$\eta_c(1S)$

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

$\eta_c(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2983.6 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.2.		
2979.8 ± 0.8 ± 3.5	4.5k	[1,2] LEES 14E	BABR	$\gamma\gamma \to K^+ K^- \pi^0$
2984.1 ± 1.1 ± 2.1	900	[1,2,3] LEES 14E	BABR	$\gamma\gamma \to K^+ K^- \eta$
2984.3 ± 0.6 ± 0.6		[4,5] ABLIKIM 12F	BES3	$\psi(2S) \to \gamma\eta_c$
2984.49 ± 1.16 ± 0.52	832	[1] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0\gamma$ hadrons
2982.7 ± 1.8 ± 2.2	486	ZHANG 12A	BELL	$e^+ e^- \to e^+ e^- \eta' \pi^+ \pi^-$
2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \to K^+ K^- \pi^+ \pi^- \pi^0$
2985.4 ± 1.5 $^{+0.5}_{-2.0}$	920	[5] VINOKUROVA 11	BELL	$B^\pm \to K^\pm (K^0_S K^\pm \pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	[6] LEES 10	BABR	10.6 $e^+ e^- \to e^+ e^- K^0_S K^\pm \pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT 08AB	BABR	$B \to \eta_c(1S) K^{(*)} \to K\overline{K}\pi K^{(*)}$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA 08	BELL	$\gamma\gamma \to \eta_c \to$ hadrons
2970 ± 5 ± 6	501	[7] ABE 07	BELL	$e^+ e^- \to J/\psi(c\overline{c})$
2971 ± 3 $^{+2}_{-1}$	195	WU 06	BELL	$B^+ \to p\overline{p}K^+$
2974 ± 7 $^{+2}_{-1}$	20	WU 06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$
2981.8 ± 1.3 ± 1.5	592	ASNER 04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm \pi^\mp$
2984.1 ± 2.1 ± 1.0	190	[8] AMBROGIANI 03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
• • • 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	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
2982.2 ± 0.6		[10] MITCHELL 09	CLEO	$e^+ e^- \to \gamma X$
2982 ± 5	270	[11] AUBERT 06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	[12] AUBERT 04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
2977.5 ± 1.0 ± 1.2		[10,13] BAI 03	BES	$J/\psi \to \gamma\eta_c$
2979.6 ± 2.3 ± 1.6	180	[14] FANG 03	BELL	$B \to \eta_c K$
2976.3 ± 2.3 ± 1.2		[10,15] BAI 00F	BES	$J/\psi,\ \psi(2S) \to \gamma\eta_c$
2976.6 ± 2.9 ± 1.3	140	[10,16] BAI 00F	BES	$J/\psi \to \gamma\eta_c$
2980.4 ± 2.3 ± 0.6		[17] BRANDENB... 00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
2975.8 ± 3.9 ± 1.2		[16] BAI 99B	BES	Sup. by BAI 00F
2999 ± 8	25	ABREU 98O	DLPH	$e^+ e^- \to e^+ e^-$ +hadrons
2988.3 $^{+3.3}_{-3.1}$		ARMSTRONG 95F	E760	$\overline{p}p \to \gamma\gamma$
2974.4 ± 1.9		[10,18] BISELLO 91	DM2	$J/\psi \to \eta_c\gamma$

2969 ± 4 ± 4	80	[10] BAI	90B	MRK3	$J/\psi \to \gamma K^+ K^- K^+ K^-$
2956 ±12 ±12		[10] BAI	90B	MRK3	$J/\psi \to \gamma K^+ K^- K^0_S K^0_L$
2982.6 $^{+2.7}_{-2.3}$	12	BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
2980.2 ± 1.6		[10,18] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$
2984 ± 2.3 ± 4.0		[10] GAISER	86	CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$
2976 ± 8		[10,19] BALTRUSAIT...	84	MRK3	$J/\psi \to 2\phi\gamma$
2982 ± 8	18	[20] HIMEL	80B	MRK2	$e^+ e^-$
2980 ± 9		[20] PARTRIDGE	80B	CBAL	$e^+ e^-$

[1] With floating width.
[2] Ignoring possible interference with the non-resonant 0^- amplitude.
[3] Using both, $\eta \to \gamma\gamma$ and $\eta \to \pi^+ \pi^- \pi^0$ decays.
[4] From a simultaneous fit to six decay modes of the η_c.
[5] Accounts for interference with non-resonant continuum.
[6] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
[7] From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.
[8] Using mass of $\psi(2S)$ = 3686.00 MeV.
[9] Not independent from the measurements reported by LEES 10.
[10] MITCHELL 09 observes a significant asymmetry in the lineshapes of $\psi(2S) \to \gamma\eta_c$ and $J/\psi \to \gamma\eta_c$ 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.
[11] From the fit of the kaon momentum spectrum. Systematic errors not evaluated.
[12] Superseded by LEES 10.
[13] From a simultaneous fit of five decay modes of the η_c.
[14] Superseded by VINOKUROVA 11.
[15] Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV.
[16] Average of several decay modes. Using an η_c width of 13.2 MeV.
[17] Superseded by ASNER 04.
[18] Average of several decay modes.
[19] $\eta_c \to \phi\phi$.
[20] Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.

$\eta_c(1S)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
31.8± 0.8 OUR FIT					
32.0± 1.0 OUR AVERAGE		Error includes scale factor of 1.2.			
25.2± 2.6±2.4	4.5k	[1,2] LEES	14E	BABR	$\gamma\gamma \to K^+ K^- \pi^0$
34.8± 3.1±4.0	900	[1,2,3] LEES	14E	BABR	$\gamma\gamma \to K^+ K^- \eta$
32.0± 1.2±1.0		[4,5] ABLIKIM	12F	BES3	$\psi(2S) \to \gamma\eta_c$
36.4± 3.2±1.7	832	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma$ hadrons
37.8$^{+5.8}_{-5.3}$±3.1	486	ZHANG	12A	BELL	$e^+ e^- \to e^+ e^- \eta' \pi^+ \pi^-$
36.2± 2.8±3.0	11k	DEL-AMO-SA...	11M	BABR	$\gamma\gamma \to K^+ K^- \pi^+ \pi^- \pi^0$
35.1± 3.1$^{+1.0}_{-1.6}$	920	[5] VINOKUROVA	11	BELL	$B^\pm \to K^\pm (K^0_S K^\pm \pi^\mp)$
31.7± 1.2±0.8	14k	[6] LEES	10	BABR	10.6 $e^+ e^- \to e^+ e^- K^0_S K^\pm \pi^\mp$

