$\eta_c(1S)$

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

$\eta_c(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
2983.9 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.2.			
2983.9 ± 0.7 ± 0.1		[1] AAIJ	20H	LHCB	$pp \to bX \to p\overline{p}X$
2985.9 ± 0.7 ± 2.1	1705	ABLIKIM	19AV	BES3	$J/\psi \to \gamma\omega\omega$
2984.6 ± 0.7 ± 2.2	2673	XU	18	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
2986.7 ± 0.5 ± 0.9	11k	[2] AAIJ	17AD	LHCB	$pp \to B^+X \to p\overline{p}K^+X$
2982.8 ± 1.0 ± 0.5	6.4k	[3] AAIJ	17BB	LHCB	$pp \to b\overline{b}X \to 2(K^+K^-)X$
2982.2 ± 1.5 ± 0.1	2.0k	[4] AAIJ	15BI	LHCB	$pp \to \eta_c(1S)X$
2983.5 ± 1.4 $^{+1.6}_{-3.6}$		[5] ANASHIN	14	KEDR	$J/\psi \to \gamma\eta_c$
2979.8 ± 0.8 ± 3.5	4.5k	[6,7] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\pi^0$
2984.1 ± 1.1 ± 2.1	900	[6,7,8] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\eta$
2984.3 ± 0.6 ± 0.6		[9,10] ABLIKIM	12F	BES3	$\psi(2S) \to \gamma\eta_c$
2984.49 ± 1.16 ± 0.52	832	[6] 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	[10] VINOKUROVA	11	BELL	$B^\pm \to K^\pm(K^0_S K^\pm\pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	[11] 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	[12] 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	[13] 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	[14] DEL-AMO-SA..	11M	BABR	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$
2982.2 ± 0.6		[15] MITCHELL	09	CLEO	$e^+e^- \to \gamma X$
2982 ± 5	270	[16] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	[17] AUBERT	04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
2977.5 ± 1.0 ± 1.2		[15,18] BAI	03	BES	$J/\psi \to \gamma\eta_c$
2979.6 ± 2.3 ± 1.6	180	[19] FANG	03	BELL	$B \to \eta_c K$
2976.3 ± 2.3 ± 1.2		[15,20] BAI	00F	BES	$J/\psi,\ \psi(2S) \to \gamma\eta_c$

$2976.6 \pm 2.9 \pm 1.3$	140	[15,21] BAI	00F BES	$J/\psi \to \gamma\eta_c$
$2980.4 \pm 2.3 \pm 0.6$		[22] BRANDENB...	00B CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
$2975.8 \pm 3.9 \pm 1.2$		[21] BAI	99B BES	Sup. by BAI 00F
2999 ± 8	25	ABREU	98O DLPH	$e^+e^- \to e^+e^-$ +hadrons
$2988.3 {+3.3 \atop -3.1}$		ARMSTRONG	95F E760	$\overline{p}p \to \gamma\gamma$
2974.4 ± 1.9		[15,23] BISELLO	91 DM2	$J/\psi \to \eta_c\gamma$
$2969 \pm 4 \pm 4$	80	[15] BAI	90B MRK3	$J/\psi \to \gamma K^+ K^- K^+ K^-$
$2956 \pm 12 \pm 12$		[15] BAI	90B MRK3	$J/\psi \to \gamma K^+ K^- K^0_S K^0_L$
$2982.6 {+2.7 \atop -2.3}$	12	BAGLIN	87B SPEC	$\overline{p}p \to \gamma\gamma$
2980.2 ± 1.6		[15,23] BALTRUSAIT...86	MRK3	$J/\psi \to \eta_c\gamma$
$2984 \pm 2.3 \pm 4.0$		[15] GAISER	86 CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$
2976 ± 8		[15,24] BALTRUSAIT...84	MRK3	$J/\psi \to 2\phi\gamma$
2982 ± 8	18	[25] HIMEL	80B MRK2	e^+e^-
2980 ± 9		[25] PARTRIDGE	80B CBAL	e^+e^-

[1] AAIJ 20H report $m_{J/\psi} - m_{\eta_c(1S)} = 113.0 \pm 0.7 \pm 0.1$ MeV. We use the current value $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to obtain the quoted mass.

[2] AAIJ 17AD report $m_{J/\psi} - m_{\eta_c(1S)} = 110.2 \pm 0.5 \pm 0.9$ MeV. We use the current value $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to obtain the quoted mass.

[3] From a fit of the $\phi\phi$ invariant mass with the mass and width of $\eta_c(1S)$ as free parameters.

[4] AAIJ 15BI reports $m_{J/\psi} - m_{\eta_c(1S)} = 114.7 \pm 1.5 \pm 0.1$ MeV from a sample of $\eta_c(1S)$ and J/ψ produced in b-hadron decays. We have used current value of $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to arrive at the quoted $m_{\eta_c(1S)}$ result.

[5] Taking into account an asymmetric photon lineshape.

[6] With floating width.

[7] Ignoring possible interference with the non-resonant 0^- amplitude.

[8] Using both, $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays.

[9] From a simultaneous fit to six decay modes of the η_c.

