.0011		KAARSBERG	89 CSB2	$e^+e^- \rightarrow \mu^+\mu^-$

0.033 $\pm$ 0.013 $\pm$ 0.007	1096	ANDREWS	83 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$

NODE=M048R1
NODE=M048R1



$\Gamma(ggg)/\Gamma_{\text{total}}$					Γ_{17}/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
35.7±2.6	3M	38 BESSON	06A CLEO	$\Upsilon(3S) \rightarrow \text{hadrons}$	

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.

NODE=M048R30
NODE=M048R30

NODE=M048R30;LINKAGE=BE

$\Gamma(\gamma gg)/\Gamma_{\text{total}}$					Γ_{18}/Γ
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 $\Gamma(\gamma gg)/\Gamma(ggg) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(ggg)/\Gamma_{\text{total}}$ BESSON 06A value.

NODE=M048R31
NODE=M048R31

NODE=M048R31;LINKAGE=BE

$\Gamma(\gamma gg)/\Gamma(ggg)$					Γ_{18}/Γ_{17}
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.72±0.06±0.49	3M	BESSON	06A CLEO	$\Upsilon(3S) \rightarrow (\gamma +) \text{hadrons}$	

NODE=M048R32
NODE=M048R32

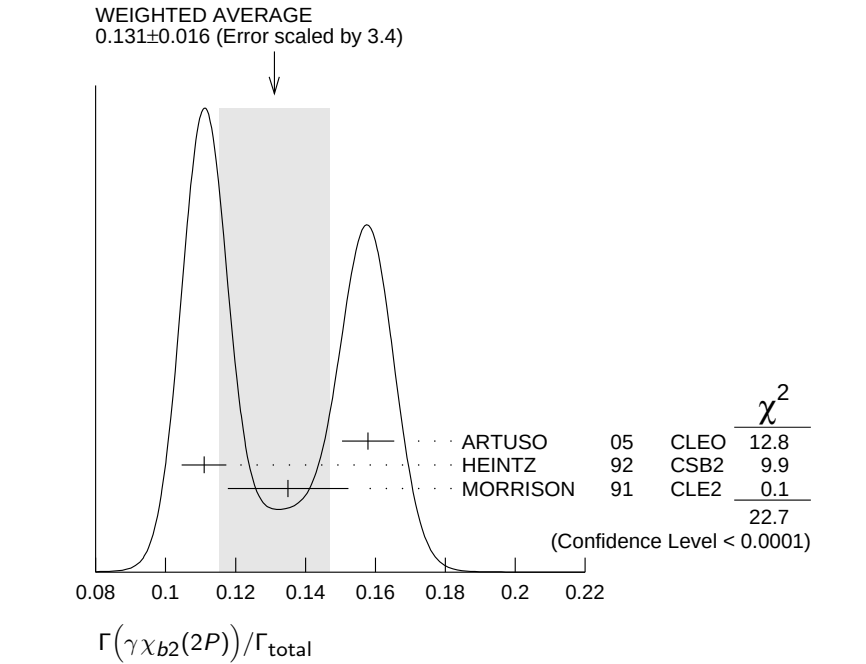
$\Gamma(\gamma\chi_{b2}(2P))/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.131 ±0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.			

0.1579±0.0017±0.0073	568k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$
0.111 ±0.005 ±0.004	10319	40 HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$
0.135 ±0.003 ±0.017	30741	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$

⁴⁰ Supersedes NARAIN 91.

NODE=M048R5
NODE=M048R5

NODE=M048R;LINKAGE=H

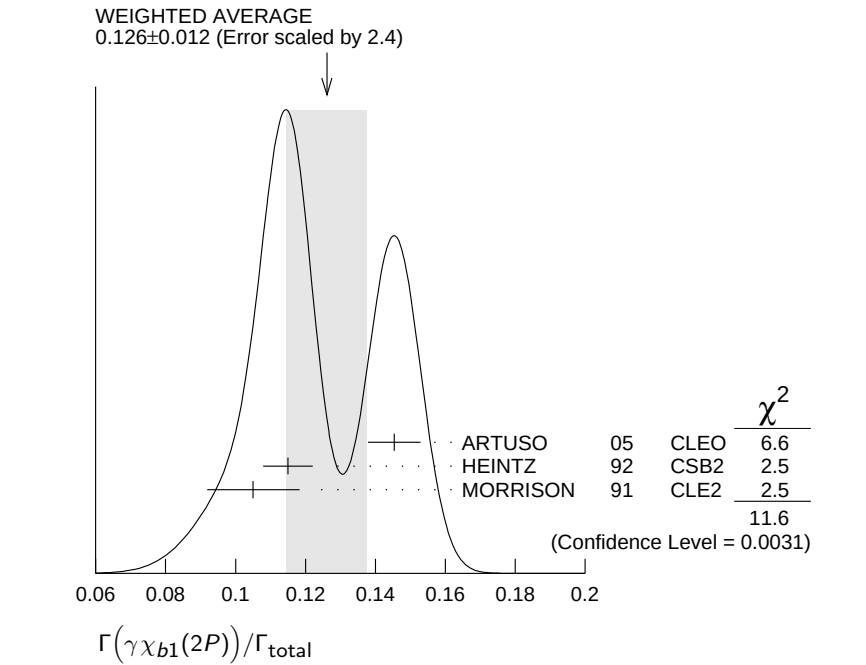


$\Gamma(\gamma\chi_{b1}(2P))/\Gamma_{\text{total}}$					Γ_{20}/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.126 ± 0.012 OUR AVERAGE					Error includes scale factor of 2.4. See the ideogram below.	
0.1454 ± 0.0018 ± 0.0073	537k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$	
0.115 ± 0.005 ± 0.005	11147	HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$	
0.105 +0.003 -0.002 ± 0.013	25759	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$	

⁴¹Supersedes NARAIN 91.

NODE=M048R6
NODE=M048R6

NODE=M048R6;LINKAGE=H

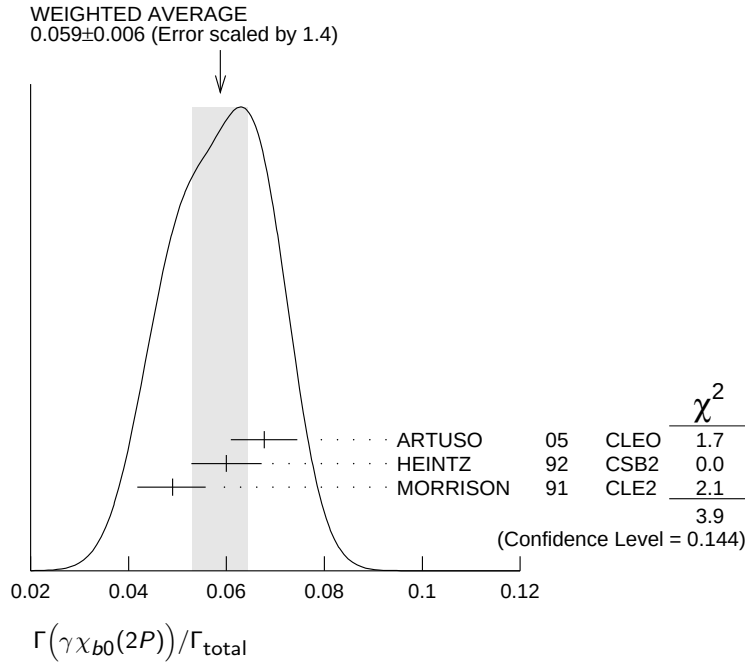


$\Gamma(\gamma\chi_{b0}(2P))/\Gamma_{\text{total}}$					Γ_{21}/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.059 ± 0.006 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.	
0.0677 ± 0.0020 ± 0.0065	225k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$	
0.060 ± 0.004 ± 0.006	4959	HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$	
0.049 +0.003 -0.004 ± 0.006	9903	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$	

NODE=M048R7
NODE=M048R7

42 Supersedes NARAIN 91.

NODE=M048R7;LINKAGE=H

 **$\Gamma(\gamma\chi_{b2}(1P))/\Gamma_{\text{total}}$** **$\Gamma_{22}/\Gamma$**

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.9±1.2 OUR AVERAGE Error includes scale factor of 1.9.					
7.5±1.2±0.5	126	43,44	KORNICER	11	CLEO $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
10.5±0.3 ^{+0.7} _{-0.6}	9.7k		LEES	11J	BABR $\Upsilon(3S) \rightarrow X\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19	90	45	ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
seen		46	HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

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 $[\Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$ < 27.1×10^{-2} which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = 7.15 \times 10^{-2}$.46 HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma\Upsilon(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0,1,2$ using inclusive $\Upsilon(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1,2$ using $\Upsilon(1S) \rightarrow \ell^+\ell^-$.NODE=M048R21;LINKAGE=KA
NODE=M048R21;LINKAGE=KR

NODE=M048R21;LINKAGE=AS

NODE=M048R21;LINKAGE=HE

 $\Gamma(\gamma\chi_{b1}(1P))/\Gamma_{\text{total}}$ **Γ_{24}/Γ**

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.5 OUR AVERAGE Error includes scale factor of 1.9.					
1.6±0.5±0.1	50	47,48	KORNICER	11	CLEO $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
0.5±0.3 ^{+0.2} _{-0.1}			LEES	11J	BABR $\Upsilon(3S) \rightarrow X\gamma$

• • • 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 $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = 6.9 \times 10^{-2}$.NODE=M048R22
NODE=M048R22NODE=M048R22;LINKAGE=KA
NODE=M048R22;LINKAGE=KR

NODE=M048R22;LINKAGE=AS

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=HE

$\Gamma(\gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$

Γ_{25}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.27 \pm 0.04 \pm 0.02$		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 $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$
< 21.9×10^{-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 $e^+ e^- \rightarrow \gamma X$

⁵² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.