$36.3^{+\ 3.7}_{-\ 3.6}\pm4.4$	0.9k	AUBERT	08AB	BABR	$B \to \eta_c(1S) K^{(*)} \to K\overline{K}\pi K^{(*)}$
$28.1\pm\ 3.2\pm2.2$	7.5k	UEHARA	08	BELL	$\gamma\gamma \to \eta_c \to$ hadrons
$48\ ^{+\ 8}_{-\ 7}\ \pm5$	195	WU	06	BELL	$B^+ \to p\overline{p}K^+$
$40\ \pm19\ \pm5$	20	WU	06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$
$24.8\pm\ 3.4\pm3.5$	592	ASNER	04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm \pi^\mp$
$20.4^{+\ 7.7}_{-\ 6.7}\pm2.0$	190	AMBROGIANI	03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
$23.9^{+12.6}_{-\ 7.1}$		ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$

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

$32.1\pm\ 1.1\pm1.3$	12k	[7] DEL-AMO-SA...	11M	BABR	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
$34.3\pm\ 2.3\pm0.9$	2.5k	[8] AUBERT	04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
$17.0\pm\ 3.7\pm7.4$		[9] BAI	03	BES	$J/\psi \to \gamma\eta_c$
$29\ \pm\ 8\ \pm6$	180	[10] FANG	03	BELL	$B \to \eta_c K$
$11.0\pm\ 8.1\pm4.1$		[11] BAI	00F	BES	$J/\psi \to \gamma\eta_c$ and $\psi(2S) \to \gamma\eta_c$
$27.0\pm\ 5.8\pm1.4$		[12] BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
$7.0^{+\ 7.5}_{-\ 7.0}$	12	BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
$10.1^{+33.0}_{-\ 8.2}$	23	[13] BALTRUSAIT...	86	MRK3	$J/\psi \to \gamma p\overline{p}$
$11.5\pm\ 4.5$		GAISER	86	CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$
< 40 90% CL	18	HIMEL	80B	MRK2	e^+e^-
< 20 90% CL		PARTRIDGE	80B	CBAL	e^+e^-

[1] With floating mass.
[2] Ignoring possible interference with the non-resonant 0^- amplitude.
[3] Using both, $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays.
[4] From a simultaneous fit to six decay modes of the η_c.
[5] Accounts for interference with non-resonant continuum.
[6] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
[7] Not independent from the measurements reported by LEES 10.
[8] Superseded by LEES 10.
[9] From a simultaneous fit of five decay modes of the η_c.
[10] Superseded by VINOKUROVA 11.
[11] From a fit to the 4-prong invariant mass in $\psi(2S) \to \gamma\eta_c$ and $J/\psi(1S) \to \gamma\eta_c$ decays.
[12] Superseded by ASNER 04.
[13] Positive and negative errors correspond to 90% confidence level.

$\eta_c(1S)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
	Decays involving hadronic resonances		
Γ_1	$\eta'(958)\pi\pi$	(4.1 ±1.7) %	
Γ_2	$\rho\rho$	(1.8 ±0.5) %	
Γ_3	$K^*(892)^0 K^-\pi^+ +$ c.c.	(2.0 ±0.7) %	
Γ_4	$K^*(892)\overline{K}^*(892)$	(7.0 ±1.3) $\times 10^{-3}$	
Γ_5	$K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-$	(1.1 ±0.5) %	

Γ_{6}	$\phi K^+ K^-$	$(2.9 \pm 1.4) \times 10^{-3}$	
Γ_{7}	$\phi\phi$	$(1.75 \pm 0.20) \times 10^{-3}$	
Γ_{8}	$\phi 2(\pi^+\pi^-)$	$< 4 \times 10^{-3}$	90%
Γ_{9}	$a_0(980)\pi$	< 2 %	90%
Γ_{10}	$a_2(1320)\pi$	< 2 %	90%
Γ_{11}	$K^*(892)\overline{K}$ + c.c.	< 1.28 %	90%
Γ_{12}	$f_2(1270)\eta$	< 1.1 %	90%
Γ_{13}	$\omega\omega$	$< 3.1 \times 10^{-3}$	90%
Γ_{14}	$\omega\phi$	$< 1.7 \times 10^{-3}$	90%
Γ_{15}	$f_2(1270) f_2(1270)$	$(9.8 \pm 2.5) \times 10^{-3}$	
Γ_{16}	$f_2(1270) f'_2(1525)$	$(9.7 \pm 3.2) \times 10^{-3}$	
Γ_{17}	$f_0(980)\eta$	seen	
Γ_{18}	$f_0(1500)\eta$	seen	
Γ_{19}	$f_0(2200)\eta$	seen	
Γ_{20}	$a_0(980)\pi$	seen	
Γ_{21}	$a_0(1320)\pi$	seen	
Γ_{22}	$a_0(1450)\pi$	seen	
Γ_{23}	$K^*_0(1430)\overline{K}$	seen	
Γ_{24}	$K^*_2(1430)\overline{K}$	seen	
Γ_{25}	$K^*_0(1950)\overline{K}$	seen	

Decays into stable hadrons

Γ_{26}	$K\overline{K}\pi$	(7.3 ± 0.5) %
Γ_{27}	$K\overline{K}\eta$	(1.35 ± 0.16) %
Γ_{28}	$\eta\pi^+\pi^-$	(1.7 ± 0.5) %
Γ_{29}	$\eta 2(\pi^+\pi^-)$	(4.4 ± 1.3) %
Γ_{30}	$K^+K^-\pi^+\pi^-$	$(6.9 \pm 1.1) \times 10^{-3}$
Γ_{31}	$K^+K^-\pi^+\pi^-\pi^0$	(3.5 ± 0.6) %
Γ_{32}	$K^0K^-\pi^+\pi^-\pi^+$+c.c.	(5.6 ± 1.5) %
Γ_{33}	$K^+K^- 2(\pi^+\pi^-)$	$(7.5 \pm 2.4) \times 10^{-3}$
Γ_{34}	$2(K^+K^-)$	$(1.46 \pm 0.30) \times 10^{-3}$
Γ_{35}	$\pi^+\pi^-\pi^0\pi^0$	(4.7 ± 1.0) %
Γ_{36}	$2(\pi^+\pi^-)$	$(9.7 \pm 1.2) \times 10^{-3}$
Γ_{37}	$2(\pi^+\pi^-\pi^0)$	(17.4 ± 3.3) %
Γ_{38}	$3(\pi^+\pi^-)$	(1.8 ± 0.4) %
Γ_{39}	$p\overline{p}$	$(1.50 \pm 0.16) \times 10^{-3}$
Γ_{40}	$p\overline{p}\pi^0$	$(3.6 \pm 1.3) \times 10^{-3}$
Γ_{41}	$\Lambda\overline{\Lambda}$	$(1.09 \pm 0.24) \times 10^{-3}$
Γ_{42}	$\Sigma^+\overline{\Sigma}^-$	$(2.1 \pm 0.6) \times 10^{-3}$
Γ_{43}	$\Xi^-\overline{\Xi}^+$	$(8.9 \pm 2.7) \times 10^{-4}$
Γ_{44}	$\pi^+\pi^- p\overline{p}$	$(5.3 \pm 1.8) \times 10^{-3}$

