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$\eta_c(1S)$

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

$\eta_c(1S)$ 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
$2988.3 ^{+3.3}_{-3.1}$		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	$J/\psi \to \gamma K^+ K^- K^0_S K^0_L$
$2982.6 ^{+2.7}_{-2.3}$	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] $\eta_c \rightarrow \phi\phi$.
[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	$J/\psi \rightarrow \gamma\omega\omega$
$30.8^{+2.3}_{-2.2} \pm 2.9$	2673	XU	18	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
34.0 ± 1.9 ± 1.3	11k	AAIJ	17AD	LHCB	$pp \rightarrow B^+X \rightarrow p\overline{p}K^+X$
31.4 ± 3.5 ± 2.0	6.4k	[1] AAIJ	17BB	LHCB	$pp \rightarrow b\overline{b}X \rightarrow 2(K^+K^-)X$
$27.2 \pm 3.1^{+5.4}_{-2.6}$		[2] ANASHIN	14	KEDR	$J/\psi \rightarrow \gamma\eta_c$
25.2 ± 2.6 ± 2.4	4.5k	[3,4] LEES	14E	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$
34.8 ± 3.1 ± 4.0	900	[3,4,5] LEES	14E	BABR	$\gamma\gamma \rightarrow K^+K^-\eta$
32.0 ± 1.2 ± 1.0		[6,7] ABLIKIM	12F	BES3	$\psi(2S) \rightarrow \gamma\eta_c$
36.4 ± 3.2 ± 1.7	832	[3] ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0\gamma$ hadrons
$37.8^{+5.8}_{-5.3} \pm 3.1$	486	ZHANG	12A	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
36.2 ± 2.8 ± 3.0	11k	DEL-AMO-SA...	11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
$35.1 \pm 3.1^{+1.0}_{-1.6}$	920	[7] VINOKUROVA	11	BELL	$B^\pm \rightarrow K^\pm(K^0_S K^\pm\pi^\mp)$
31.7 ± 1.2 ± 0.8	14k	[8] LEES	10	BABR	10.6 $e^+e^- \rightarrow e^+e^-K^0_S K^\pm\pi^\mp$
$36.3^{+3.7}_{-3.6} \pm 4.4$	0.9k	AUBERT	08AB	BABR	$B \rightarrow \eta_c(1S)K^{(*)} \rightarrow K\overline{K}\pi K^{(*)}$
28.1 ± 3.2 ± 2.2	7.5k	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons
$48\ ^{+8}_{-7} \pm 5$	195	WU	06	BELL	$B^+ \rightarrow p\overline{p}K^+$
40 ± 19 ± 5	20	WU	06	BELL	$B^+ \rightarrow \Lambda\overline{\Lambda}K^+$
24.8 ± 3.4 ± 3.5	592	ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K^0_S K^\pm\pi^\mp$
$20.4^{+7.7}_{-6.7} \pm 2.0$	190	AMBROGIANI	03	E835	$\overline{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
$23.9^{+12.6}_{-7.1}$		ARMSTRONG	95F	E760	$\overline{p}p \rightarrow \gamma\gamma$
• • • 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	$\gamma\gamma \rightarrow K^0_S K^\pm\pi^\mp$
34.3 ± 2.3 ± 0.9	2.5k	[10] AUBERT	04D	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\overline{K}\pi$
17.0 ± 3.7 ± 7.4		[11] BAI	03	BES	$J/\psi \rightarrow \gamma\eta_c$
29 ± 8 ± 6	180	[12] FANG	03	BELL	$B \rightarrow \eta_c K$
11.0 ± 8.1 ± 4.1		[13] BAI	00F	BES	$J/\psi \rightarrow \gamma\eta_c$ and $\psi(2S) \rightarrow \gamma\eta_c$
27.0 ± 5.8 ± 1.4		[14] BRANDENB...	00B	CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K^0_S\pi^\mp$
$7.0^{+7.5}_{-7.0}$	12	BAGLIN	87B	SPEC	$\overline{p}p \rightarrow \gamma\gamma$
$10.1^{+33.0}_{-8.2}$	23	[15] BALTRUSAIT...	86	MRK3	$J/\psi \rightarrow \gamma p\overline{p}$
11.5 ± 4.5		GAISER	86	CBAL	$J/\psi \rightarrow \gamma X$, $\psi(2S) \rightarrow \gamma X$