⁵³ Systematic error re-evaluated by AUBERT 09AQ.

⁵⁴ Superseded by BONVICINI 10.

NODE=M048R17
NODE=M048R17

NODE=M048R17;LINKAGE=BO
NODE=M048R17;LINKAGE=AU
NODE=M048R17;LINKAGE=SU

$\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$

Γ_{28}/Γ

(1.5 GeV < m_X < 5.0 GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	95	ROSNER	07A CLEO	$e^+ e^- \rightarrow \gamma X$

NODE=M048R20
NODE=M048R20
NODE=M048R20

$\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$

Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.6 \times 10^{-4}$	90	⁵⁵ AUBERT	09P BABR	$e^+ e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

NODE=M048R29
NODE=M048R29

⁵⁵ 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

$\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$

Γ_{23}/Γ

(0.3 GeV < m_{A^0} < 7 GeV)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8 \times 10^{-5}$	90	⁵⁶ LEES	11H BABR	$\Upsilon(3S) \rightarrow \gamma \text{hadrons}$

NODE=M048R02
NODE=M048R02
NODE=M048R02

⁵⁶ 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_{30}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.2	90	LEES	10B BABR	$e^+ e^- \rightarrow e^\pm \tau^\mp$

NODE=M048R01
NODE=M048R01

$\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	LEES	10B BABR	$e^+ e^- \rightarrow \mu^\pm \tau^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<20.3	95	LOVE	08A CLEO	$e^+ e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M048R23
 NODE=M048R23

 $\tau(3S)$ 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 031104R	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
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.)	REFID=43313
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)	REFID=43604
BROCK	91	PR D43 1448	I.C. Brock <i>et al.</i>	(CLEO Collab.)	REFID=41579
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
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)	REFID=40919
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					
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
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
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)	REFID=22273
GREEN	82	PRL 49 617	J. Green <i>et al.</i>	(CLEO Collab.)	REFID=22321
MAGERAS	82	PL 118B 453	G. Mageras <i>et al.</i>	(COLU, CORN, LSU+)	REFID=22359

$\chi_b(3P)$

$$I^G(J^{PC}) = ?^?(\text{?}^?+)$$

OMITTED FROM SUMMARY TABLE

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

NODE=M206

 $\chi_b(3P)$ MASS

NODE=M206M

NODE=M206M

VALUE (GeV)	DOCUMENT ID	TECN	COMMENT
$10.530 \pm 0.005 \pm 0.009$	¹ AAD	12A ATLS	$p p \rightarrow \gamma \mu^+ \mu^- + X$
¹ The mass barycenter of the merged lineshapes from $J = 0, 1$, and 2 states, assuming a hyperfine splitting of 12 MeV.			

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	$p p \rightarrow \gamma \mu^+ \mu^- + X$	
$\Gamma(\Upsilon(2S)\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
VALUE				
seen	AAD	12A ATLS	$p p \rightarrow \gamma \mu^+ \mu^- + X$	

NODE=M206R01
NODE=M206R01NODE=M206R02
NODE=M206R02 $\chi_b(3P)$ REFERENCES

NODE=M206

AAD 12A PRL 108 152001 G. Aad et al. (ATLAS Collab.)

REFID=54037

NODE=M047

 $\Upsilon(4S)$ or $\Upsilon(10580)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 $\Upsilon(4S)$ MASS

NODE=M047M

NODE=M047M

VALUE (GeV)	DOCUMENT ID	TECN	COMMENT
10.5794 ± 0.0012 OUR AVERAGE			
$10.5793 \pm 0.0004 \pm 0.0012$	AUBERT	05Q BABR	$e^+ e^- \rightarrow \text{hadrons}$
10.5800 ± 0.0035	¹ BEBEK	87 CLEO	$e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.5774 ± 0.0010	² LOVELOCK	85 CUSB	$e^+ e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BESSON 85.			
² No systematic error given.			

NODE=M047M;LINKAGE=C
NODE=M047M;LINKAGE=B $\Upsilon(4S)$ WIDTH

NODE=M047W

NODE=M047W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
20.5 ± 2.5 OUR AVERAGE			
$20.7 \pm 1.6 \pm 2.5$	AUBERT	05Q BABR	$e^+ e^- \rightarrow \text{hadrons}$
$20 \pm 2 \pm 4$	BESSON	85 CLEO	$e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
25 ± 2.5	LOVELOCK	85 CUSB	$e^+ e^- \rightarrow \text{hadrons}$

T(4S) DECAY MODES

NODE=M047215;NODE=M047

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $B\bar{B}$	> 96 %	95%
Γ_2 B^+B^-	(51.6 $\pm$ 0.6) %	
Γ_3 D^+ anything + c.c.	(17.8 $\pm$ 2.6) %	
Γ_4 $B^0\bar{B}^0$	(48.4 $\pm$ 0.6) %	
Γ_5 $J/\psi K_S^0(J/\psi, \eta_c)K_S^0$	< 4 $\times 10^{-7}$	90%
Γ_6 non- $B\bar{B}$	< 4 %	95%
Γ_7 e^+e^-	(1.57 $\pm$ 0.08) $\times 10^{-5}$	
Γ_8 $\rho^+\rho^-$	< 5.7 $\times 10^{-6}$	90%
Γ_9 $J/\psi(1S)$ anything	< 1.9 $\times 10^{-4}$	95%
Γ_{10} D^{*+} anything + c.c.	< 7.4 %	90%
Γ_{11} ϕ anything	(7.1 $\pm$ 0.6) %	
Γ_{12} $\phi\eta$	< 1.8 $\times 10^{-6}$	90%
Γ_{13} $\phi\eta'$	< 4.3 $\times 10^{-6}$	90%
Γ_{14} $\rho\eta$	< 1.3 $\times 10^{-6}$	90%
Γ_{15} $\rho\eta'$	< 2.5 $\times 10^{-6}$	90%
Γ_{16} $T(1S)$ anything	< 4 $\times 10^{-3}$	90%
Γ_{17} $T(1S)\pi^+\pi^-$	(8.1 $\pm$ 0.6) $\times 10^{-5}$	
Γ_{18} $T(1S)\eta$	(1.96 $\pm$ 0.11) $\times 10^{-4}$	
Γ_{19} $T(2S)\pi^+\pi^-$	(8.6 $\pm$ 1.3) $\times 10^{-5}$	
Γ_{20} $h_b(1P)\pi^+\pi^-$	not seen	
Γ_{21} d anything	< 1.3 $\times 10^{-5}$	90%

DESIG=8;OUR EST;→ NOT CHECKED ←

DESIG=10

DESIG=12

DESIG=11

DESIG=15

DESIG=6

DESIG=1

DESIG=16

DESIG=2

DESIG=3

DESIG=4

DESIG=13

DESIG=18

DESIG=19

DESIG=20

DESIG=5

DESIG=7

DESIG=17

DESIG=9

DESIG=21

DESIG=14

T(4S) PARTIAL WIDTHS

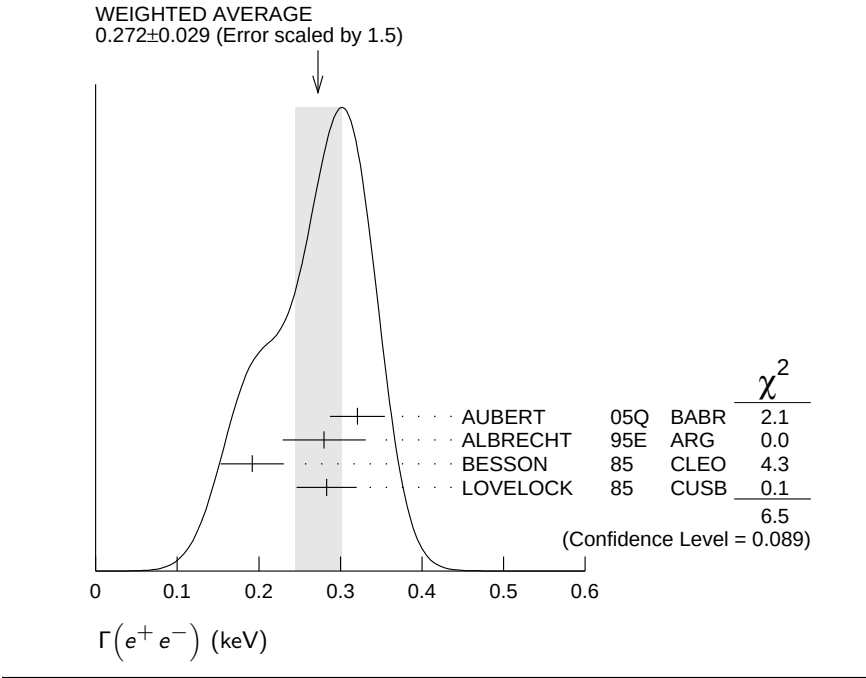
NODE=M047220

$\Gamma(e^+e^-)$	DOCUMENT ID	TECN	COMMENT
VALUE (keV)			
0.272$\pm$0.029 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
0.321 $\pm$ 0.017 $\pm$ 0.029	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
0.28 $\pm$ 0.05 $\pm$ 0.01	³ ALBRECHT	95E ARG	$e^+e^- \rightarrow$ hadrons
0.192 $\pm$ 0.007 $\pm$ 0.038	BESSON	85 CLEO	$e^+e^- \rightarrow$ hadrons
0.283 $\pm$ 0.037	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons
³ Using LEYAOUANC 77 parametrization of $\Gamma(s)$.			