[10] Accounts for interference with non-resonant continuum.

[11] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

[12] From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

[13] Using mass of $\psi(2S) = 3686.00$ MeV.

[14] Not independent from the measurements reported by LEES 10.

[15] 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.

[16] From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

[17] Superseded by LEES 10.

[18] From a simultaneous fit of five decay modes of the η_c.

[19] Superseded by VINOKUROVA 11.

[20] Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV.

[21] Average of several decay modes. Using an η_c width of 13.2 MeV.

[22] Superseded by ASNER 04.

[23] Average of several decay modes.

[24] $\eta_c \to \phi\phi$.
[25] Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.

$\eta_c(1S)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
32.0± 0.7 OUR FIT					
32.1± 0.8 OUR AVERAGE		Error includes scale factor of 1.1.			
33.8± 1.6±4.1	1705	ABLIKIM	19AV	BES3	$J/\psi \to \gamma\omega\omega$
$30.8^{+2.3}_{-2.2}\pm2.9$	2673	XU	18	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
34.0± 1.9±1.3	11k	AAIJ	17AD	LHCB	$pp \to B^+X \to p\overline{p}K^+X$
31.4± 3.5±2.0	6.4k	[1] AAIJ	17BB	LHCB	$pp \to b\overline{b}X \to 2(K^+K^-)X$
$27.2\pm3.1^{+5.4}_{-2.6}$		[2] ANASHIN	14	KEDR	$J/\psi \to \gamma\eta_c$
25.2± 2.6±2.4	4.5k	[3,4] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\pi^0$
34.8± 3.1±4.0	900	[3,4,5] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\eta$
32.0± 1.2±1.0		[6,7] ABLIKIM	12F	BES3	$\psi(2S) \to \gamma\eta_c$
36.4± 3.2±1.7	832	[3] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma$ hadrons
$37.8^{+5.8}_{-5.3}\pm3.1$	486	ZHANG	12A	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
36.2± 2.8±3.0	11k	DEL-AMO-SA...	11M	BABR	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$
$35.1\pm3.1^{+1.0}_{-1.6}$	920	[7] VINOKUROVA	11	BELL	$B^\pm \to K^\pm(K^0_S K^\pm\pi^\mp)$
31.7± 1.2±0.8	14k	[8] 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± 3.2±2.2	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 ±19 ±5	20	WU	06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$
24.8± 3.4±3.5	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± 1.1±1.3	12k	[9] DEL-AMO-SA...	11M	BABR	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$
34.3± 2.3±0.9	2.5k	[10] AUBERT	04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
17.0± 3.7±7.4		[11] BAI	03	BES	$J/\psi \to \gamma\eta_c$
29 ± 8 ±6	180	[12] FANG	03	BELL	$B \to \eta_c K$
11.0± 8.1±4.1		[13] BAI	00F	BES	$J/\psi \to \gamma\eta_c$ and $\psi(2S) \to \gamma\eta_c$
27.0± 5.8±1.4		[14] 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	[15] BALTRUSAIT...	86	MRK3	$J/\psi \to \gamma p\overline{p}$
11.5± 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] From a fit of the $\phi\phi$ invariant mass with the mass and width of $\eta_c(1S)$ as free parameters.
[2] Taking into account an asymmetric photon lineshape.
[3] With floating mass.
[4] Ignoring possible interference with the non-resonant 0^- amplitude.
[5] Using both, $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays.
[6] From a simultaneous fit to six decay modes of the η_c.
[7] Accounts for interference with non-resonant continuum.
[8] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
[9] Not independent from the measurements reported by LEES 10.
[10] Superseded by LEES 10.
[11] From a simultaneous fit of five decay modes of the η_c.
[12] Superseded by VINOKUROVA 11.
[13] 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.
[14] Superseded by ASNER 04.
[15] 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	$K^*(892)\overline{K}^*(892)$	$(6.9 \pm 1.3) \times 10^{-3}$	
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	$\phi\phi$	$(1.74 \pm 0.19) \times 10^{-3}$	
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}	$\omega\omega$	$(2.9 \pm 0.8) \times 10^{-3}$	
Γ_{14}	$\omega\phi$	$< 2.5 \times 10^{-4}$	90%
Γ_{15}	$f_2(1270) f_2(1270)$	$(9.8 \pm 2.5) \times 10^{-3}$	
Γ_{16}	$f_2(1270) f'_2(1525)$	$(9.5 \pm 3.2) \times 10^{-3}$	
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}	$a_0(1950)\pi$	seen	
Γ_{24}	$K_0^*(1430)\overline{K}$	seen	
Γ_{25}	$K_2^*(1430)\overline{K}$	seen	
Γ_{26}	$K_0^*(1950)\overline{K}$	seen	