<40	90% CL	18	HIMEL	80B	MRK2	e^+e^-
<20	90% CL		PARTRIDGE	80B	CBAL	e^+e^-

[1] From a 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	$\eta'(958)K\overline{K}$	(3.5 ± 1.5) %	
Γ_3	$\rho\rho$	(1.8 ± 0.5) %	
Γ_4	$K^*(892)^0 K^-\pi^+ +$ c.c.	(2.0 ± 0.7) %	
Γ_5	$K^*(892)\overline{K}^*(892)$	$(6.9 \pm 1.3) \times 10^{-3}$	
Γ_6	$K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-$	(1.1 ± 0.5) %	
Γ_7	ϕK^+K^-	$(2.9 \pm 1.4) \times 10^{-3}$	
Γ_8	$\phi\phi$	$(1.74 \pm 0.19) \times 10^{-3}$	
Γ_9	$\phi 2(\pi^+\pi^-)$	$< 4 \times 10^{-3}$	90%
Γ_{10}	$a_0(980)\pi$	seen	
Γ_{11}	$a_2(1320)\pi$	< 2 %	90%
Γ_{12}	$K^*(892)\overline{K} +$ c.c.	< 1.28 %	90%
Γ_{13}	$f_2(1270)\eta$	< 1.1 %	90%
Γ_{14}	$f_2(1270)\eta'$	seen	
Γ_{15}	$\omega\omega$	$(2.9 \pm 0.8) \times 10^{-3}$	
Γ_{16}	$\omega\phi$	$< 2.5 \times 10^{-4}$	90%
Γ_{17}	$f_2(1270)f_2(1270)$	$(9.8 \pm 2.5) \times 10^{-3}$	
Γ_{18}	$f_2(1270)f_2'(1525)$	$(9.5 \pm 3.2) \times 10^{-3}$	
Γ_{19}	$f_0(500)\eta$	seen	
Γ_{20}	$f_0(500)\eta'$	seen	
Γ_{21}	$f_0(980)\eta$	seen	
Γ_{22}	$f_0(980)\eta'$	seen	
Γ_{23}	$f_0(1500)\eta$	seen	

Γ_{24}	$f_0(1710)\eta'$		seen	
Γ_{25}	$f_0(2100)\eta'$		seen	
Γ_{26}	$f_0(2200)\eta$		seen	
Γ_{27}	$a_0(1320)\pi$		seen	
Γ_{28}	$a_0(1450)\pi$		seen	
Γ_{29}	$a_0(1700)\pi$		seen	
Γ_{30}	$a_0(1950)\pi$		seen	
Γ_{31}	$K_0^*(1430)\overline{K}$		seen	
Γ_{32}	$K_2^*(1430)\overline{K}$		seen	
Γ_{33}	$K_0^*(1950)\overline{K}$		seen	

Decays into stable hadrons

Γ_{34}	$K\overline{K}\pi$		(7.3 ± 0.4) %	
Γ_{35}	$K\overline{K}\eta$		(1.36 ± 0.15) %	
Γ_{36}	$\eta\pi^+\pi^-$		(1.7 ± 0.6) %	
Γ_{37}	$\eta 2(\pi^+\pi^-)$		(4.4 ± 1.6) %	
Γ_{38}	$K^+K^-\pi^+\pi^-$		$(6.6 \pm 1.1) \times 10^{-3}$	
Γ_{39}	$K^+K^-\pi^+\pi^-\pi^0$		(3.5 ± 0.6) %	
Γ_{40}	$K^0K^-\pi^+\pi^-\pi^+$+c.c.		(5.6 ± 1.9) %	
Γ_{41}	$K^+K^-2(\pi^+\pi^-)$		$(7.5 \pm 2.4) \times 10^{-3}$	
Γ_{42}	$2(K^+K^-)$		$(1.43 \pm 0.30) \times 10^{-3}$	
Γ_{43}	$\pi^+\pi^-\pi^0$		$< 5 \times 10^{-4}$	90%
Γ_{44}	$\pi^+\pi^-\pi^0\pi^0$		(4.7 ± 1.4) %	
Γ_{45}	$2(\pi^+\pi^-)$		$(9.1 \pm 1.2) \times 10^{-3}$	
Γ_{46}	$2(\pi^+\pi^-\pi^0)$		(15.8 ± 2.3) %	
Γ_{47}	$3(\pi^+\pi^-)$		(1.7 ± 0.4) %	
Γ_{48}	$p\overline{p}$		$(1.44 \pm 0.14) \times 10^{-3}$	
Γ_{49}	$p\overline{p}\pi^0$		$(3.6 \pm 1.5) \times 10^{-3}$	
Γ_{50}	$\Lambda\overline{\Lambda}$		$(1.06 \pm 0.23) \times 10^{-3}$	
Γ_{51}	$K^+\overline{p}\Lambda$+ c.c.		$(2.5 \pm 0.4) \times 10^{-3}$	
Γ_{52}	$\overline{\Lambda}(1520)\Lambda$+ c.c.		$(3.1 \pm 1.3) \times 10^{-3}$	
Γ_{53}	$\Sigma^+\overline{\Sigma}^-$		$(2.1 \pm 0.6) \times 10^{-3}$	
Γ_{54}	$\Xi^-\overline{\Xi}^+$		$(9.0 \pm 2.6) \times 10^{-4}$	
Γ_{55}	$\pi^+\pi^-p\overline{p}$		$(5.3 \pm 2.1) \times 10^{-3}$	