NODE=M047W1

NODE=M047W1

NODE=M047W1;LINKAGE=A



$\Upsilon(4S)$ BRANCHING RATIOS **$B\bar{B}$ DECAYS**

The ratio of branching fraction to charged and neutral B mesons is often derived assuming isospin invariance in the decays, and relies on the knowledge of the B^+/B^0 lifetime ratio. "OUR EVALUATION" is obtained based on averages of rescaled data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/rescaling procedure takes into account the common dependence of the measurement on the value of the lifetime ratio.

 $\Gamma(B^+B^-)/\Gamma_{\text{total}}$

VALUE

DOCUMENT ID

0.516±0.006 OUR EVALUATIONAssuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$ **Γ_2/Γ**

NODE=M047230

NODE=M047BBD

NODE=M047BBD

NODE=M047R11
NODE=M047R11

→ NOT CHECKED ←

 $\Gamma(D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE

DOCUMENT ID

TECN

COMMENT

0.178±0.021±0.016⁴ ARTUSO 05B CLE3 $e^+e^- \rightarrow D_s X$ **Γ_3/Γ** NODE=M047R13
NODE=M047R13

⁴ ARTUSO 05B reports $[\Gamma(\Upsilon(4S) \rightarrow D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = (8.0 \pm 0.2 \pm 0.9) \times 10^{-3}$ which we divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R13;LINKAGE=AR

 $\Gamma(B^0\bar{B}^0)/\Gamma_{\text{total}}$

VALUE

DOCUMENT ID

TECN

COMMENT

0.484±0.006 OUR EVALUATIONAssuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$ **Γ_4/Γ** NODE=M047R12
NODE=M047R12

→ NOT CHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.487±0.010±0.008

⁵ AUBERT,B 05H BABR $\Upsilon(4S) \rightarrow \bar{B}B \rightarrow D^*\ell\nu_\ell$

⁵ Direct measurement. This value is averaged with the value extracted from the $\Gamma(B^+B^-) / \Gamma(B^0\bar{B}^0)$ measurements.

NODE=M047R12;LINKAGE=AU

 $\Gamma(B^+B^-)/\Gamma(B^0\bar{B}^0)$

VALUE

DOCUMENT ID

TECN

COMMENT

1.065±0.026 OUR EVALUATION

1.006±0.036±0.031

⁶ AUBERT 04F BABR $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K$

1.01 ±0.03 ±0.09

⁶ HASTINGS 03 BELL $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow \text{dileptons}$

1.058±0.084±0.136

⁷ ATHAR 02 CLEO $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow D^*\ell\nu$

1.10 ±0.06 ±0.05

⁸ AUBERT 02 BABR $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow (c\bar{c})K^*$

1.04 ±0.07 ±0.04

⁹ ALEXANDER 01 CLEO $\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K^*$

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

→ NOT CHECKED ←

NODE=M047R10;LINKAGE=F
NODE=M047R10;LINKAGE=D
NODE=M047R10;LINKAGE=E
NODE=M047R10;LINKAGE=C **$\Gamma(J/\psi K_S^0(J/\psi, \eta_c) K_S^0)/\Gamma_{\text{total}}$** Forbidden by CP invariance.VALUE (units 10^{-7})

CL%

DOCUMENT ID

TECN

COMMENT

<4

90

¹⁰ TAJIMA

07A

BELL $\Upsilon(4S) \rightarrow B^0\bar{B}^0$ **Γ_5/Γ**

NODE=M047R16

NODE=M047R16

NODE=M047R16

¹⁰ $\Upsilon(4S)$ with $CP = +1$ decays to the final state with $CP = -1$.

NODE=M047R16;LINKAGE=TA

NODE=M047NBB

non- $B\bar{B}$ DECAYS **$\Gamma(\text{non-}B\bar{B})/\Gamma_{\text{total}}$**

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.04

95

BARISH

96B

CLEO e^+e^- **Γ_6/Γ**

NODE=M047R6

NODE=M047R6

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

1.57±0.08 OUR AVERAGE

1.55±0.04±0.07

AUBERT

05Q

BABR

 $e^+e^- \rightarrow \text{hadrons}$

2.77±0.50±0.49

¹¹ ALBRECHT

95E

ARG

 $e^+e^- \rightarrow \text{hadrons}$ **Γ_7/Γ**

NODE=M047R5

NODE=M047R5

¹¹ Using LEYAQUANC 77 parametrization of $\Gamma(s)$.

NODE=M047R5;LINKAGE=A

$\Gamma(\rho^+\rho^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.7 \times 10^{-6}$	90	AUBERT	08BO BABR	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0$

NODE=M047R17
NODE=M047R17

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	12 ABE	02D BELL	$e^+e^- \rightarrow J/\psi X \rightarrow \ell^+\ell^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<4.7	90	12 AUBERT	01C BABR	$e^+e^- \rightarrow J/\psi X \rightarrow \ell^+\ell^-X$
12 Uses $B(J/\psi \rightarrow e^+e^-) = 0.0593 \pm 0.0010$ and $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.				

NODE=M047R1
NODE=M047R1

NODE=M047R;LINKAGE=AC

$\Gamma(D^{*+} \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.074	90	13 ALEXANDER	90C CLEO	e^+e^-
13 For $x > 0.473$.				

NODE=M047R2
NODE=M047R2

NODE=M047R2;LINKAGE=A

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
7.1 $\pm 0.1 \pm 0.6$		HUANG	07 CLEO	$\Upsilon(4S) \rightarrow \phi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.23	90	14 ALEXANDER	90C CLEO	e^+e^-
14 For $x > 0.52$.				

NODE=M047R3
NODE=M047R3

NODE=M047R3;LINKAGE=A

$\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	15 BELOUS	09 BELL	$e^+e^- \rightarrow \phi\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.5	90	AUBERT, BE	06F BABR	$e^+e^- \rightarrow \phi\eta$
15 Using all intermedite branching fraction values from PDG 08.				

NODE=M047R14
NODE=M047R14

NODE=M047R14;LINKAGE=BE

$\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.3	90	16 BELOUS	09 BELL	$e^+e^- \rightarrow \phi\eta'$
16 Using all intermedite branching fraction values from PDG 08.				

NODE=M047R21
NODE=M047R21

NODE=M047R21;LINKAGE=BE

$\Gamma(\rho\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	17 BELOUS	09 BELL	$e^+e^- \rightarrow \rho\eta$
17 Using all intermedite branching fraction values from PDG 08.				

NODE=M047R22
NODE=M047R22

NODE=M047R22;LINKAGE=BE

$\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	18 BELOUS	09 BELL	$e^+e^- \rightarrow \rho\eta'$
18 Using all intermedite branching fraction values from PDG 08.				

NODE=M047R23
NODE=M047R23

NODE=M047R23;LINKAGE=BE

$\Gamma(\Upsilon(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.004	90	ALEXANDER	90C CLEO	e^+e^-

NODE=M047R4
NODE=M047R4

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.1 ± 0.6 OUR AVERAGE					
8.5 $\pm 1.3 \pm 0.2$	113 ± 16	19	SOKOLOV 09	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
8.00 $\pm 0.64 \pm 0.27$	430	20	AUBERT 08BP	BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
17.8 $\pm 4.0 \pm 0.3$		21,22	SOKOLOV 07	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
9.0 $\pm 1.5 \pm 0.2$	167 ± 19	23	AUBERT 06R	BABR	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
<12	90		GLENN 99	CLE2	e^+e^-

NODE=M047R7
NODE=M047R7

¹⁹SOKOLOV 09 reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (0.211 \pm 0.030 \pm 0.014) \times 10^{-5}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R7;LINKAGE=SK

²⁰Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M047R7;LINKAGE=UB

²¹SOKOLOV 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

²²According to the authors, systematic errors were underestimated.

NODE=M047R7;LINKAGE=US

²³Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (2.23 \pm 0.25 \pm 0.27) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R7;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ **Γ_{18}/Γ**

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.96±0.06±0.09	56	²⁴ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\pi^0\ell^+\ell^-$

NODE=M047R18
NODE=M047R18

²⁴Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M047R18;LINKAGE=UB

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ **Γ_{18}/Γ_{17}**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.41±0.40±0.12 56 ²⁵ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+\pi^-(\pi^0)\ell^+\ell^-$

²⁵Not independent of other values reported by AUBERT 08BP.