Decays into stable hadrons

Γ_{27}	$K\overline{K}\pi$		(7.3 ±0.4) %	
Γ_{28}	$K\overline{K}\eta$		(1.36±0.15) %	
Γ_{29}	$\eta\pi^+\pi^-$		(1.7 ±0.6) %	
Γ_{30}	$\eta 2(\pi^+\pi^-)$		(4.4 ±1.6) %	
Γ_{31}	$K^+K^-\pi^+\pi^-$		(6.6 ±1.1) $\times 10^{-3}$	
Γ_{32}	$K^+K^-\pi^+\pi^-\pi^0$		(3.5 ±0.6) %	
Γ_{33}	$K^0K^-\pi^+\pi^-\pi^+$+c.c.		(5.6 ±1.9) %	
Γ_{34}	$K^+K^-2(\pi^+\pi^-)$		(7.5 ±2.4) $\times 10^{-3}$	
Γ_{35}	$2(K^+K^-)$		(1.43±0.30) $\times 10^{-3}$	
Γ_{36}	$\pi^+\pi^-\pi^0$		$<$ 5 $\times 10^{-4}$	90%
Γ_{37}	$\pi^+\pi^-\pi^0\pi^0$		(4.7 ±1.4) %	
Γ_{38}	$2(\pi^+\pi^-)$		(9.1 ±1.2) $\times 10^{-3}$	
Γ_{39}	$2(\pi^+\pi^-\pi^0)$		(15.8 ±2.3) %	
Γ_{40}	$3(\pi^+\pi^-)$		(1.7 ±0.4) %	
Γ_{41}	$p\overline{p}$		(1.44±0.14) $\times 10^{-3}$	
Γ_{42}	$p\overline{p}\pi^0$		(3.6 ±1.5) $\times 10^{-3}$	
Γ_{43}	$\Lambda\overline{\Lambda}$		(1.06±0.23) $\times 10^{-3}$	
Γ_{44}	$K^+\overline{p}\Lambda$+ c.c.		(2.5 ±0.4) $\times 10^{-3}$	
Γ_{45}	$\overline{\Lambda}(1520)\Lambda$+ c.c.		(3.1 ±1.3) $\times 10^{-3}$	
Γ_{46}	$\Sigma^+\overline{\Sigma}^-$		(2.1 ±0.6) $\times 10^{-3}$	
Γ_{47}	$\Xi^-\overline{\Xi}^+$		(9.0 ±2.6) $\times 10^{-4}$	
Γ_{48}	$\pi^+\pi^-p\overline{p}$		(5.3 ±2.1) $\times 10^{-3}$	

Radiative decays

Γ_{49}	$\gamma\gamma$		(1.61±0.12) $\times 10^{-4}$	

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

Γ_{50}	$\pi^+\pi^-$	*P,CP*	$<$ 1.1 $\times 10^{-4}$	90%
Γ_{51}	$\pi^0\pi^0$	*P,CP*	$<$ 4 $\times 10^{-5}$	90%
Γ_{52}	K^+K^-	*P,CP*	$<$ 6 $\times 10^{-4}$	90%
Γ_{53}	$K^0_SK^0_S$	*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 93 measurements and one constraint to determine 13 parameters. The overall fit has a $\chi^2 = 117.8$ for 81 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_{27}	x_{28}	x_{31}	x_{35}	x_{38}	x_{41}	x_{43}	x_{49}
x_7	16										
x_{15}	3	5									
x_{27}	18	35	6								
x_{28}	9	17	3	47							
x_{31}	10	18	3	21	10						
x_{35}	7	13	2	21	10	8					
x_{38}	12	22	4	25	12	14	10				
x_{41}	11	20	4	27	13	12	10	15			
x_{43}	3	5	1	6	3	3	2	4	23		
x_{49}	−27	−51	−9	−59	−28	−32	−23	−38	−38	−9	
Γ	−1	−3	0	−3	−1	−2	−1	−2	6	1	−27

	Mode	Rate (MeV)
Γ_4	$K^*(892)\overline{K}^*(892)$	0.22 ±0.04
Γ_7	$\phi\phi$	0.056 ±0.006
Γ_{15}	$f_2(1270) f_2(1270)$	0.31 ±0.08
Γ_{27}	$K\overline{K}\pi$	2.32 ±0.14
Γ_{28}	$K\overline{K}\eta$	0.43 ±0.05
Γ_{31}	$K^+K^-\pi^+\pi^-$	0.210 ±0.035
Γ_{35}	$2(K^+K^-)$	0.046 ±0.010
Γ_{38}	$2(\pi^+\pi^-)$	0.29 ±0.04
Γ_{41}	$p\overline{p}$	0.046 ±0.005
Γ_{43}	$\Lambda\overline{\Lambda}$	0.034 ±0.008
Γ_{49}	$\gamma\gamma$	0.00515±0.00035

$\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ Γ_{49}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.15± 0.35 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 ± 1.2 ± 1.8	157 ± 33	[4] KUO 05	BELL	$\gamma\gamma \to p\overline{p}$
7.4 ± 0.4 ± 2.3		[5] ASNER 04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm\pi^\mp$
13.9 ± 2.0 ± 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 ± 0.8 ± 2.3		[5,8] BRANDENB... 00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S\pi^\mp$
6.9 ± 1.7 ± 2.1	76	[9] ACCIARRI 99T	L3	$e^+e^- \to e^+e^-\eta_c$

27 ±16 ±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.