Radiative decays

Γ_{56}	$\gamma\gamma$		$(1.61 \pm 0.12) \times 10^{-4}$	

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

Γ_{57}	$\pi^+\pi^-$	P,CP	$< 1.1 \times 10^{-4}$	90%
Γ_{58}	$\pi^0\pi^0$	P,CP	$< 4 \times 10^{-5}$	90%
Γ_{59}	K^+K^-	P,CP	$< 6 \times 10^{-4}$	90%
Γ_{60}	$K_S^0K_S^0$	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 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, $x_i \equiv \Gamma_i/\Gamma_{total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

	x_5	x_8	x_{17}	x_{34}	x_{35}	x_{38}	x_{42}	x_{45}	x_{48}	x_{50}
x_8	16									
x_{17}	3	5								
x_{34}	18	35	6							
x_{35}	9	17	3	47						
x_{38}	10	18	3	21	10					
x_{42}	7	13	2	21	10	8				
x_{45}	12	22	4	25	12	14	10			
x_{48}	11	20	4	27	13	12	10	15		
x_{50}	3	5	1	6	3	3	2	4	23	
x_{56}	−27	−51	−9	−59	−28	−32	−23	−38	−38	−9
Γ	−1	−3	0	−3	−1	−2	−1	−2	6	1

	x_{56}
Γ	−27

	Mode	Rate (MeV)
Γ_5	$K^*(892)\overline{K}^*(892)$	0.22 ±0.04
Γ_8	$\phi\phi$	0.056 ±0.006
Γ_{17}	$f_2(1270) f_2(1270)$	0.31 ±0.08
Γ_{34}	$K\overline{K}\pi$	2.32 ±0.14
Γ_{35}	$K\overline{K}\eta$	0.43 ±0.05
Γ_{38}	$K^+K^-\pi^+\pi^-$	0.210 ±0.035
Γ_{42}	$2(K^+K^-)$	0.046 ±0.010
Γ_{45}	$2(\pi^+\pi^-)$	0.29 ±0.04
Γ_{48}	$p\overline{p}$	0.046 ±0.005
Γ_{50}	$\Lambda\overline{\Lambda}$	0.034 ±0.008
Γ_{56}	$\gamma\gamma$	0.00515±0.00035

$\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ — Γ_{56}

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	$B^\pm \to K^\pm X_{c\overline{c}}$
$5.5 \pm 1.2 \pm 1.8$	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)

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_1\Gamma_{56}/\Gamma$

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.

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_3\Gamma_{56}/\Gamma$

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

$\Gamma(K^*(892)\overline{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_5\Gamma_{56}/\Gamma$

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

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_8\Gamma_{56}/\Gamma$

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)%.

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{15}\Gamma_{56}/\Gamma$

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)%.

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{16}\Gamma_{56}/\Gamma$

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)%.

$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{17}\Gamma_{56}/\Gamma$

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

$\Gamma(f_2(1270)f'_2(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{18}\Gamma_{56}/\Gamma$

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

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{34}\Gamma_{56}/\Gamma$

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.

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{38}\Gamma_{56}/\Gamma$

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)%.

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_{39}\Gamma_{56}/\Gamma$

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.

$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{42}\Gamma_{56}/\Gamma$

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($\eta_c \to$) $2(K^+K^-) = (2.1 \pm 1.2)\%$.