NODE=M047R19
NODE=M047R19

NODE=M047R19;LINKAGE=UB

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{19}/Γ**

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.86±0.11±0.07		220	²⁶ AUBERT	08BP BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

NODE=M047R9
NODE=M047R9

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.88±0.17±0.08 97 ± 15 ²⁷ AUBERT 06R BABR $e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
<3.9 90 GLENN 99 CLE2 e^+e^-

²⁶Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$ and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.

NODE=M047R9;LINKAGE=UB

²⁷Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = (1.69 \pm 0.26 \pm 0.20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R9;LINKAGE=AU

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ **Γ_{19}/Γ_{17}**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.16±0.16±0.14 220 ²⁸ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

²⁸Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.

NODE=M047R20
NODE=M047R20

NODE=M047R20;LINKAGE=UB

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{20}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	35 ± 21k	²⁹ ADACHI	12 BELL	$10.58 e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

NODE=M047R01
NODE=M047R01

²⁹From the upper limit on the ratio of $\sigma(e^+e^- \rightarrow h_b(1P)\pi^+\pi^-)$ at the $\Upsilon(4S)$ to that at the $\Upsilon(5S)$ of 0.27.

NODE=M047R01;LINKAGE=AD

 $\Gamma(\bar{d} \text{ anything})/\Gamma_{\text{total}}$ **Γ_{21}/Γ**

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	ASNER	07 CLEO	$e^+e^- \rightarrow \bar{d}X$

NODE=M047R15
NODE=M047R15

$\Upsilon(4S)$ REFERENCES

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 051103R	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 071103R	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 111103R	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>	(CUSB Collab.)
LEYAOUANC	77	PL B71 397	A. Le Yaouanc <i>et al.</i>	(ORSAY)

NODE=M047

REFID=53962
REFID=53107
REFID=52760
REFID=52659
REFID=52660
REFID=52166
REFID=51617
REFID=51624
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REFID=44693
REFID=44372
REFID=44139
REFID=41346
REFID=40270
REFID=22368
REFID=22369
REFID=44695

 $X(10610)^\pm$

$$J^G(J^P) = ?^+(1^+)$$

OMITTED FROM SUMMARY TABLE

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses.

NODE=M207

NODE=M207

 $X(10610)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10607.2$\pm$2.0	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
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 $\pm 2 \pm 3$ -1	² BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10599 $\pm 6 \pm 5$ $-3 -4$	² BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹ Average of the BONDAR 12 measurements in separate channels.² Superseded by the average measurement of BONDAR 12.

NODE=M207M

NODE=M207M

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M207M;LINKAGE=BO

NODE=M207M;LINKAGE=BN

 $X(10610)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
18.4$\pm$ 2.4	³ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
22.3 $\pm$ 7.7 $^{+3.0}_{-4.0}$	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
24.2 $\pm$ 3.1 $^{+2.0}_{-3.0}$	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 $^{+4.5+2.1}_{-3.9-1.2}$	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
13 $^{+10}_{-8} \pm 9$ -7	⁴ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

³ Average of the BONDAR 12 measurements in separate channels.⁴ Superseded by the average measurement of BONDAR 12.

NODE=M207W

NODE=M207W

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M207W;LINKAGE=BO

NODE=M207W;LINKAGE=BN

$X(10610)^+$ DECAY MODES $X(10610)^-$ decay modes are charge conjugates of the modes below.

NODE=M207215;NODE=M207

NODE=M207

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	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**

NODE=M207R01

NODE=M207R01

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**

NODE=M207R02

NODE=M207R02

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**

NODE=M207R03

NODE=M207R03

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

 $\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ **Γ_4/Γ**

NODE=M207R04

NODE=M207R04

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

 $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ **Γ_5/Γ**

NODE=M207R05

NODE=M207R05

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

 $X(10610)^\pm$ REFERENCES

NODE=M207

BONDAR 12 PRL 108 122001 A. Bondar *et al.* (BELLE Collab.)

REFID=53963

NODE=M208

 $X(10650)^\pm$

$$J^G(J^P) = ?^+(1^+)$$

OMITTED FROM SUMMARY TABLE

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses.

NODE=M208

 $X(10650)^\pm$ MASS

NODE=M208M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10652.2$\pm$1.5	¹ BONDAR	12	BELL $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10657 $\pm 6 \pm 3$	² BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10651 $\pm 2 \pm 3$	² BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10652 $\pm 1 \pm 2$	² BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10654 $\pm 3 \begin{smallmatrix} +1 \\ -2 \end{smallmatrix}$	² BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10651 $\begin{smallmatrix} +2 \\ -3 \end{smallmatrix} \pm 3 \begin{smallmatrix} +1 \\ -2 \end{smallmatrix}$	² BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208M

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

¹ Average of the BONDAR 12 measurements in separate channels.² Superseded by the average measurement of BONDAR 12.

NODE=M208M;LINKAGE=BO

NODE=M208M;LINKAGE=BN

 $X(10650)^\pm$ WIDTH

NODE=M208W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11.5$\pm$2.2	³ BONDAR	12	BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M208W

• • • We do not use the following data for averages, fits, limits, etc. • • •

$16.3 \pm 9.8^{+6.0}_{-2.0}$	⁴ BONDAR	12	BELL	$e^+e^- \rightarrow \gamma(1S)\pi^+\pi^-$	OCCUR=2
$13.3 \pm 3.3^{+4.0}_{-3.0}$	⁴ BONDAR	12	BELL	$e^+e^- \rightarrow \gamma(2S)\pi^+\pi^-$	OCCUR=3
$8.4 \pm 2.0 \pm 2.0$	⁴ BONDAR	12	BELL	$e^+e^- \rightarrow \gamma(3S)\pi^+\pi^-$	OCCUR=4
$20.9^{+5.4+2.1}_{-4.7-5.7}$	⁴ BONDAR	12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$	OCCUR=5
$19 \pm 7 \pm^{+11}_{-7}$	⁴ BONDAR	12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$	OCCUR=6

³ Average of the BONDAR 12 measurements in separate channels.

⁴ Superseded by the average measurement of BONDAR 12.

NODE=M208W;LINKAGE=BO
NODE=M208W;LINKAGE=BN

$X(10650)^+$ DECAY MODES

NODE=M208215;NODE=M208

$X(10650)^-$ decay modes are charge conjugates of the modes below.

NODE=M208

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \gamma(1S)\pi^+$	seen
$\Gamma_2 \quad \gamma(2S)\pi^+$	seen
$\Gamma_3 \quad \gamma(3S)\pi^+$	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

$X(10650)^\pm$ BRANCHING RATIOS

NODE=M208225

$\Gamma(\gamma(1S)\pi^+)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	BONDAR 12 BELL $e^+e^- \rightarrow \gamma(1S)\pi^+\pi^-$
$\Gamma(\gamma(2S)\pi^+)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	BONDAR 12 BELL $e^+e^- \rightarrow \gamma(2S)\pi^+\pi^-$
$\Gamma(\gamma(3S)\pi^+)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	BONDAR 12 BELL $e^+e^- \rightarrow \gamma(3S)\pi^+\pi^-$
$\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	BONDAR 12 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
$\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	BONDAR 12 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208R01
NODE=M208R01

NODE=M208R02
NODE=M208R02

NODE=M208R03
NODE=M208R03

NODE=M208R04
NODE=M208R04

NODE=M208R05
NODE=M208R05

$X(10650)^\pm$ REFERENCES

NODE=M208

BONDAR 12 PRL 108 122001 A. Bondar *et al.* (BELLE Collab.)

REFID=53963

$\Upsilon(10860)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M092

 $\Upsilon(10860)$ MASS

NODE=M092M

VALUE (MeV) DOCUMENT ID TECN COMMENT
10876 ±11 OUR EVALUATION Weighted-average of Belle and BaBar results, but tripling the scaling S -factors applied to the uncertainties to account for model-dependence, handling of radiative corrections, and interference effects.

NODE=M092M

→ NOT CHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

10879 ± 3	^{1,2} CHEN	10	BELL	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ hadrons
10869 ± 2	⁴ AUBERT	09E	BABR	$e^+e^- \rightarrow$ hadrons
10868 ± 6 ±5	⁵ BESSON	85	CLEO	$e^+e^- \rightarrow$ hadrons
10845 ±20	⁶ LOVELOCK	85	CUSB	$e^+e^- \rightarrow$ hadrons

OCCUR=2

OCCUR=2

¹ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M092M;LINKAGE=AU

² The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

NODE=M092M;LINKAGE=CH
 NODE=M092M;LINKAGE=CE

³ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

NODE=M092M;LINKAGE=UB

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 .

NODE=M092M;LINKAGE=BE
 NODE=M092M;LINKAGE=LO

⁶ In a coupled-channel model with three resonances and a smooth step in R .

 $\Upsilon(10860)$ WIDTH

NODE=M092W

VALUE (MeV) DOCUMENT ID TECN COMMENT
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.