Radiative decays

Γ_{45}	$\gamma\gamma$	$(1.59 \pm 0.12) \times 10^{-4}$

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

Γ_{46}	$\pi^+\pi^-$	P,CP	< 1.1	$\times 10^{-4}$	90%
Γ_{47}	$\pi^0\pi^0$	P,CP	< 4	$\times 10^{-5}$	90%
Γ_{48}	K^+K^-	P,CP	< 6	$\times 10^{-4}$	90%
Γ_{49}	$K_S^0 K_S^0$	P,CP	< 3.1	$\times 10^{-4}$	90%

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 8 combinations of partial widths obtained from integrated cross section, and 19 branching ratios uses 84 measurements and one constraint to determine 13 parameters. The overall fit has a $\chi^2 = 117.7$ for 72 degrees of freedom.

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

	x_4	x_7	x_{15}	x_{26}	x_{27}	x_{30}	x_{34}	x_{36}	x_{39}	x_{41}
x_7	18									
x_{15}	3	6								
x_{26}	22	41	7							
x_{27}	12	22	4	54						
x_{30}	11	21	4	25	13					
x_{34}	9	16	3	25	14	10				
x_{36}	14	25	5	30	16	16	12			
x_{39}	14	26	5	36	19	16	13	20		
x_{41}	3	6	1	9	5	4	3	5	25	
x_{45}	−29	−54	−10	−66	−35	−34	−27	−41	−46	−11
Γ	−2	−3	−1	−4	−2	−2	−1	−2	7	2

	x_{45}
Γ	−28

	Mode	Rate (MeV)
Γ_4	$K^*(892)\overline{K}^*(892)$	0.22 ± 0.04
Γ_7	$\phi\phi$	0.056 ± 0.007
Γ_{15}	$f_2(1270) f_2(1270)$	0.31 ± 0.08
Γ_{26}	$K\overline{K}\pi$	2.32 ± 0.17
Γ_{27}	$K\overline{K}\eta$	0.43 ± 0.05
Γ_{30}	$K^+K^-\pi^+\pi^-$	0.219 ± 0.034
Γ_{34}	$2(K^+K^-)$	0.046 ± 0.010

Γ_{36}	$2(\pi^+\pi^-)$	0.31 ± 0.04
Γ_{39}	$p\overline{p}$	0.048 ± 0.005
Γ_{41}	$\Lambda\overline{\Lambda}$	0.035 ± 0.008
Γ_{45}	$\gamma\gamma$	0.0051 ± 0.0004

$\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ — Γ_{45}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.1± 0.4 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.8 ± 1.1	486	[1] ZHANG 12A	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
5.2 ± 1.2	273 ± 43	[2,3] AUBERT 06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
$5.5 \pm 1.2 \pm 1.8$	157 ± 33	[4] KUO 05	BELL	$\gamma\gamma \to p\overline{p}$
$7.4 \pm 0.4 \pm 2.3$		[5] ASNER 04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm \pi^\mp$
$13.9 \pm 2.0 \pm 3.0$	41	[6] ABDALLAH 03J	DLPH	$\gamma\gamma \to \eta_c$
$3.8^{+1.1}_{-1.0}{}^{+1.9}_{-1.0}$	190	[7] AMBROGIANI 03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
$7.6 \pm 0.8 \pm 2.3$		[5,8] BRANDENB... 00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
$6.9 \pm 1.7 \pm 2.1$	76	[9] ACCIARRI 99T	L3	$e^+e^- \to e^+e^-\eta_c$
$27 \pm 16 \pm 10$	5	[5] SHIRAI 98	AMY	$58\ e^+e^-$
$6.7^{+2.4}_{-1.7} \pm 2.3$		[4] ARMSTRONG 95F	E760	$\overline{p}p \to \gamma\gamma$
11.3 ± 4.2		[10] ALBRECHT 94H	ARG	$e^+e^- \to e^+e^-\eta_c$
$8.0 \pm 2.3 \pm 2.4$	17	[11] ADRIANI 93N	L3	$e^+e^- \to e^+e^-\eta_c$
$5.9^{+2.1}_{-1.8} \pm 1.9$		[7] CHEN 90B	CLEO	$e^+e^- \to e^+e^-\eta_c$
$6.4^{+5.0}_{-3.4}$		[12] AIHARA 88D	TPC	$e^+e^- \to e^+e^-X$
$4.3^{+3.4}_{-3.7} \pm 2.4$		[4] BAGLIN 87B	SPEC	$\overline{p}p \to \gamma\gamma$
28 ± 15		[5,13] BERGER 86	PLUT	$\gamma\gamma \to K\overline{K}\pi$

[1] Assuming there is no interference with the non-resonant background.

[2] Calculated by us using $\Gamma(\eta_c \to K\overline{K}\pi) \times \Gamma(\eta_c \to \gamma\gamma) / \Gamma = 0.44 \pm 0.05$ keV from PDG 06 and $B(\eta_c \to K\overline{K}\pi) = (8.5 \pm 1.8)\%$ from AUBERT 06E.

[3] Systematic errors not evaluated.

[4] Normalized to $B(\eta_c \to p\overline{p}) = (1.3 \pm 0.4) \times 10^{-3}$.

[5] Normalized to $B(\eta_c \to K^\pm K^0_S \pi^\mp)$.

[6] Average of $K^0_S K^\pm \pi^\mp$, $\pi^+\pi^- K^+K^-$, and $2(K^+K^-)$ decay modes.

[7] Normalized to the sum of $B(\eta_c \to K^\pm K^0_S \pi^\mp)$, $B(\eta_c \to K^+K^-\pi^+\pi^-)$, and $B(\eta_c \to 2\pi^+2\pi^-)$.

[8] Superseded by ASNER 04.

[9] Normalized to the sum of 9 branching ratios.