$\eta_c(1S)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ — $\Gamma_1\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
98.1±3.9±11.7	2673	XU	18	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$75.8 {}^{+6.3}_{-6.2} \pm 8.4$	486	[1] ZHANG	12A	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$

[1] Superseded by XU 18.

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ — $\Gamma_2\Gamma_{49}/\Gamma$

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

$\Gamma(K^*(892)\overline{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ — $\Gamma_4\Gamma_{49}/\Gamma$

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

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_7\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.0 ±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)%.

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{13}\Gamma_{49}/\Gamma$

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)%.

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{14}\Gamma_{49}/\Gamma$

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)%.

$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{15}\Gamma_{49}/\Gamma$

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

$\Gamma(f_2(1270)f'_2(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{16}\Gamma_{49}/\Gamma$

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

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{27}\Gamma_{49}/\Gamma$

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.374±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 $e^+e^- \to e^+e^-K^0_S K^\pm\pi^\mp$
0.407±0.022±0.028			[2,3] ASNER 04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm\pi^\mp$
0.60 ±0.12 ±0.09		41	[3,4] ABDALLAH 03J	DLPH	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$
1.47 ±0.87 ±0.27			[3] SHIRAI 98	AMY	$\gamma\gamma \to \eta_c \to K^\pm K^0_S\pi^\mp$
0.84 ±0.21			[3] ALBRECHT 94H	ARG	$\gamma\gamma \to K^\pm K^0_S\pi^\mp$
0.60 $^{+0.23}_{-0.20}$			[3] CHEN 90B	CLEO	$\gamma\gamma \to \eta_c K^\pm K^0_S\pi^\mp$
1.06 ±0.41 ±0.27		11	[3] BRAUNSCH... 89	TASS	$\gamma\gamma \to K\overline{K}\pi$
1.5 $^{+0.60}_{-0.45}$ ±0.3		7	[3] BERGER 86	PLUT	$\gamma\gamma \to K\overline{K}\pi$
• • • 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	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$
0.418±0.044±0.022			[3,6] BRANDENB... 00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S\pi^\mp$

<0.63	95	[3] BEHREND	89	CELL	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
<4.4	95	ALTHOFF	85B	TASS	$\gamma\gamma \to K\overline{K}\pi$

[1] From the corrected and unfolded mass spectrum.
[2] Calculated by us from the value reported in ASNER 04 that assumes B($\eta_c \to K\overline{K}\pi$) = 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($\eta_c \to K^0_S K^\pm \pi^\mp$) = (1.5 ± 0.4)%.
[5] Not independent from the measurements reported by LEES 10.
[6] Superseded by ASNER 04.

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{31}\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
34 ± 5 OUR FIT					
27 ± 6 OUR AVERAGE					
25.7 ± 3.2 ± 4.9	2019 ± 248	UEHARA	08	BELL	$\gamma\gamma \to \pi^+\pi^-K^+K^-$
280 ± 100 ± 60	42	[1] ABDALLAH	03J	DLPH	$\gamma\gamma \to \pi^+\pi^-K^+K^-$
170 ± 80 ± 20	13.9 ± 6.6	ALBRECHT	94H	ARG	$\gamma\gamma \to \pi^+\pi^-K^+K^-$

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

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{32}\Gamma_{49}/\Gamma$

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	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$

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

$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{35}\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
7.3 ± 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 ± 1.2)%.
[2] Includes all topological modes except $\eta_c \to \phi\phi$.

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{38}\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
47 ± 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	$\gamma\gamma \to 2(\pi^+\pi^-)$

$\Gamma(p\overline{p}) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{41}\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
7.4 ±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.

$\Gamma(K^0_S K^0_S) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{53}\Gamma_{49}/\Gamma$

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.

$\Gamma(K^*(892)^0 K^-\pi^+ + c.c.)/\Gamma_{total}$ 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
69±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±24	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($J/\psi(1S) \to \gamma\eta_c(1S)$)] = $(1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$ 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.

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{2.9^{+0.9}_{-0.8}\pm1.1}$	$14.1^{+4.4}_{-3.7}$	[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($\eta_c \to K\overline{K}\pi$) = $(5.5 \pm 1.7) \times 10^{-2}$.

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
17.4± 1.9 OUR FIT					
28 ± 4 OUR AVERAGE					
$26\ ^{+\ 4}_{-\ 8}\ \pm\ 5$	1.2k	[1] ABLIKIM	17P	BES3	$J/\psi \to K^+K^-K^+K^-\gamma$
25.3± 5.1± 9.1	72	[2] ABLIKIM	05L	BES2	$J/\psi \to K^+K^-K^+K^-\gamma$
26 ± 9	357	[2] BAI	04	BES	$J/\psi \to \gamma K^+K^-K^+K^-$
31 ± 7 ±10	19	[2] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^+K^-$
$30\ ^{+18}_{-12}\ \pm10$	5	[2] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^0_S K^0_L$
74 ±18 ±24	80	[2] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^+K^-$
67 ±21 ±24		[2] 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. • • •					
$18\ ^{+\ 8}_{-\ 6}\ \pm\ 7$	7	[3] HUANG	03	BELL	$B^+ \to (\phi\phi)\ K^+$

[1] ABLIKIM 17P reports [$\Gamma(\eta_c(1S) \to \phi\phi)/\Gamma_{total}$] × [B($J/\psi(1S) \to \gamma\eta_c(1S)$)] = $(4.3 \pm 0.5^{+0.5}_{-1.2}) \times 10^{-5}$ 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.