NODE=M092W

→ NOT CHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

46 ⁺⁹ ₋₇	^{7,8} CHEN	10	BELL	$e^+e^- \rightarrow$ 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	$e^+e^- \rightarrow$ hadrons
74 ± 4	¹⁰ AUBERT	09E	BABR	$e^+e^- \rightarrow$ hadrons
112 ±17 ±23	¹¹ BESSON	85	CLEO	$e^+e^- \rightarrow$ hadrons
110 ±15	¹² LOVELOCK	85	CUSB	$e^+e^- \rightarrow$ hadrons

OCCUR=2

OCCUR=2

⁷ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M092W;LINKAGE=AU

⁸ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

NODE=M092W;LINKAGE=CH
 NODE=M092W;LINKAGE=CE

⁹ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

NODE=M092W;LINKAGE=UB

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 .

NODE=M092W;LINKAGE=BE
 NODE=M092W;LINKAGE=LO

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 e^+e^-	(5.6 ±3.1) × 10 ⁻⁶	DESIG=1
Γ_2 $B\bar{B}X$	(71 ±6) %	DESIG=9
Γ_3 $B\bar{B}$	(5.5 ±1.0) %	DESIG=2
Γ_4 $B\bar{B}^* +$ c.c.	(13.7 ±1.6) %	DESIG=3
Γ_5 $B^*\bar{B}^*$	(38.1 ±3.4) %	DESIG=4
Γ_6 $B\bar{B}^{(*)}\pi$	< 19.7 %	90% DESIG=10
Γ_7 $B\bar{B}\pi$	(0.0 ±1.2) %	DESIG=23

Γ_8	$B^* \bar{B} \pi + B \bar{B}^* \pi$	(7.3 $\pm$ 2.3) %	DESIG=24
Γ_9	$B^* \bar{B}^* \pi$	(1.0 $\pm$ 1.4) %	DESIG=25
Γ_{10}	$B \bar{B} \pi \pi$	< 8.9 %	DESIG=11
Γ_{11}	$B_s^{(*)} \bar{B}_s^{(*)}$	(19.3 $\pm$ 2.9) %	DESIG=16
Γ_{12}	$B_s \bar{B}_s$	(5 $\pm$ 5) $\times 10^{-3}$	DESIG=5
Γ_{13}	$B_s \bar{B}_s^* + \text{c.c.}$	(1.4 $\pm$ 0.6) %	DESIG=7
Γ_{14}	$B_s^* \bar{B}_s^*$	(17.4 $\pm$ 2.7) %	DESIG=8
Γ_{15}	$\Upsilon(1S) \pi^+ \pi^-$	(5.3 $\pm$ 0.6) $\times 10^{-3}$	DESIG=17
Γ_{16}	$\Upsilon(2S) \pi^+ \pi^-$	(7.8 $\pm$ 1.3) $\times 10^{-3}$	DESIG=18
Γ_{17}	$\Upsilon(3S) \pi^+ \pi^-$	(4.8 $\pm$ 1.9) $\times 10^{-3}$	DESIG=19
Γ_{18}	$\Upsilon(1S) K^+ K^-$	(6.1 $\pm$ 1.8) $\times 10^{-4}$	DESIG=20
Γ_{19}	$h_b(1P) \pi^+ \pi^-$	(3.5 $\pm$ 1.0) $\times 10^{-3}$	DESIG=26
Γ_{20}	$h_b(2P) \pi^+ \pi^-$	(6.0 $\pm$ 2.1) $\times 10^{-3}$	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_{21}	ϕ anything	(13.8 $\pm$ 2.4) %	DESIG=12
Γ_{22}	D^0 anything + c.c.	(108 $\pm$ 8) %	DESIG=13
Γ_{23}	D_s anything + c.c.	(46 $\pm$ 6) %	DESIG=6
Γ_{24}	J/ψ anything	(2.06 $\pm$ 0.21) %	DESIG=14
Γ_{25}	B^0 anything + c.c.	(77 $\pm$ 8) %	DESIG=21
Γ_{26}	B^+ anything + c.c.	(72 $\pm$ 6) %	DESIG=22

 $\Upsilon(10860)$ PARTIAL WIDTHS

NODE=M092220

$\Gamma(e^+ e^-)$					Γ_1
VALUE (keV)	DOCUMENT ID	TECN	COMMENT		
0.31 $\pm$ 0.07 OUR AVERAGE	Error includes scale factor of 1.3.				NODE=M092W1
0.22 $\pm$ 0.05 $\pm$ 0.07	BESSON	85	CLEO	$e^+ e^- \rightarrow \text{hadrons}$	NODE=M092W1
0.365 $\pm$ 0.070	LOVELOCK	85	CUSB	$e^+ e^- \rightarrow \text{hadrons}$	

 $\Upsilon(10860)$ BRANCHING RATIOS

NODE=M092230

$\Gamma(B \bar{B} X) / \Gamma_{\text{total}}$					Γ_2 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.71 $\pm$ 0.06 OUR AVERAGE					NODE=M092R13
0.737 $\pm$ 0.032 $\pm$ 0.051	13 DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$	NODE=M092R13
0.589 $\pm$ 0.100 $\pm$ 0.092	14 HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$	

$\Gamma(B \bar{B}) / \Gamma_{\text{total}}$					Γ_3 / Γ
VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT		
5.5 $\pm$ 1.0 $\pm$ 0.4	15 DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$	NODE=M092R16
• • • We do not use the following data for averages, fits, limits, etc. • • •					NODE=M092R16
<13.8	90	14 HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

$\Gamma(B \bar{B}) / \Gamma(B \bar{B} X)$					Γ_3 / Γ_2
VALUE	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_4 / Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.137 $\pm$ 0.016 OUR AVERAGE					NODE=M092R15
0.137 $\pm$ 0.013 $\pm$ 0.011	15 DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+ X, B^0 X$	NODE=M092R15
0.143 $\pm$ 0.053 $\pm$ 0.027	14 HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$	

$\Gamma(B \bar{B}^* + \text{c.c.}) / \Gamma(B \bar{B} X)$					Γ_4 / Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT		
0.24 $\pm$ 0.09 $\pm$ 0.03	10	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R06
NODE=M092R06

$$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma$$

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 $\Upsilon(5S) \rightarrow \text{hadrons}$

$$\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X)$$

$$\Gamma_5/\Gamma_2$$

VALUE EVTS DOCUMENT ID TECN COMMENT
0.74±0.15±0.08

31

AQUINES 06 CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R07
 NODE=M092R07

$$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma$$

VALUE CL% DOCUMENT ID TECN COMMENT
<0.197

90

14 HUANG 07 CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R17
 NODE=M092R17

$$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma(B\bar{B}X)$$

$$\Gamma_6/\Gamma_2$$

VALUE CL% DOCUMENT ID TECN COMMENT
<0.32

90

AQUINES 06 CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R08
 NODE=M092R08

$$\Gamma(B\bar{B}\pi)/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma$$

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

$$[\Gamma(B^*\bar{B}\pi) + \Gamma(B\bar{B}^*\pi)]/\Gamma_{\text{total}}$$

$$\Gamma_8/\Gamma$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
7.3^{+2.3}_{-2.1}±0.8

38

15 DRUTSKOY 10 BELL $\Upsilon(5S) \rightarrow B^{+0}\pi^- X$

NODE=M092R29
 NODE=M092R29

$$\Gamma(B^*\bar{B}^*\pi)/\Gamma_{\text{total}}$$

$$\Gamma_9/\Gamma$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
1.0^{+1.4}_{-1.3}±0.4

5

15 DRUTSKOY 10 BELL $\Upsilon(5S) \rightarrow B^{+0}\pi^- X$

NODE=M092R30
 NODE=M092R30

$$\Gamma(B\bar{B}\pi\pi)/\Gamma_{\text{total}}$$

$$\Gamma_{10}/\Gamma$$

VALUE CL% DOCUMENT ID TECN COMMENT
<0.089

90

14 HUANG 07 CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R18
 NODE=M092R18

$$\Gamma(B\bar{B}\pi\pi)/\Gamma(B\bar{B}X)$$

$$\Gamma_{10}/\Gamma_2$$

VALUE CL% DOCUMENT ID TECN COMMENT
<0.14

90

AQUINES 06 CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R09
 NODE=M092R09

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma_{\text{total}}$$

$$\Gamma_{11}/\Gamma = (\Gamma_{12} + \Gamma_{13} + \Gamma_{14})/\Gamma$$

VALUE DOCUMENT ID TECN COMMENT
0.193±0.029 OUR EVALUATION

Taking into account common systematics.