[10] Normalized to the sum of $B(\eta_c \to K^\pm K^0_S \pi^\mp)$, $B(\eta_c \to \phi\phi)$, $B(\eta_c \to K^+K^-\pi^+\pi^-)$, and $B(\eta_c \to 2\pi^+2\pi^-)$.

[11] Superseded by ACCIARRI 99T.

[12] Normalized to the sum of $B(\eta_c \to K^\pm K^0_S \pi^\mp)$, $B(\eta_c \to 2K^+2K^-)$, $B(\eta_c \to K^+K^-\pi^+\pi^-)$, and $B(\eta_c \to 2\pi^+2\pi^-)$.

[13] Re-evaluated by AIHARA 88D.

$\eta_c(1S)$ Γ(i)Γ(γγ)/Γ(total)

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_1\Gamma_{45}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
$75.8^{+6.3}_{-6.2}\pm8.4$	486	[1] ZHANG	12A	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$

[1] Assuming there is no interference with the non-resonant background.

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_2\Gamma_{45}/\Gamma$

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	$\gamma\gamma \to 2(\pi^+\pi^-)$

$\Gamma(K^*(892)\overline{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_4\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
36 ±6 OUR FIT					
32.4±4.2±5.8	882 ± 115	UEHARA	08	BELL	$\gamma\gamma \to \pi^+\pi^-K^+K^-$

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_7\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
8.9 ±0.8 OUR FIT					
7.75±0.66±0.62	386 ± 31	[1] LIU	12B	BELL	$\gamma\gamma \to 2(K^+K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.8 ±1.2 ±1.3	132 ± 23	UEHARA	08	BELL	$\gamma\gamma \to 2(K^+K^-)$

[1] Supersedes UEHARA 08. Using B($\phi \to K^+K^-$) = (48.9 ± 0.5)%.

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{13}\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
8.67±2.86±0.96	85 ± 29	[1] LIU	12B	BELL	$\gamma\gamma \to 2(\pi^+\pi^-\pi^0)$

[1] Using B($\omega \to \pi^+\pi^-\pi^0$) = (89.2 ± 0.7)%.

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{14}\Gamma_{45}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.49	90	[1] LIU	12B	BELL	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$

[1] Using B($\phi \to K^+K^-$) = (48.9 ± 0.5)% and B($\omega \to \pi^+\pi^-\pi^0$) = (89.2 ± 0.7)%.

$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{15}\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
50±13 OUR FIT					
69±17±12	3182±766	UEHARA	08	BELL	$\gamma\gamma \to 2(\pi^+\pi^-)$

$\Gamma(f_2(1270)f_2'(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{16}\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
49±9±13	1128±206	UEHARA	08	BELL	$\gamma\gamma \to \pi^+\pi^-K^+K^-$

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{26}\Gamma_{45}/\Gamma$

VALUE (keV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.368±0.021 OUR FIT						
0.407±0.027 OUR AVERAGE			Error includes scale factor of 1.2.			
0.374±0.009±0.031		14k	[1] LEES	10	BABR	10.6 $e^+e^- \rightarrow e^+e^- K^0_S K^\pm \pi^\mp$
0.407±0.022±0.028			[2,3] ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K^0_S K^\pm \pi^\mp$
0.60 ±0.12 ±0.09		41	[3,4] ABDALLAH	03J	DLPH	$\gamma\gamma \rightarrow K^0_S K^\pm \pi^\mp$
1.47 ±0.87 ±0.27			[3] SHIRAI	98	AMY	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K^0_S \pi^\mp$
0.84 ±0.21			[3] ALBRECHT	94H	ARG	$\gamma\gamma \rightarrow K^\pm K^0_S \pi^\mp$
0.60 $^{+0.23}_{-0.20}$			[3] CHEN	90B	CLEO	$\gamma\gamma \rightarrow \eta_c K^\pm K^0_S \pi^\mp$
1.06 ±0.41 ±0.27		11	[3] BRAUNSCH...	89	TASS	$\gamma\gamma \rightarrow K\overline{K}\pi$
1.5 $^{+0.60}_{-0.45}$ ±0.3		7	[3] BERGER	86	PLUT	$\gamma\gamma \rightarrow K\overline{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.386±0.008±0.021		12k	[5] DEL-AMO-SA..	11M	BABR	$\gamma\gamma \rightarrow K^0_S K^\pm \pi^\mp$
0.418±0.044±0.022			[3,6] BRANDENB...	00B	CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K^0_S \pi^\mp$
<0.63	95		[3] BEHREND	89	CELL	$\gamma\gamma \rightarrow K^0_S K^\pm \pi^\mp$
<4.4	95		ALTHOFF	85B	TASS	$\gamma\gamma \rightarrow K\overline{K}\pi$

[1] From the corrected and unfolded mass spectrum.
[2] Calculated by us from the value reported in ASNER 04 that assumes B($\eta_c \rightarrow K\overline{K}\pi$) = 5.5 ± 1.7%
[3] We have multiplied $K^\pm K^0_S \pi^\mp$ measurement by 3 to obtain $K\overline{K}\pi$.
[4] Calculated by us from the value reported in ABDALLAH 03J, which uses B($\eta_c \rightarrow K^0_S K^\pm \pi^\mp$) = (1.5 ± 0.4)%.
[5] Not independent from the measurements reported by LEES 10.
[6] Superseded by ASNER 04.

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{30}\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
35 ± 5 OUR FIT					
27 ± 6 OUR AVERAGE					
25.7± 3.2± 4.9	2019±248	UEHARA	08	BELL	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
280 ±100 ±60	42	[1] ABDALLAH	03J	DLPH	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
170 ± 80 ±20	13.9 ± 6.6	ALBRECHT	94H	ARG	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$

[1] Calculated by us from the value reported in ABDALLAH 03J, which uses B($\eta_c \rightarrow \pi^+\pi^-K^+K^-$) = (2.0 ± 0.7)%.

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{31}\Gamma_{45}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.190±0.006±0.028	11k	[1] DEL-AMO-SA..11M		BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

[1] Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{34}\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
7.4± 1.5 OUR FIT					
5.8± 1.9 OUR AVERAGE					
5.6± 1.1± 1.6	216 ± 42	UEHARA	08	BELL	$\gamma\gamma \to 2(K^+K^-)$
350 ±90 ±60	46	[1] ABDALLAH	03J	DLPH	$\gamma\gamma \to 2(K^+K^-)$
231 ±90 ±23	9.1 ± 3.3	[2] ALBRECHT	94H	ARG	$\gamma\gamma \to 2(K^+K^-)$

[1] Calculated by us from the value reported in ABDALLAH 03J, which uses B($\eta_c \to$) $2(K^+K^-) = (2.1 \pm 1.2)\%$.