[2] 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.

[3] 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_{27}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0240±0.0025 OUR FIT					
$0.044^{+0.012}_{-0.010}$ OUR AVERAGE					
$0.055 \pm 0.014 \pm 0.005$		AUBERT,B	04B	BABR	$B^\pm \to K^\pm \eta_c$
$0.032^{+0.014}_{-0.010} \pm 0.009$	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 $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(\phi\phi)/\Gamma(p\overline{p})$ — Γ_7/Γ_{41}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.79±0.14±0.32	6.4k	[1] AAIJ	17BB	LHCB	$pp \to b\overline{b}X \to 2(K^+K^-)X$

[1] Using inputs from AAIJ 15AS and AAIJ 15BI and $\Gamma(b \to J/\psi(1S)\,\text{anything})/\Gamma_{total} = (1.16 \pm 0.10)\%$ and $\Gamma(J/\psi(1S) \to p\overline{p})/\Gamma_{total} = (2.120 \pm 0.029) \times 10^{-3}$ from PDG 16.

$\Gamma(\phi 2(\pi^+\pi^-))/\Gamma_{total}$ — 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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

$\Gamma(a_0(980)\pi)/\Gamma_{total}$ — 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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

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

$\Gamma(K^*(892)\overline{K} + \text{c.c.})/\Gamma_{total}$ — 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 (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
2.9±0.5±0.6		1705	[1] ABLIKIM	19AV	BES3	$J/\psi \to \gamma\omega\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<6.3	90		[2] ABLIKIM	05L	BES2	$J/\psi \to 2(\pi^+\pi^-\pi^0)\gamma$
<6.3	90		[2] BISELLO	91	DM2	$J/\psi \to \gamma\omega\omega$
<3.1	90		[2] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

[1] ABLIKIM 19AV reports $[\Gamma(\eta_c(1S) \to \omega\omega)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (4.90 \pm 0.17 \pm 0.77) \times 10^{-5}$ 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.,

[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.

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 2.5 \times 10^{-4}$	90	[1] ABLIKIM	17P	BES3	$J/\psi \to \pi^+\pi^-\pi^0 K^+K^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<17 \times 10^{-4}$	90	[2] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^0 K^+K^-\gamma$

[1] Using $B(J/\psi \to \gamma\eta_c) = 0.017 \pm 0.004$.

[2] 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 $\eta_c \to K^+ K^- \pi^0$

$\Gamma(a_0(1950)\pi)/\Gamma_{total}$ — Γ_{23}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	12k	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$

[1] From a model-independant partial wave analysis.

$\Gamma(K_0^*(1430)\overline{K})/\Gamma_{total}$ — Γ_{24}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	12k	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
seen		LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta/\pi^0$

[1] From a model-independant partial wave analysis.

$\Gamma(K_2^*(1430)\overline{K})/\Gamma_{total}$ — Γ_{25}/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_{26}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	12k	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
seen		LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta/\pi^0$

[1] From a Dalitz plot analysis using an isobar model.

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
7.3 ±0.4 OUR FIT					
6.9 ±0.5 OUR AVERAGE					
6.9 ±0.7 ±0.6	146	[1] ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
7.8 ±0.6 ±0.6	267	[2] ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
6.3 ±1.3 ±1.4	55	[3,4] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K^+ K^- \pi^0$
7.9 ±1.4 ±1.8	107	[5,6] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K_S^0 K^\mp \pi^\pm$
8.5 ±1.8		[7] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
5.1 ±2.1	0.6k	[8] BAI	04	BES	$J/\psi \to \gamma K^\pm \pi^\mp K_S^0$
6.90±1.42±1.32	33	[8] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- \pi^0$
5.43±0.94±0.94	68	[8] BISELLO	91	DM2	$J/\psi \to \gamma K^\pm \pi^\mp K_S^0$
4.8 ±1.7	95	[8,9] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
16.1 $^{+9.2}_{-7.3}$		[10,11] 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		[8,12] PARTRIDGE	80B	CBAL	$J/\psi \to \eta_c\gamma$