NODE=M092R01
 NODE=M092R01
 → NOT CHECKED ←

0.195^{+0.030}_{-0.023} OUR AVERAGE

$$0.180 \pm 0.013 \pm 0.032$$

16 DRUTSKOY 07 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. • • •

$$0.160 \pm 0.026 \pm 0.058$$

18 ARTUSO 05B CLEO $e^+e^- \rightarrow D_X X$

$$\Gamma(B_s^*\bar{B}_s^*)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

$$\Gamma_{14}/\Gamma_{11} = \Gamma_{14}/(\Gamma_{12} + \Gamma_{13} + \Gamma_{14})$$

VALUE (units 10^{-2}) DOCUMENT ID TECN COMMENT
90.1^{+3.8}_{-4.0}±0.2

19

LOUVOT 09 BELL $10.86 e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$

NODE=M092R19
 NODE=M092R19

• • • We do not use the following data for averages, fits, limits, etc. • • •

$$93^{+7}_{-9} \pm 1$$

19

DRUTSKOY 07A BELL Superseded by LOUVOT 09

$$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

$$\Gamma_{12}/\Gamma_{11} = \Gamma_{12}/(\Gamma_{12} + \Gamma_{13} + \Gamma_{14})$$

VALUE (units 10^{-2}) DOCUMENT ID TECN COMMENT
2.6^{+2.6}_{-2.5}

LOUVOT

09

BELL

$10.86 e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$

NODE=M092R24
 NODE=M092R24

$$\Gamma(B_s \bar{B}_s)/\Gamma(B_s^* \bar{B}_s^*)$$

$$\Gamma_{12}/\Gamma_{14}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3 $e^+ e^-$

NODE=M092R03
NODE=M092R03

$$\Gamma(B_s \bar{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)} \bar{B}_s^{(*)})$$

$$\Gamma_{13}/\Gamma_{11} = \Gamma_{13}/(\Gamma_{12} + \Gamma_{13} + \Gamma_{14})$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$7.3^{+3.3}_{-3.0} \pm 0.1$	LOUVOT	09	BELL $10.86 e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}$

NODE=M092R25
NODE=M092R25

$$\Gamma(B_s \bar{B}_s^* + \text{c.c.})/\Gamma(B_s^* \bar{B}_s^*)$$

$$\Gamma_{13}/\Gamma_{14}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3 $e^+ e^-$

NODE=M092R04
NODE=M092R04

$$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{15}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.3 \pm 0.3 \pm 0.5$	325	²⁰ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M092R20
NODE=M092R20

$$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{16}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.8 \pm 0.6 \pm 1.1$	186	²⁰ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

NODE=M092R21
NODE=M092R21

$$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.8^{+1.8}_{-1.5} \pm 0.7$	10	²⁰ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

NODE=M092R22
NODE=M092R22

$$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.1^{+1.6}_{-1.4} \pm 1.0$	20	²⁰ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

NODE=M092R23
NODE=M092R23

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$$

$$\Gamma_{19}/\Gamma_{16}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.45 \pm 0.08^{+0.07}_{-0.12}$	ADACHI	12	BELL $10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R31
NODE=M092R31

$$\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$$

$$\Gamma_{20}/\Gamma_{16}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.77 \pm 0.08^{+0.22}_{-0.17}$	ADACHI	12	BELL $10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R32
NODE=M092R32

$$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$$

$$\Gamma_{21}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.138 \pm 0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO $\Upsilon(5S) \rightarrow \phi X$

NODE=M092R12
NODE=M092R12

$$\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{22}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.076 \pm 0.040 \pm 0.068$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D^0 X$

NODE=M092R10
NODE=M092R10

$$\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{23}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.46 ± 0.06 OUR AVERAGE			
$0.472 \pm 0.024 \pm 0.072$	¹⁶ DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D_s X$
$0.44 \pm 0.09 \pm 0.04$	²¹ ARTUSO	05B	CLE3 $e^+ e^- \rightarrow D_s X$

NODE=M092R02
NODE=M092R02

$$\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$$

$$\Gamma_{24}/\Gamma$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$2.060 \pm 0.160 \pm 0.134$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow J/\psi X$

NODE=M092R11
NODE=M092R11

$$\Gamma(B^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{25}/\Gamma$$

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

$\Gamma(B^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
$0.721^{+0.039}_{-0.038} \pm 0.050$	711	DRUTSKOY 10	BELL	$\Upsilon(5S) \rightarrow B^+ X$
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 Using $B(D_S^+ \rightarrow \phi \pi^+) = (4.4 \pm 0.6)\%$ from PDG 06. 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 Uses a model-dependent estimate $B(B_S \rightarrow D_S X) = (92 \pm 11)\%$. ¹⁹ 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. ²⁰ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance. ²¹ 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=M092R27
 NODE=M092R27

NODE=M092R13;LINKAGE=DR
 NODE=M092R;LINKAGE=HU
 NODE=M092R15;LINKAGE=DR
 NODE=M092R02;LINKAGE=DR
 NODE=M092R01;LINKAGE=HU

NODE=M092R01;LINKAGE=AR
 NODE=M092R19;LINKAGE=DR
 NODE=M092R20;LINKAGE=CH
 NODE=M092R02;LINKAGE=AR

 $\Upsilon(10860)$ REFERENCES

ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
CHEN	10	PR D82 091106R	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	10	PR D81 112003	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
LOUVOT	09	PRL 102 021801	R. Louvot <i>et al.</i>	(BELLE Collab.)
CHEN	08	PRL 100 112001	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07A	PR D76 012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)
AQUINES	06	PRL 96 152001	O. Aquines <i>et al.</i>	(CLEO Collab.)
BONVICINI	06	PRL 96 022002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M092

REFID=53962
 REFID=53531
 REFID=53358
 REFID=52661
 REFID=52646
 REFID=52153
 REFID=51621
 REFID=51852
 REFID=51624
 REFID=51106
 REFID=50995
 REFID=51004
 REFID=50992
 REFID=22368
 REFID=22369

 $\Upsilon(11020)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M093

 $\Upsilon(11020)$ MASS

VALUE (GeV)	DOCUMENT ID	TECN	COMMENT
11.019 ± 0.008 OUR AVERAGE			
$11.019 \pm 0.005 \pm 0.007$	BESSION 85	CLEO	$e^+ e^- \rightarrow \text{hadrons}$
11.020 ± 0.030	LOVELOCK 85	CUSB	$e^+ e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
10.996 ± 0.002	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			
$61 \pm 13 \pm 22$	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

$\Gamma(e^+ e^-)$					Γ_1
VALUE (keV)	DOCUMENT ID	TECN	COMMENT		
0.130$\pm$0.030 OUR AVERAGE					
0.095 $\pm$ 0.03 $\pm$ 0.035	BESSON	85	CLEO	$e^+ e^- \rightarrow$ hadrons	
0.156 $\pm$ 0.040	LOVELOCK	85	CUSB	$e^+ e^- \rightarrow$ hadrons	

NODE=M093220

NODE=M093W1
NODE=M093W1 **$\Upsilon(11020)$ REFERENCES**

AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M093

REFID=52661
REFID=22368
REFID=22369**NON- $q\bar{q}$ CANDIDATES**

We include here reference lists on gluonium and other non- $q\bar{q}$ candidates. For a review see PDG 06, Journal of Physics, G **33** 1 (2006). See also the "Note on scalar mesons" in the $f_0(500)$ Particle Listings, our note "New charmonium-like states" in PDG 08, Physics Letters **B667** 1 (2008), and the extensive chapter on Spectroscopy in N. Brambilla *et al.* (Quarkonium Working Group), to be published in the Eur. Phys. J. in 2010.

NODE=MXXX050

NODE=MXXX050

Non- $q\bar{q}$ Candidates

OMITTED FROM SUMMARY TABLE

NODE=M201

NON- $q\bar{q}$ CANDIDATES REFERENCES

CHOI	08	PRL 100 142001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
LEE	08	PL B661 28	S.H. Lee <i>et al.</i>	
LI	08	PR D77 054001	Y. Li, C.-D. Lu, W. Wang	
LIU	08A	PR D77 034003	X. Liu <i>et al.</i>	
AMBROSINO	07A	PL B648 267	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
BUISSERET	07	PR C76 025206	F. Buisseret	
CHEN	07E	PR D76 094025	H.-X. Chen, A. Hosaka, S.L. Zhu	
CHIU	07	PL B646 95	T.-W. Chiu, T.-H. Hsieh	
DING	07A	PL B657 49	G.-J. Ding, M.-L. Yan	
FAESSLER	07B	PR D76 114008	A. Faessler <i>et al.</i>	
GENERAL	07	EPJ C51 347	I.J. General, S.R. Contanch, F.J. Llanes-Estrada	
GENERAL	07A	PL B653 216	L.J. General <i>et al.</i>	
GLOZMAN	07	PRPL 444 1	L.Ya. Glozman	
GUO	07	PL B647 133	F.-K. Guo <i>et al.</i>	
HANHART	07	PR D75 074015	C. Hanhart <i>et al.</i>	
LEMMER	07	PL B650 152	R.H. Lemmer	
MAIANI	07	EPJ C50 609	L. Maiani <i>et al.</i>	
MATHEUS	07	PR D75 014005	R. Matheus <i>et al.</i>	
MATHUR	07	PR D76 114505	N. Mathur	
ROSNER	07	PR D76 114002	J. Rosner	
SANTOPINTO	07	PR C75 045206	E. Santopinto, G. Galata	
YANG	07	PR D76 094001	K.-C. Yang	
ABD-EL-HADY	06	PR D73 073010	A. Abd-El-Hady	
ACHARD	06A	PL B638 128	P. Achard <i>et al.</i>	(L3 Collab.)
ALFIKY	06	PL B640 238	M. Alfiky, F. Gabbiani, A.A. Petrov	(WAYN)
ANISOVICH	06A	PAN 69 520	V.V. Anisovich <i>et al.</i>	
AUBERT	06	PR D73 011101R	B. Aubert <i>et al.</i>	(BABAR Collab.)
BRAATEN	06	PR D73 011501	E. Braaten	
BUISSERET	06	EPJ A29 343	F. Buisseret, V. Mathieu	(UMH)
BURNS	06	PR D74 034003	T.J. Burns, F.E. Close	
CHEN	06	PR D73 014516	Y. Chen, A. Alexandru, S.J. Dong	
CHENG	06	PR D73 014017	H.-Y. Cheng, C.-K. Chua, K.-C. Yang	
CHENG	06A	PR D74 094005	H.-Y. Cheng, C.-K. Chua, K.-F. Liu	
CHIU	06	PR D73 094510	T.-W. Chiu, T.-H. Hsieh	
COOK	06	PR D74 094501	M.S. Cook, H.R. Fiebig	
CUI	06	PR D73 014018	Y. Cui <i>et al.</i>	
DING	06	PL B643 33	G.-J. Ding, M.-L. Yan	(CST)
DMITRASINO...	06	MPL A21 533	V. Dmitrasinovic	
DUBYSKIY	06	PR D74 094017	S. Dubynskiy, M. Voloshin	
FARIBORZ	06	PR D74 054030	A.H. Fariborz	
GIACOSA	06	PR D74 014028	F. Giacosa	
GUO	06A	PR D74 097503	F.-K. Guo, P.-N. Shen	