[2] Includes all topological modes except $\eta_c \to \phi\phi$.

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{36}\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
49 ± 6 OUR FIT					
42 ± 6 OUR AVERAGE					
40.7± 3.7± 5.3	5381 ± 492	UEHARA	08	BELL	$\gamma\gamma \to 2(\pi^+\pi^-)$
180 ±70 ±20	21.4 ± 8.6	ALBRECHT	94H	ARG	$\gamma\gamma \to 2(\pi^+\pi^-)$

$\Gamma(p\overline{p}) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{39}\Gamma_{45}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
7.6 ±0.7 OUR FIT					
$7.20 \pm 1.53^{+0.67}_{-0.75}$	157 ± 33	[1] KUO	05	BELL	$\gamma\gamma \to p\overline{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.6\ ^{+1.3}_{-1.1} \pm 0.4$	190	[1] AMBROGIANI	03	E835	$\overline{p}p \to \gamma\gamma$
$8.1\ ^{+2.9}_{-2.0}$		[1] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$

[1] Not independent from the $\Gamma_{\gamma\gamma}$ reported by the same experiment.

$\Gamma(K^0_S K^0_S) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{49}\Gamma_{45}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
<1.6	90	[1] UEHARA	13	BELL	$\gamma\gamma \to K^0_S K^0_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.29	90	[2] UEHARA	13	BELL	$\gamma\gamma \to K^0_S K^0_S$

[1] Taking into account interference with the non-resonant continuum.

[2] Neglecting interference with the non-resonant continuum.

$\eta_c(1S)$ BRANCHING RATIOS

HADRONIC DECAYS

$\Gamma(\eta'(958)\pi\pi)/\Gamma_{total}$ — Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.041±0.017	14	[1] BALTRUSAIT..86	MRK3	$J/\psi \to \eta_c\gamma$

[1] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036.

$\Gamma(\rho\rho)/\Gamma_{total}$ Γ_2/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
18 ± 5 OUR AVERAGE						
12.6± 3.8±5.1		72	[1] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^+\pi^-\gamma$
26.0± 2.4±8.8		113	[1] BISELLO	91	DM2	$J/\psi \to \gamma\rho^0\rho^0$
23.6±10.6±8.2		32	[1] BISELLO	91	DM2	$J/\psi \to \gamma\rho^+\rho^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<14	90		[1] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

[1] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

$\Gamma(K^*(892)^0 K^-\pi^+ + \text{c.c.})/\Gamma_{total}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.02±0.007	63	[1,2] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

[1] BALTRUSAITIS 86 has an error according to Partridge.
[2] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036.

$\Gamma(K^*(892)\overline{K}^*(892))/\Gamma_{total}$ Γ_4/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
70±13 OUR FIT					
91±26 OUR AVERAGE					
108±25±44	60	[1] ABLIKIM	05L	BES2	$J/\psi \to K^+K^-\pi^+\pi^-\gamma$
82±28±27	14	[1] BISELLO	91	DM2	$e^+e^- \to \gamma K^+K^-\pi^+\pi^-$
90±50	9	[1] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

[1] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

$\Gamma(K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-)/\Gamma_{total}$ Γ_5/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
113±47±25	45	[1] ABLIKIM	06A	BES2	$J/\psi \to K^{*0}\overline{K}^{*0}\pi^+\pi^-\gamma$

[1] ABLIKIM 06A reports [$\Gamma(\eta_c(1S) \to K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-)/\Gamma_{total}$] × [B($J/\psi(1S) \to \gamma\eta_c(1S)$)] = (1.91 ± 0.64 ± 0.48) × 10^{-4} which we divide by our best value B($J/\psi(1S) \to \gamma\eta_c(1S)$) = (1.7 ± 0.4) × 10^{-2}. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\phi K^+K^-)/\Gamma_{total}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$2.9^{+0.9}_{-0.8}$±1.1	$14.1^{+4.4}_{-3.7}$	[1] HUANG	03	BELL	$B^+ \to (\phi K^+K^-)\, K^+$

[1] Using B($B^+ \to \eta_c K^+$) = $(1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and B($\eta_c \to K\overline{K}\pi$) = (5.5 ± 1.7) × 10^{-2}.

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
17.5± 2.0 OUR FIT					
30 ± 5 OUR AVERAGE					
25.3± 5.1± 9.1	72	[1] ABLIKIM	05L	BES2	$J/\psi \to K^+K^-K^+K^-\gamma$
26 ± 9	357 ± 64	[1] BAI	04	BES	$J/\psi \to \gamma K^+K^-K^+K^-$
31 ± 7 ±10	19	[1] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^+K^-$
30 $^{+18}_{-12}$ ±10	5	[1] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^0_S K^0_L$
74 ±18 ±24	80	[1] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^+K^-$
67 ±21 ±24		[1] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^0_S K^0_L$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
18 $^{+8}_{-6}$ ± 7	7.0$^{+3.0}_{-2.3}$	[2] HUANG	03	BELL	$B^+ \to (\phi\phi) K^+$

[1] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

[2] Using B($B^+ \to \eta_c K^+$) = $(1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and B($\eta_c \to K\overline{K}\pi$) = $(5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(\phi\phi)/\Gamma(K\overline{K}\pi)$ Γ_7/Γ_{26}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0240±0.0026 OUR FIT					
0.044 $^{+0.012}_{-0.010}$ OUR AVERAGE					
0.055 ±0.014 ±0.005		AUBERT,B	04B	BABR	$B^\pm \to K^\pm \eta_c$
0.032 $^{+0.014}_{-0.010}$ ±0.009	7	[1] HUANG	03	BELL	$B^\pm \to K^\pm \phi\phi$

[1] Using B($B^+ \to \eta_c K^+$) = $(1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and B($\eta_c \to K\overline{K}\pi$) = $(5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(\phi 2(\pi^+\pi^-))/\Gamma_{total}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<40	90	[1] ABLIKIM	06A	BES2	$J/\psi \to \phi 2(\pi^+\pi^-)\gamma$

[1] ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \to \phi 2(\pi^+\pi^-))/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.603 \times 10^{-4}$ which we divide by our best value B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 1.7×10^{-2}.

$\Gamma(a_0(980)\pi)/\Gamma_{total}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	90	[1,2] BALTRUSAIT..86	MRK3	$J/\psi \to \eta_c\gamma$

[1] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036.