[1] ABLIKIM 19AP quotes B($\eta_c \to K^+ K^- \pi^0$) = $(1.15 \pm 0.12 \pm 0.10) \times 10^{-2}$ which we multiply by 6 to account for isospin symmetry.
[2] ABLIKIM 19AP quotes B($\eta_c \to K^0_S K^\pm \pi^\mp$) = $(2.60 \pm 0.21 \pm 0.20) \times 10^{-2}$ which we multiply by 3 to account for isospin symmetry.
[3] 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.
[4] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ 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($h_c(1P) \to \gamma\eta_c(1S)$) = $(50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.
[5] ABLIKIM 12N quotes B($\psi(2S) \to \pi^0 h_c$) · B($h_c \to \gamma \eta_c$) · B($\eta_c \to K^0_S K^\pm \pi^\mp$) = $(11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.
[6] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ 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($h_c(1P) \to \gamma\eta_c(1S)$) = $(50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.
[7] 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.
[8] 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.
[9] Average from $K^+ K^- \pi^0$ and $K^\pm K^0_S \pi^\mp$ decay channels.
[10] $K^\pm K^0_S \pi^\mp$ corrected to $K\overline{K}\pi$ by factor 3. KS, MR.
[11] Estimated using B($\psi(2S) \to \gamma\eta_c(1S)$) = 0.0028 ± 0.0006.
[12] $K^+ K^- \pi^0$ corrected to $K\overline{K}\pi$ by factor 6. KS, MR

$\Gamma(\phi K^+ K^-)/\Gamma(K\overline{K}\pi)$ — Γ_6/Γ_{27}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.052^{+0.016}_{-0.014} \pm 0.014$	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_{28}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.36±0.15 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($\psi(2S) \to \pi^0 h_c$) · B($h_c \to \gamma \eta_c$) · 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 $[\Gamma(\eta_c(1S) \to K\overline{K}\eta)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values B($\psi(2S) \to \pi^0 h_c(1P)$) = $(8.6 \pm 1.3) \times 10^{-4}$, B($h_c(1P) \to \gamma\eta_c(1S)$) = $(50 \pm 9) \times 10^{-2}$. 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 ± 0.0036.

$\Gamma(K\overline{K}\eta)/\Gamma(K\overline{K}\pi)$ Γ_{28}/Γ_{27}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.187±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_{29}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7±0.4±0.4	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 $[\Gamma(\eta_c(1S) \to \eta\pi^+\pi^-)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[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_{30}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±1.2±1.0	39	[1] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0\gamma\eta 2(\pi^+\pi^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \eta 2(\pi^+\pi^-))/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{total}$ Γ_{31}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.6± 1.1 OUR FIT				
11.8± 2.3 OUR AVERAGE				
9.7± 2.2±2.2	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 $[\Gamma(\eta_c(1S) \to K^+K^-\pi^+\pi^-)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[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_{32}/Γ_{27}

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.

$\Gamma(K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ — Γ_{33}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.6±1.4±1.3	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 $[\Gamma(\eta_c(1S) \to K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5±2.4 OUR AVERAGE				
8 ±4 ±2	10	[1] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0\gamma K^+K^-2(\pi^+\pi^-)$
7.2±2.4±1.5	100	[2] ABLIKIM 06A	BES2	$J/\psi \to K^+K^-2(\pi^+\pi^-)\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[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_{35}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.43± 0.30 OUR FIT				
2.2 ± 0.9 ±0.5	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 $[\Gamma(\eta_c(1S) \to 2(K^+K^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[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_{35}/Γ_{27}

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	$B^\pm \to K^\pm \eta_c$
$0.026^{+0.009}_{-0.007}\pm0.007$	15	[1] HUANG	03	BELL	$B^\pm \to K^\pm(2K^+2K^-)$

[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($\eta_c \to K\overline{K}\pi$) = ($5.5 \pm 1.7$) $\times 10^{-2}$.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5 \times 10^{-4}$	90	[1] ABLIKIM	17AJ	BES3	$\psi(2S) \to \gamma\pi^+\pi^-\pi^0$

[1] ABLIKIM 17AJ reports [$\Gamma(\eta_c(1S) \to \pi^+\pi^-\pi^0)/\Gamma_{total}$] $\times$ [B($\psi(2S) \to \gamma\eta_c(1S)$)] $< 1.6 \times 10^{-6}$ which we divide by our best value B($\psi(2S) \to \gamma\eta_c(1S)$) = 3.4×10^{-3}.

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
4.7±0.9±1.1	118	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\pi^+\pi^-2\pi^0$

[1] ABLIKIM 12N reports [$\Gamma(\eta_c(1S) \to \pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}$] $\times$ [B($\psi(2S) \to \pi^0 h_c(1P)$)] $\times$ [B($h_c(1P) \to \gamma\eta_c(1S)$)] = ($20.31 \pm 2.20 \pm 3.33$) $\times 10^{-6}$ 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($h_c(1P) \to \gamma\eta_c(1S)$) = ($50 \pm 9$) $\times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ — Γ_{38}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.91±0.12 OUR FIT					
1.27±0.23 OUR AVERAGE					
1.7 ±0.3 ±0.4	100	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 2(\pi^+\pi^-)$
1.0 ±0.5	542 ± 75	[2] BAI	04	BES	$J/\psi \to \gamma\, 2(\pi^+\pi^-)$
1.05±0.17±0.34	137	[2] BISELLO	91	DM2	$J/\psi \to \gamma 2\pi^+ 2\pi^-$
1.3 ±0.6	25	[2] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
$2.0\ ^{+1.5}_{-1.0}$		[3] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

[1] ABLIKIM 12N reports [$\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-))/\Gamma_{total}$] $\times$ [B($\psi(2S) \to \pi^0 h_c(1P)$)] $\times$ [B($h_c(1P) \to \gamma\eta_c(1S)$)] = ($7.51 \pm 0.85 \pm 1.11$) $\times 10^{-6}$ 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($h_c(1P) \to \gamma\eta_c(1S)$) = ($50 \pm 9$) $\times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[2] 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.