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HOGAASEN	06	PR D73 054013	H. Hogaasen <i>et al.</i>	REFID=51167
KARLINER	06	PL B638 221	M. Karliner, H.J. Lipkin	REFID=51172
KOCHELEV	06	PL B633 283	N. Kochelev, D.-P. Min	REFID=51000
LEE	06A	EPJ A30 423	H.-J. Lee	REFID=51524
LI	06	PR D74 034019	B.A. Li	REFID=51173
LI	06A	PR D74 054017	B.A. Li	REFID=51175
LI	06B	MPL A21 743	D.M. Li <i>et al.</i>	REFID=51174
LOAN	06	IJMP A21 2905	M. Loan <i>et al.</i>	REFID=51176
NAVARRA	06	PL B639 272	F.S. Navarra, M. Nielsen	REFID=51181
NIELSEN	06	PL B634 35	M. Nielsen	REFID=51182
PELAEZ	06	PRL 97 242002	J.R. Pelaez, G. Rios	REFID=51567
QIAO	06	PL B639 263	C. Qiao	REFID=51183
SWANSON	06	PRPL 429 243	E.S. Swanson	REFID=51188
UEHARA	06	PRL 96 082003	S. Uehara <i>et al.</i>	REFID=51039
VENTO	06	PR D73 054006	V. Vento	REFID=51192
VIJANDE	06	PR D73 034002	J. Vijande, F. Fernandez, A. Valcarce	REFID=51052
VOLOSHIN	06	IJMP A21 1239	M. Voloshin	REFID=51193
WANG	06	PR D73 094020	Z.-G. Wang, S.-L. Wan	REFID=51194
YUAN	06	PL B634 399	C.Z. Yuan, P. Wang, X.H. Mo	REFID=51044
ZHAO	06	PR D74 114025	Q. Zhao, B.S. Zhou	REFID=51569
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	REFID=50450
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	REFID=50985
ACHARD	05B	PL B615 19	P. Achard <i>et al.</i>	REFID=50761
ANIKIN	05	PL B626 86	I.V. Anikin, B. Pire, O.V. Teryaev	REFID=50770
ANISOVICH	05	JETPL 80 715	V.V. Anisovich	REFID=50772
ANISOVICH	05A	Translated from ZETFP 80 845.	V.V. Anisovich, A.V. Sarantsev	REFID=50771
ANISOVICH	05C	JETPL 81 417	V.V. Anisovich, M.A. Matveev, A.V. Sarantsev	REFID=50959
AUBERT	05B	Translated from ZETFP 81 531.	B. Aubert <i>et al.</i>	REFID=50498
AUBERT	05R	IJMP A20 6327	B. Aubert <i>et al.</i>	REFID=50627
AUBERT,B	05I	PR D71 031501R	B. Aubert <i>et al.</i>	REFID=50776
BICUDO	05	PR D71 071103R	B. Aubert <i>et al.</i>	REFID=50455
BIGI	05	PRL 95 142001	P. Bicudo	REFID=50994
BRAATEN	05	NP A748 537	I. Bigi <i>et al.</i>	REFID=50782
BRAATEN	05A	PR D72 114016	E. Braaten, M. Kusunoki	REFID=50783
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BRACCO	05	PR D72 054022	E. Braaten, M. Kusunoki	REFID=50784
BRITO	05	PR D71 074005	M.E. Bracco, A. Lozea, R.D. Matheus	REFID=50456
CHANG	05B	PL B624 217	T.V. Brito <i>et al.</i>	REFID=50787
CHANOWITZ	05	PL B608 69	C.-H. Chang, C.S. Kim, G. Wang	REFID=50835
CHOI	05	PL B623 218	M. Chanowitz	REFID=50737
CLOSE	05	PRL 95 172001	S.-K. Choi <i>et al.</i>	REFID=50788
CLOSE	05A	PRL 94 182002	F.E. Close, Q. Zhao	REFID=50830
DING	05	PR D71 094022	F.E. Close, P.R. Page	REFID=50790
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GUO	05	PR C71 025202	F. Giacosa <i>et al.</i>	REFID=50828
HEDDITCH	05	PL B622 277	F.-K. Guo <i>et al.</i>	REFID=50998
HUANG	05A	NP A761 269	J.N. Hedditch <i>et al.</i>	REFID=50795
IWASAKI	05A	PR D72 114507	M.Q. Huang, D.W. Wang	REFID=50965
JAFFE	05	PR D71 114015	M. Iwasaki, T. Fukutome	REFID=50502
KALASHNIK...	05	PR D72 094016	R.L. Jaffe	REFID=50799; ERROR=3
KANADA-EN...	05	PRPL 409 1	Yu.S. Kalashnikova, A.E. Kudryavtsev, A.V. Nefediev	REFID=50800
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KOU	05	PR D72 074012	H. Kim, Y. Oh	REFID=50967
LI	05	PL B631 164	E. Kou	REFID=50339
LI	05E	PL B605 306	B.A. Li	REFID=50968
LIU	05	MPL A20 2497	D.-M. Li <i>et al.</i>	REFID=50805
LOISEAU	05	PR D72 054023	X. Liu, X.Q. Zeng, X.Q. Li	REFID=50804
LU	05	PR C72 011001	B. Loiseau, S. Wycech	REFID=50459
MAIANI	05	PRL 94 032002	M. Lu <i>et al.</i>	REFID=50460
MAIANI	05A	PR D71 014028	L. Maiani <i>et al.</i>	REFID=50806
POPLAWSKI	05	PR D72 031502R	L. Maiani <i>et al.</i>	REFID=50809
SETH	05	PR D71 056003	N.J. Poplawski, A.P. Szczepaniak, J.T. Londergan	REFID=50814
SUZUKI	05	PL B612 1	K.K. Seth	REFID=51002
VIJANDE	05	PR D72 114013	M. Suzuki	REFID=50816
VOLOSHIN	05	PR D72 034025	J. Vijande, A. Valarce, F. Fernandez	REFID=50818
WANG	05A	PR D71 114003	M.B. Voloshin	REFID=50651
WANG	05C	PL B617 141	M.-Z. Wang <i>et al.</i>	REFID=50819
ZHANG	05	EPJ C42 89	Z.-G. Wang, W.-M. Yang	REFID=50461
ZHAO	05	PR D71 011502R	Z.F. Zhang, H.Y. Jin	REFID=50842
ZHAO	05A	PR D72 074001	Q. Zhao	REFID=50971
ZHU	05	PL B631 22	Q. Zhao, B.-S. Zou, Z.-B. Ma	REFID=50822
ABAZOV	04F	PL B625 212	S.-L. Zhu	REFID=50200
ABE	04	PRL 93 162002	V.M. Abazov <i>et al.</i>	REFID=49650
ABLIKIM	04E	EPJ C32 323	K. Abe <i>et al.</i>	REFID=50174
ACOSTA	04	PL B603 138	M. Ablikim <i>et al.</i>	REFID=49742
AMSLER	04	PRL 93 072001	D. Acosta <i>et al.</i>	REFID=49701
AMSLER	04A	PRPL 389 61	C. Amsler, N.A. Tornqvist	REFID=50166
BARNES	04	NP A740 130	C. Amsler <i>et al.</i>	REFID=49756
BARNES	04A	PR D69 054008	T. Barnes, S. Godfrey	REFID=50171
BARU	04	PL B600 223	T. Barnes <i>et al.</i>	REFID=49757
BRAATEN	04	PL B586 53	V. Baru <i>et al.</i>	REFID=49760
BRAATEN	04B	PR D69 074005	E. Braaten <i>et al.</i>	REFID=50199
BUGG	04C	PRL 93 162001	E. Braaten, M. Kusunoki, S. Nussinov	REFID=50203
CHAO	04A	PRPL 397 257	D.V. Bugg	REFID=50170
CHEN	04	PL B599 43	K.-T. Chao	REFID=49764
CHEN	04A	PR D69 076003	J.-X. Chen, J.-C. Su	REFID=50180
CHEN	04C	PR D69 054002	C.-H. Chen	REFID=50334
CHEN	04C	PRL 93 232001	Y.-Q. Chen, X.-Q. Li	