[2] We are assuming B($a_0(980) \to \eta\pi$) >0.5.

$\Gamma(a_2(1320)\pi)/\Gamma_{total}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	90	[1] BALTRUSAIT..86	MRK3	$J/\psi \to \eta_c\gamma$

[1] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0128	90	BISELLO	91	DM2	$J/\psi \to \gamma K^0_S K^\pm \pi^\mp$
<0.0132	90	[1] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- \pi^0$

[1] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(f_2(1270)\eta)/\Gamma_{total}$ — Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.011	90	[1] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$

[1] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(\omega\omega)/\Gamma_{total}$ — Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0031	90	[1] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.0063	90	[1] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^0\pi^+\pi^-\pi^0\gamma$
<0.0063		[1] BISELLO	91	DM2	$J/\psi \to \gamma\omega\omega$

[1] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

$\Gamma(\omega\phi)/\Gamma_{total}$ — Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0017	90	[1] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^0 K^+ K^- \gamma$

[1] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(f_2(1270) f_2(1270))/\Gamma_{total}$ — Γ_{15}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.98±0.25 OUR FIT					
$0.77^{+0.25}_{-0.30}\pm0.17$	91.2 ± 19.8	[1] ABLIKIM	04M	BES	$J/\psi \to \gamma 2\pi^+ 2\pi^-$

[1] ABLIKIM 04M reports $[\Gamma(\eta_c(1S) \to f_2(1270) f_2(1270))/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.3 \pm 0.3^{+0.3}_{-0.4}) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(f_0(980)\eta)/\Gamma_{total}$ — Γ_{17}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta$

$\Gamma(f_0(1500)\eta)/\Gamma_{total}$ — Γ_{18}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta$

$\Gamma(f_0(2200)\eta)/\Gamma_{total}$ — Γ_{19}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta$

$\Gamma(a_0(980)\pi)/\Gamma_{total}$ Γ_{20}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \pi^0$

$\Gamma(a_0(1320)\pi)/\Gamma_{total}$ Γ_{21}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \pi^0$

$\Gamma(a_0(1450)\pi)/\Gamma_{total}$ Γ_{22}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \pi^0$

$\Gamma(K_0^*(1430)\overline{K})/\Gamma_{total}$ Γ_{23}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta/\pi^0$

$\Gamma(K_2^*(1430)\overline{K})/\Gamma_{total}$ Γ_{24}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \pi^0$

$\Gamma(K_0^*(1950)\overline{K})/\Gamma_{total}$ Γ_{25}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta/\pi^0$

$\Gamma(K\overline{K}\pi)/\Gamma_{total}$ Γ_{26}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
7.3 ±0.5 OUR FIT					
6.5 ±0.6 OUR AVERAGE					
6.3 ±1.3 ±0.6	55	[1,2] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma K^+ K^- \pi^0$
7.9 ±1.4 ±0.7	107	[3,4] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma K_S^0 K^\mp \pi^\pm$
8.5 ±1.8		[5] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
5.1 ±2.1	0.6k	[6] BAI	04	BES	$J/\psi \to \gamma K^\pm \pi^\mp K_S^0$
6.90±1.42±1.32	33	[6] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- \pi^0$
5.43±0.94±0.94	68	[6] BISELLO	91	DM2	$J/\psi \to \gamma K^\pm \pi^\mp K_S^0$
4.8 ±1.7	95	[6,7] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$
16.1 $^{+9.2}_{-7.3}$		[8,9] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<10.7 90% CL		[6,10] PARTRIDGE	80B	CBAL	$J/\psi \to \eta_c \gamma$

[1] ABLIKIM 12N quotes B($\psi(2S) \to \pi^0 h_c$) · B($h_c \to \gamma \eta_c$) · B($\eta_c \to K^+ K^- \pi^0$) = $(4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.

[2] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[3] ABLIKIM 12N quotes B($\psi(2S) \to \pi^0 h_c$) · B($h_c \to \gamma \eta_c$) · B($\eta_c \to K_S^0 K^\pm \pi^\mp$) = $(11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.

[4] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[5] Determined from the ratio of $B(B^\pm \to K^\pm \eta_c)\ B(\eta_c \to K\overline{K}\pi) = (7.4 \pm 0.5 \pm 0.7) \times 10^{-5}$ reported in AUBERT,B 04B and $B(B^\pm \to K^\pm \eta_c) = (8.7 \pm 1.5) \times 10^{-3}$ reported in AUBERT 06E.

[6] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

[7] Average from $K^+K^-\pi^0$ and $K^\pm K^0_S \pi^\mp$ decay channels.

[8] $K^\pm K^0_S \pi^\mp$ corrected to $K\overline{K}\pi$ by factor 3. KS, MR.

[9] Estimated using $B(\psi(2S) \to \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

[10] $K^+K^-\pi^0$ corrected to $K\overline{K}\pi$ by factor 6. KS, MR

$\Gamma(\phi K^+K^-)/\Gamma(K\overline{K}\pi)$ — Γ_6/Γ_{26}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.052^{+0.016}_{-0.014} \pm 0.014}$	7	[1] HUANG	03	BELL	$B^\pm \to K^\pm \phi\phi$

[1] Using $B(B^+ \to \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(K\overline{K}\eta)/\Gamma_{total}$ — Γ_{27}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.35±0.16 OUR FIT						
1.0 ±0.5 ±0.2		7	[1,2] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\eta K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.1	90		[3] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

[1] ABLIKIM 12N quotes $B(\psi(2S) \to \pi^0 h_c) \cdot B(h_c \to \gamma\eta_c) \cdot B(\eta_c \to K^+K^-\eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.

[2] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\eta)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \eta_c(1S)\gamma)] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \eta_c(1S)\gamma) = (51 \pm 6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[3] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(K\overline{K}\eta)/\Gamma(K\overline{K}\pi)$ — Γ_{27}/Γ_{26}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.186±0.018 OUR FIT					
0.190±0.008±0.017	5.4k	[1] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\eta/\pi^0$

[1] LEES 14E reports $B(\eta_c(1S) \to K^+K^-\eta)/B(\eta_c(1S) \to K^+K^-\pi^0) = 0.571 \pm 0.025 \pm 0.051$, which we divide by 3 to account for isospin symmetry. It uses both $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays.