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

$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{total}$ — Γ_{39}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
15.8±2.3 OUR AVERAGE					
15.3±1.8±1.8	333	ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
17 ±3 ±4	175	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 2(\pi^+\pi^-\pi^0)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-\pi^0))/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(3(\pi^+\pi^-))/\Gamma_{total}$ — Γ_{40}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
17 ±4 OUR AVERAGE					
20 ±5 ±5	51	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 3(\pi^+\pi^-)$
15.4±3.4±3.3	479	[2] ABLIKIM	06A	BES2	$J/\psi \to 3(\pi^+\pi^-)\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 3(\pi^+\pi^-))/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[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_{41}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
14.4± 1.4 OUR FIT					
12.6± 2.1 OUR AVERAGE					
12.0± 2.6±1.5	34	ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
15 ± 5 ±3	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. • • •					
$13.1^{+1.8}_{-2.1}\pm0.9$	195	[4] WU	06	BELL	$B^+ \to p\overline{p}K^+$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[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 $B(B^+ \to \eta_c K^+) = (1.09 \pm 0.08) \times 10^{-3}$. 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_{41}/Γ_{27}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0198±0.0019 OUR FIT					
0.021 ±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 $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\phi\phi)/\Gamma_{total}$ — $\Gamma_{41}/\Gamma \times \Gamma_7/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
0.25±0.04 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_{42}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.36±0.13±0.08	14	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}\pi^0$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p}\pi^0)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(\Lambda\overline{\Lambda})/\Gamma_{total}$ — Γ_{43}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
10.6±2.3 OUR FIT						
11.8±2.3±2.5			[1] ABLIKIM	12B	BES3	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$8.7^{+2.4}_{-2.3}\pm0.6$		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 $B(B^+ \to \eta_c K^+) = (1.09 \pm 0.08) \times 10^{-3}$. 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_{43}/Γ_{41}

VALUE	DOCUMENT ID		TECN	COMMENT
0.74±0.16 OUR FIT				
$\mathbf{0.67^{+0.19}_{-0.16}\pm0.12}$	[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.

$\Gamma(K^+\overline{p}\Lambda+\text{c.c.})/\Gamma_{total}$ — Γ_{44}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{2.50^{+0.34}_{-0.32}{}^{+0.17}_{-0.18}}$	157	[1] LU	19	BELL	$B^+ \to \overline{p}\Lambda K^+K^+$

[1] LU 19 reports $(2.83^{+0.36}_{-0.34} \pm 0.35) \times 10^{-3}$ from a measurement of $[\Gamma(\eta_c(1S) \to K^+\overline{p}\Lambda+ \text{c.c.})/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)]$ assuming $B(B^+ \to \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \to \eta_c K^+) = (1.09 \pm 0.08) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{\Lambda}(1520)\Lambda+\text{c.c.})/\Gamma_{total}$ — Γ_{45}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.1±1.3±0.2	43	[1] LU	19	BELL	$B^+ \to \overline{p}\Lambda K^+K^+$

[1] LU 19 reports $(3.48 \pm 1.48 \pm 0.46) \times 10^{-3}$ from a measurement of $[\Gamma(\eta_c(1S) \to \overline{\Lambda}(1520)\Lambda+ \text{c.c.})/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)]$ assuming $B(B^+ \to \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \to \eta_c K^+) = (1.09 \pm 0.08) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Sigma^+\overline{\Sigma}^-)/\Gamma_{total}$ — Γ_{46}/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_{47}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.90±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_{48}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
5.3±1.7±1.2		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 $[\Gamma(\eta_c(1S) \to \pi^+\pi^- p\overline{p})/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

RADIATIVE DECAYS

$\Gamma(\gamma\gamma)/\Gamma_{total}$ — Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.61±0.12 OUR FIT					
$1.9^{+0.7}_{-0.6}$ OUR AVERAGE					
$2.7 \pm 0.8 \pm 0.6$			[1] ABLIKIM 13I	BES3	
$1.4^{+0.7}_{-0.5} \pm 0.3$		$1.2^{+2.8}_{-1.1}$	[2] ADAMS 08	CLEO	$\psi(2S) \to \pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.0^{+0.9}_{-0.7} \pm 0.1$		13	[3] WICHT 08	BELL	$B^\pm \to K^\pm\gamma\gamma$
$2.80^{+0.67}_{-0.58} \pm 1.0$			[4] ARMSTRONG 95F	E760	$\overline{p}p \to \gamma\gamma$
< 9	90		[5] BISELLO 91	DM2	$J/\psi \to \gamma\gamma\gamma$
$6^{+4}_{-3} \pm 4$			[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 $B(B^+ \to \eta_c K^+) = (1.09 \pm 0.08) \times 10^{-3}$. 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_{49}/Γ_{27}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.22±0.25 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 $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{41}/\Gamma \times \Gamma_{49}/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
0.232±0.022 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_{50}/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_{51}/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 $[\Gamma(\eta_c(1S) \to \pi^0\pi^0)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 6.0\times10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7\times10^{-2}$.