CLOSE	04A	PR D70 094015	F.E. Close, J.J. Dudek	REFID=50192
CLOSE	04B	PR D69 034010	F.E. Close, J.J. Dudek	REFID=50318
COHEN	04	PL B578 359	T.D. Cohen <i>et al.</i>	REFID=49765
DAI	04	JHEP 0411 043	Y.-B. Dai <i>et al.</i>	REFID=50335
DMITRASINO...	04	PR D70 096011	V. DMITRASINOVIC	REFID=50336
EICHTEEN	04	PR D69 094019	E. Eichten, K. Lane, C. Quigg	REFID=49767
FADDEEV	04	PR D70 114033	L. Faddeev <i>et al.</i>	REFID=50338
FARIBORZ	04	IJMP A19 2095	A.H. Fariborz	REFID=50160
GLOZMAN	04	PL B587 69	L.Ya. Glzman	REFID=49770
KREWALD	04	PR D69 016003	S. Krewald, R.H. Lemmer, F.P. Sassen	REFID=52081
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	REFID=49773
LIPKIN	04	PL B580 50	H.J. Lipkin	REFID=49776
LIU	04A	PR D70 094009	Y.-R. Liu	REFID=50191
LONGACRE	04	PR D70 094041	R.S. Longacre, S.J. Lindenbaum	REFID=50341
MAIANI	04	PR D70 054009	L. Maiani <i>et al.</i>	REFID=50181
NAPSUCIALE	04A	PR D70 094043	N.N. Napsuciale, S. Rodriguez	REFID=50345
PELAEZ	04	PRL 92 102001	J.R. Pelaez	REFID=49777
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	REFID=50347
SWANSON	04	PL B582 167	E. Swanson	REFID=49780
SWANSON	04A	PL B588 189	E. Swanson	REFID=49781
SWANSON	04B	PL B598 197	E. Swanson	REFID=50168
TESHIMA	04	JPG 30 663	T. Teshima <i>et al.</i>	REFID=50161
TORNQVIST	04	PL B590 209	N. Tornqvist	REFID=49782
VANBEVEREN	04	MPL A19 1949	E. van Beveren, G. Rupp	REFID=50164
VOLOSHIN	04A	PL B604 69	M.B. Voloshin	REFID=50205
WONG	04	PR C69 055202	C. Wong	REFID=50177
ZOU	04	PR D69 034004	B.S. Zou, H.C. Chiang	REFID=49784
AUBERT	03G	PRL 90 242001	B. Aubert <i>et al.</i>	REFID=49417
BARNES	03	PR D68 054006	T. Barnes <i>et al.</i>	REFID=49581
BESSON	03	PR D68 032002	D. Besson <i>et al.</i>	REFID=49583
CHENG	03B	PR D67 054021	H.Y. Cheng	REFID=49397
CHENG	03C	PL B566 193	H.-Y. Cheng, W.-S. Hou	REFID=49469
CHOI	03	PRL 91 262001	S.-K. Choi <i>et al.</i>	REFID=49628
TERASAKI	03	PR D68 011501	K. Terasaki	REFID=49474
ABE	02K	PRL 88 181803	K. Abe <i>et al.</i>	REFID=48690
ALOISIO	02C	PL B536 209	A. Aloisio <i>et al.</i>	REFID=48823
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	REFID=48824
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	REFID=48580
AMSLER	02B	PL B541 22	C. Amsler	REFID=48826
CHUNG	02C	EPJ A15 539	S.U. Chung, E. Klempt, J.G. Korener	REFID=49176
CLOSE	02B	JPG 28 R249	F.E. Close, N. Tornqvist	REFID=49166
ABELE	01	EPJ C19 667	A. Abele <i>et al.</i>	REFID=48334
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	REFID=48356
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	REFID=48321
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	REFID=48004
AMSLER	01	PL B520 175	C. Amsler <i>et al.</i>	REFID=48558
CLOSE	01B	EPJ C21 531	F.E. Close, A. Kirk	REFID=48357
IDDIR	01	PL B507 183	F. Iddir, A.S. Safir	REFID=48326
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	REFID=48317
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	REFID=47928
ALFORD	00	NP B578 367	M. Alford, R.L. Jaffe	REFID=47938
BARATE	00E	PL B472 189	R. Barate <i>et al.</i>	REFID=47428
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	REFID=47959
KIRK	00	PL B489 29	A. Kirk	REFID=47985
LEE	00	PR D61 014015	W. Lee, D. Weingarten	REFID=47408
ABELE	99	PL B446 349	A. Abele <i>et al.</i>	REFID=46602
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin <i>et al.</i>	REFID=47392
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	REFID=46888
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	REFID=47395
CHUNG	99	PR D60 092001	S.U. Chung <i>et al.</i>	REFID=47387
DELBOURGO	99	PL B446 332	R. Delbourgo, D. Liu, M. Scadron	REFID=46607
DONNACHIE	99	PR D60 114011	A. Donnachie, Yu.S. Kalashnikova	REFID=47388
DUENNWEBER	99	NP A 663 + 664, 592C	W. Duennweber	REFID=47548
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MINKOWSKI	99	EPJ C9 283	P. Minkowski, W. Ochs	REFID=46928
MORNINGSTAR	99	PR D60 034509	C.J. Morningstar, M. Peardon	REFID=46933
PAGE	99	PR D59 034016	P.R. Page, E.S. Swanson, A.P. Szczepaniak	REFID=46617
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	REFID=45863
ABELE	98B	PL B423 175	A. Abele <i>et al.</i>	REFID=45864
ADAMS	98B	PRL 81 5760	G.S. Adams <i>et al.</i>	REFID=46610
AMSLER	98	RMP 70 1293	C. Amsler	REFID=46601
BARBERIS	98	PL B432 436	D. Barberis <i>et al.</i>	REFID=46344
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	REFID=45782
CLOSE	98B	PL B419 387	F.E. Close	REFID=46361
DONNACHIE	98	PR D58 114012	A. Donnachie <i>et al.</i>	REFID=46598
EVANGELIS...	98	PR D57 5370	C. Evangelista <i>et al.</i>	REFID=46365
LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	REFID=46372
ANISOVICH	97	PL B395 123	A.V. Anisovich, A.V. Sarantsev	REFID=45388
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	REFID=45758
BARNES	97	PR D55 4157	T. Barnes <i>et al.</i>	REFID=45384
BERNARD	97	PR D56 7039	C. Bernard <i>et al.</i>	REFID=47516
BOGLIONE	97	PRL 79 1998	M. Boglione <i>et al.</i>	REFID=45694
CLOSE	97	PL B397 333	F. Close <i>et al.</i>	REFID=45390
FRABETTI	97	PL B391 235	P.L. Frabetti <i>et al.</i>	REFID=45246
LACOCK	97	PL B401 308	P. Lacock <i>et al.</i>	REFID=45773
MICHAEL	97	Hadron 97 Conf.	C. Michael	REFID=47550
AIP Conf.	Proc.	432 657		
OLLER	97B	Hadron 97 Conf.	J.A. Oller, E. Oset	REFID=47551
AIP Conf.	Proc.	432 413		
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	REFID=45584
WEINGARTEN	97	NPPS 53 232	D. Weingarten	REFID=47553
ABELE	96B	PL B385 425	A. Abele <i>et al.</i>	REFID=45038
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	REFID=45202
AMSLER	96	PR D53 295	C. Amsler, F.E. Close	REFID=44635
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	REFID=44736
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	REFID=44507
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	REFID=44433
CLOSE	95	NP B443 233	F.E. Close, P.R. Page	REFID=44643
PROKOSHKIN	95B	PAN 58 606	Y.D. Prokoshkin, S.A. Sadovsky	REFID=44619
Translated from YAF 58 662.				

PROKOSHKIN	95C	PAN 58 853	Y.D. Prokoshkin, S.A. Sadovsky	(SERP)	REFID=44620
		Translated from YAF 58 921.			
SEXTON	95	PRL 75 4563	J. Sexton <i>et al.</i>	(IBM)	REFID=44634
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)	REFID=44092
BALI	93	PL B309 378	G.S. Bali <i>et al.</i>	(LIVP)	REFID=43607
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=43598
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)	REFID=42177
GOUZ	92	Dallas HEP 92, p. 572	Yu.P. Gouz <i>et al.</i>	(VES Collab.)	REFID=47527
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KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=42170
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40935
MAY	90	ZPHY C46 203	B. May <i>et al.</i>	(ASTERIX Collab.)	REFID=41365
WEINSTEIN	90	PR D41 2236	J. Weinstein, N. Isgur	(TNTO)	REFID=43674
ALDE	88B	PL B205 397	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=40558
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40330
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=40285
CLOSE	87B	PL B196 245	F.E. Close, H.J. Lipkin		REFID=47547
BOOTH	86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)	REFID=21870
BARNES	85	PL B165 434	T. Barnes		REFID=47526
ISGUR	85	PRL 54 869	N. Isgur, R. Kokoski, J. Paton	(TNTO)	REFID=43675
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)	REFID=43673