$\Gamma(\eta\pi^+\pi^-)/\Gamma_{total}$ Γ_{28}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.7±0.4±0.1	33	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\eta\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
5.4±2.0	75	[2] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$
3.7±1.3±2.0	18	[2] PARTRIDGE	80B	CBAL	$J/\psi \to \eta\pi^+\pi^-\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \eta\pi^+\pi^-)/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

$\Gamma(\eta 2(\pi^+\pi^-))/\Gamma_{total}$ Γ_{29}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
4.4±1.2±0.4	39	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\eta 2(\pi^+\pi^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \eta 2(\pi^+\pi^-))/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{total}$ Γ_{30}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
6.9± 1.1 OUR FIT					
11.2± 1.9 OUR AVERAGE					
9.7± 2.2±0.9	38	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K^+K^-\pi^+\pi^-$
12 ± 4	0.4k	[2] BAI	04	BES	$J/\psi \to \gamma K^+K^-\pi^+\pi^-$
21 ± 7	110	[2] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$
14 $^{+22}_{-9}$		[3] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K^+K^-\pi^+\pi^-)/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

[3] Estimated using $B(\psi(2S) \to \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

$\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\overline{K}\pi)$ Γ_{31}/Γ_{26}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.477±0.017±0.070	11k	[1] DEL-AMO-SA...11M		BABR	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$

[1] We have multiplied the value of $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K^0_S K^\pm\pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\overline{K}\pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

$\Gamma(K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
5.6±1.4±0.5	43	[1,2] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma K^0_S K^\mp \pi^\mp 2\pi^\pm$

[1] ABLIKIM 12N quotes $B(\psi(2S) \to \pi^0 h_c) \cdot B(h_c \to \gamma \eta_c) \cdot B(\eta_c \to K^0_S K^- \pi^- 2\pi^+) = (12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to take c.c. into account.

[2] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
7.5±2.4 OUR AVERAGE					
8 ±4 ±1	10	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$
7.2±2.4±1.6	100	[2] ABLIKIM	06A	BES2	$J/\psi \to K^+ K^- 2(\pi^+ \pi^-)\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \to K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma \eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.46± 0.30 OUR FIT					
2.2 ± 0.9 ±0.2	7	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma 2(K^+ K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.4 {}^{+0.5}_{-0.4} \pm 0.6$	$14.5^{+4.6}_{-3.0}$	[2] HUANG	03	BELL	$B^+ \to 2(K^+ K^-) K^+$
21 ±10 ±6		[3] ALBRECHT	94H	ARG	$\gamma\gamma \to K^+ K^- K^+ K^-$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 2(K^+ K^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] Using $B(B^+ \to \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

[3] Normalized to the sum of $B(\eta_c \to K^\pm K^0_S \pi^\mp)$, $B(\eta_c \to \phi\phi)$, $B(\eta_c \to K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \to 2\pi^+ 2\pi^-)$.

$\Gamma(2(K^+K^-))/\Gamma(K\overline{K}\pi)$ — Γ_{34}/Γ_{26}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.020±0.004 OUR FIT					
0.024±0.007 OUR AVERAGE					
0.023±0.007±0.006		AUBERT,B	04B	BABR	$B^\pm \rightarrow K^\pm \eta_c$
$0.026^{+0.009}_{-0.007}\pm0.007$	15	[1] HUANG	03	BELL	$B^\pm \rightarrow K^\pm (2K^+ 2K^-)$

[1] Using B($B^+ \rightarrow \eta_c K^+$) = $(1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and B($\eta_c \rightarrow K\overline{K}\pi$) = $(5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}$ — Γ_{35}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
4.7±0.9±0.4	118	[1] ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma \pi^+ \pi^- 2\pi^0$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total}] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ — Γ_{36}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.97±0.12 OUR FIT					
1.35±0.21 OUR AVERAGE					
1.74±0.32±0.15	100	[1] ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+\pi^-)$
1.0 ±0.5	542 ± 75	[2] BAI	04	BES	$J/\psi \rightarrow \gamma\, 2(\pi^+\pi^-)$
1.05±0.17±0.34	137	[2] BISELLO	91	DM2	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$
1.3 ±0.6	25	[2] BALTRUSAIT...	86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
$2.0\ ^{+1.5}_{-1.0}$		[3] HIMEL	80B	MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-))/\Gamma_{total}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total}] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] The quoted branching ratios use B($J/\psi(1S) \rightarrow \gamma\eta_c(1S)$) = 0.0127 ± 0.0036. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

[3] Estimated using B($\psi(2S) \rightarrow \gamma\eta_c(1S)$) = 0.0028 ± 0.0006.

$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{total}$ — Γ_{37}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
17.4±2.9±1.5	175	[1] ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+\pi^- 2\pi^0)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{total}] \times [\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total}] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(3(\pi^+\pi^-))/\Gamma_{total}$ Γ_{38}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
18 ±4 OUR AVERAGE					
20 ±5 ±2	51	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 3(\pi^+\pi^-)$
15.3±3.4±3.3	479	[2] ABLIKIM	06A	BES2	$J/\psi \to 3(\pi^+\pi^-)\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 3(\pi^+\pi^-))/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \to 3(\pi^+\pi^-))/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (2.59 \pm 0.32 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p\overline{p})/\Gamma_{total}$ Γ_{39}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
15.0± 1.6 OUR FIT					
13.2± 2.7 OUR AVERAGE					
15 ± 5 ±1	15	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}$
15 ± 6	213 ± 33	[2] BAI	04	BES	$J/\psi \to \gamma p\overline{p}$
10 ± 3 ±4	18	[2] BISELLO	91	DM2	$J/\psi \to \gamma p\overline{p}$
11 ± 6	23	[2] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
29^{+29}_{-15}		[3] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$14.8^{+2.0+1.7}_{-2.4-1.8}$	195	[4] WU	06	BELL	$B^+ \to p\overline{p}K^+$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

[3] Estimated using $B(\psi(2S) \to \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

[4] WU 06 reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (1.42 \pm 0.11^{+0.16}_{-0.20}) \times 10^{-6}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p\overline{p})/\Gamma(K\overline{K}\pi)$ Γ_{39}/Γ_{26}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0207±0.0021 OUR FIT					
$0.021 \pm 0.002^{+0.004}_{-0.006}$	195	[1] WU	06	BELL	$B^\pm \to K^\pm p\overline{p}$

[1] Using $B(B^+ \to \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\phi\phi)/\Gamma_{total}$ — $\Gamma_{39}/\Gamma \times \Gamma_7/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
0.26±0.05 OUR FIT				
4.0 $^{+3.5}_{-3.2}$	BAGLIN	89	SPEC	$\overline{p}p \to K^+K^-K^+K^-$