[2] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to \pi^0\pi^0)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.71\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7\times10^{-2}$.

$\Gamma(K^+K^-)/\Gamma_{total}$ — Γ_{52}/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_{53}/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 $[\Gamma(\eta_c(1S) \rightarrow K^0_S K^0_S)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.53\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7\times10^{-2}$.
[2] Taking into account interference with the non-resonant continuum.
[3] Neglecting interference with the non-resonant continuum.

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ABE	07	PRL 98 082001	K. Abe *et al.*	(BELLE Collab.)
ABLIKIM	06A	PL B633 19	M. Ablikim *et al.*	(BES Collab.)
ABLIKIM	06B	EPJ C45 337	M. Ablikim *et al.*	(BES Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert *et al.*	(BABAR Collab.)
PDG	06	JP G33 1	W.-M. Yao *et al.*	(PDG Collab.)
WU	06	PRL 97 162003	C.-H. Wu *et al.*	(BELLE Collab.)
ABLIKIM	05L	PR D72 072005	M. Ablikim *et al.*	(BES Collab.)
KUO	05	PL B621 41	C.C. Kuo *et al.*	(BELLE Collab.)
ABE	04G	PR D70 071102	K. Abe *et al.*	(BELLE Collab.)
ABLIKIM	04M	PR D70 112008	M. Ablikim *et al.*	(BES Collab.)
ASNER	04	PRL 92 142001	D.M. Asner *et al.*	(CLEO Collab.)
AUBERT	04D	PRL 92 142002	B. Aubert *et al.*	(BABAR Collab.)
AUBERT,B	04B	PR D70 011101	B. Aubert *et al.*	(BABAR Collab.)
BAI	04	PL B578 16	J.Z. Bai *et al.*	(BES Collab.)
ABDALLAH	03J	EPJ C31 481	J. Abdallah *et al.*	(DELPHI Collab.)
AMBROGIANI	03	PL B566 45	M. Ambrogiani *et al.*	(FNAL E835 Collab.)
BAI	03	PL B555 174	J.Z. Bai *et al.*	(BES Collab.)
FANG	03	PRL 90 071801	F. Fang *et al.*	(BELLE Collab.)
HUANG	03	PRL 91 241802	H.-C. Huang *et al.*	(BELLE Collab.)
ABE,K	02	PRL 89 142001	K. Abe *et al.*	(BELLE Collab.)
BAI	00F	PR D62 072001	J.Z. Bai *et al.*	(BES Collab.)
BRANDENB...	00B	PRL 85 3095	G. Brandenburg *et al.*	(CLEO Collab.)
ACCIARRI	99T	PL B461 155	M. Acciarri *et al.*	(L3 Collab.)
BAI	99B	PR D60 072001	J.Z. Bai *et al.*	(BES Collab.)
ABREU	98O	PL B441 479	P. Abreu *et al.*	(DELPHI Collab.)
SHIRAI	98	PL B424 405	M. Shirai *et al.*	(AMY Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong *et al.*	(FNAL, FERR, GENO+)
ALBRECHT	94H	PL B338 390	H. Albrecht *et al.*	(ARGUS Collab.)

ADRIANI	93N	PL B318 575	O. Adriani *et al.*	(L3 Collab.)
BISELLO	91	NP B350 1	D. Bisello *et al.*	(DM2 Collab.)
BAI	90B	PRL 65 1309	Z. Bai *et al.*	(Mark III Collab.)
CHEN	90B	PL B243 169	W.Y. Chen *et al.*	(CLEO Collab.)
BAGLIN	89	PL B231 557	C. Baglin, S. Baird, G. Bassompierre	(R704 Collab.)
BEHREND	89	ZPHY C42 367	H.J. Behrend *et al.*	(CELLO Collab.)
BRAUNSCH...	89	ZPHY C41 533	W. Braunschweig *et al.*	(TASSO Collab.)
AIHARA	88D	PRL 60 2355	H. Aihara *et al.*	(TPC Collab.)
BAGLIN	87B	PL B187 191	C. Baglin *et al.*	(R704 Collab.)
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis *et al.*	(Mark III Collab.)
BERGER	86	PL 167B 120	C. Berger *et al.*	(PLUTO Collab.)
GAISER	86	PR D34 711	J. Gaiser *et al.*	(Crystal Ball Collab.)
ALTHOFF	85B	ZPHY C29 189	M. Althoff *et al.*	(TASSO Collab.)
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis *et al.*	(CIT, UCSC+) JP
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)
HIMEL	80B	PRL 45 1146	T.M. Himel *et al.*	(SLAC, LBL, UCB)
PARTRIDGE	80B	PRL 45 1150	R. Partridge *et al.*	(CIT, HARV, PRIN+)