$\Gamma(p\overline{p}\pi^0)/\Gamma_{total}$ — Γ_{40}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.36±0.13±0.03	14	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}\pi^0$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p}\pi^0)/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Lambda\overline{\Lambda})/\Gamma_{total}$ — Γ_{41}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
10.9±2.4 OUR FIT						
11.7±2.3±2.6			[1] ABLIKIM	12B	BES3	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$9.9^{+2.7}_{-2.6}\pm1.2$		20	[2] WU	06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$
<20	90		[3] BISELLO	91	DM2	$e^+e^- \to \gamma\Lambda\overline{\Lambda}$

[1] ABLIKIM 12B reports $[\Gamma(\eta_c(1S) \to \Lambda\overline{\Lambda})/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (0.198 \pm 0.021 \pm 0.032) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] WU 06 reports $[\Gamma(\eta_c(1S) \to \Lambda\overline{\Lambda})/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (0.95^{+0.25}_{-0.22}{}^{+0.08}_{-0.11}) \times 10^{-6}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[3] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(\Lambda\overline{\Lambda})/\Gamma(p\overline{p})$ — Γ_{41}/Γ_{39}

VALUE	DOCUMENT ID		TECN	COMMENT
0.72±0.16 OUR FIT				
$0.67^{+0.19}_{-0.16}\pm0.12$	[1] WU	06	BELL	$B^+ \to p\overline{p}K^+$, $\Lambda\overline{\Lambda}K^+$

[1] Not independent from other $\eta_c \to \Lambda\overline{\Lambda}$, $p\overline{p}$ branching ratios reported by WU 06.

$\Gamma(\Sigma^+\overline{\Sigma}^-)/\Gamma_{total}$ — Γ_{42}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.1±0.3±0.5	112	[1] ABLIKIM	13C	BES3	$J/\psi \to \gamma p\overline{p}\pi^0\pi^0$

[1] ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \to \Sigma^+\overline{\Sigma}^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Xi^-\overline{\Xi}^+)/\Gamma_{total}$ — Γ_{43}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.89±0.18±0.19	78	[1] ABLIKIM	13C	BES3	$J/\psi \to \gamma\Lambda\overline{\Lambda}\pi^+\pi^-$

[1] ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \to \Xi^-\overline{\Xi}^+)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+\pi^- p\overline{p})/\Gamma_{total}$ — Γ_{44}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
5.3±1.7±0.5		19	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<12	90		HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \pi^+\pi^- p\overline{p})/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \eta_c(1S)\gamma)/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

RADIATIVE DECAYS

$\Gamma(\gamma\gamma)/\Gamma_{total}$ — Γ_{45}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.59±0.12 OUR FIT						
1.9 $^{+0.7}_{-0.6}$ OUR AVERAGE						
2.7 ±0.8 ±0.6			[1] ABLIKIM	13I	BES3	
1.4 $^{+0.7}_{-0.5}$ ±0.3		$1.2^{+2.8}_{-1.1}$	[2] ADAMS	08	CLEO	$\psi(2S) \to \pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
2.3 $^{+1.0}_{-0.8}$ ±0.3		13	[3] WICHT	08	BELL	$B^\pm \to K^\pm\gamma\gamma$
2.80 $^{+0.67}_{-0.58}$ ±1.0			[4] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
< 9	90		[5] BISELLO	91	DM2	$J/\psi \to \gamma\gamma\gamma$
6 $^{+4}_{-3}$ ±4			[4] BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
< 18	90		[6] BLOOM	83	CBAL	$J/\psi \to \eta_c\gamma$

[1] ABLIKIM 13I reports $[\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (4.5 \pm 1.2 \pm 0.6) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] ADAMS 08 reports $[\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (2.4^{+1.1}_{-0.8} \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[3] WICHT 08 reports $[\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (2.2^{+0.9}_{-0.7}{}^{+0.4}_{-0.2}) \times 10^{-7}$ which we divide by our best value $B(B^+ \to \eta_c K^+) =$

$(9.6 \pm 1.1) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[4] Not independent from the values of the total and two-photon width quoted by the same experiment.

[5] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

[6] Using $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(\gamma\gamma)/\Gamma(K\overline{K}\pi)$ — Γ_{45}/Γ_{26}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.19±0.29 OUR FIT					
$3.2\ ^{+1.3}_{-1.0}\ ^{+0.8}_{-0.6}$	13	[1] WICHT	08	BELL	$B^{\pm} \to K^{\pm}\gamma\gamma$

[1] Using $B(B^+ \to \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{39}/\Gamma \times \Gamma_{45}/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
0.239±0.024 OUR FIT					
0.26 ±0.05 OUR AVERAGE Error includes scale factor of 1.4.					
$0.224^{+0.038}_{-0.037}\pm0.020$	190	AMBROGIANI	03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
$0.336^{+0.080}_{-0.070}$		ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
$0.68\ ^{+0.42}_{-0.31}$	12	BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$

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

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ — Γ_{46}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<11	90	[1] ABLIKIM	11G	BES3	$J/\psi \to \gamma\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<70	90	[2] ABLIKIM	06B	BES2	$J/\psi \to \pi^+\pi^-\gamma$

[1] ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \to \pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 1.82\times10^{-6}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7\times10^{-2}$.

[2] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to \pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 1.1\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7\times10^{-2}$.

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — Γ_{47}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
< 4	90	[1] ABLIKIM	11G	BES3	$J/\psi \to \gamma\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<40	90	[2] ABLIKIM	06B	BES2	$J/\psi \to \pi^0\pi^0\gamma$

[1] ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \to \pi^0\pi^0)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

[2] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to \pi^0\pi^0)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.71 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

$\Gamma(K^+ K^-)/\Gamma_{total}$ Γ_{48}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<60	90	[1] ABLIKIM	06B	BES2	$J/\psi \to K^+ K^- \gamma$

[1] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to K^+ K^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.96\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7\times10^{-2}$.

$\Gamma(K^0_S K^0_S)/\Gamma_{total}$ Γ_{49}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<31	90	[1] ABLIKIM	06B	BES2	$J/\psi \to K^0_S K^0_S \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<32	90	[2] UEHARA	13	BELL	$\gamma\gamma \to K^0_S K^0_S$
< 5.6	90	[3] UEHARA	13	BELL	$\gamma\gamma \to K^0_S K^0_S$

[1] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to K^0_S K^0_S)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.53\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7\times10^{-2}$.

[2] Taking into account interference with the non-resonant continuum.

[3] Neglecting interference with the non-resonant continuum.

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