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

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{45}\Gamma_{56}/\Gamma$

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

$\Gamma(p\overline{p}) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{48}\Gamma_{56}/\Gamma$

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.

$\Gamma(K^0_S K^0_S) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{60}\Gamma_{56}/\Gamma$

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

$\Gamma(\rho\rho)/\Gamma_{total}$ — Γ_3/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_4/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_5/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_6/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 ± 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_7/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 ± 0.12$^{+0.10}_{-0.12}$) × 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_8/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	$J/\psi \to K^+ K^- K^+ K^- \gamma$
$25.3 \pm 5.1 \pm 9.1$	72	[2] ABLIKIM	05L	BES2	$J/\psi \to K^+ K^- K^+ K^- \gamma$
26 ± 9	357	[2] BAI	04	BES	$J/\psi \to \gamma K^+ K^- K^+ K^-$
$31 \pm 7 \pm 10$	19	[2] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- K^+ K^-$
$30\ {}^{+18}_{-12}\ \pm 10$	5	[2] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- K^0_S K^0_L$
$74 \pm 18 \pm 24$	80	[2] BAI	90B	MRK3	$J/\psi \to \gamma K^+ K^- K^+ K^-$
$67 \pm 21 \pm 24$		[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 $[\Gamma(\eta_c(1S) \to \phi\phi)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (4.3 \pm 0.5^{+0.5}_{-1.2}) \times 10^{-5}$ 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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. 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_8/Γ_{34}

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_8/Γ_{48}

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_9/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_{10}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
seen		LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$
seen		LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\pi^0$

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

<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_{11}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
seen		LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$
<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.

$\Gamma(K^*(892)\overline{K}+c.c.)/\Gamma_{total}$ — Γ_{12}/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 ± 0.0036.

$\Gamma(f_2(1270)\eta)/\Gamma_{total}$ — Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
seen		LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$
<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 ± 0.0036.

$\Gamma(f_2(1270)\eta')/\Gamma_{total}$ — Γ_{14}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta'$; $K^+K^-\eta'$

$\Gamma(\omega\omega)/\Gamma_{total}$ — Γ_{15}/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 [$\Gamma(\eta_c(1S) \to \omega\omega)/\Gamma_{total}$] × [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 ± 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_{16}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
< 2.5 × 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 × 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 ± 0.004.
[2] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036.

$\Gamma(f_2(1270) f_2(1270))/\Gamma_{total}$ Γ_{17}/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 [$\Gamma(\eta_c(1S) \to f_2(1270) f_2(1270))/\Gamma_{total}$] × [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.

$\Gamma(f_0(500)\eta)/\Gamma_{total}$ Γ_{19}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$

$\Gamma(f_0(500)\eta')/\Gamma_{total}$ Γ_{20}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c(1S) \to \pi^+\pi^-\eta'$

$\Gamma(f_0(980)\eta)/\Gamma_{total}$ Γ_{21}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta$

$\Gamma(f_0(980)\eta')/\Gamma_{total}$ Γ_{22}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta'$, $K^+K^-\eta'$

$\Gamma(f_0(1500)\eta)/\Gamma_{total}$ Γ_{23}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta$

$\Gamma(f_0(1710)\eta')/\Gamma_{total}$ Γ_{24}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta'$

$\Gamma(f_0(2100)\eta')/\Gamma_{total}$ Γ_{25}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$

$\Gamma(f_0(2200)\eta)/\Gamma_{total}$ — Γ_{26}/Γ

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

$\Gamma(a_0(1320)\pi)/\Gamma_{total}$ — Γ_{27}/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_{28}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+ \pi^- \eta$
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \pi^0$

$\Gamma(a_0(1700)\pi)/\Gamma_{total}$ — Γ_{29}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+ \pi^- \eta'$

$\Gamma(a_0(1950)\pi)/\Gamma_{total}$ — Γ_{30}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen		LEES	21A	BABR	Dalitz anal. of $\eta_c(1S) \to \pi^+ \pi^- \eta'$
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_{31}/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_{32}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta'$
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \pi^0$

$\Gamma(K_0^*(1950)\overline{K})/\Gamma_{total}$ — Γ_{33}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen		LEES	21A	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta'$
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_{34}/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	$\psi(2S) \to \pi^0 \gamma K^0_S K^\mp \pi^\pm$
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	$J/\psi \to \gamma K^\pm \pi^\mp K^0_S$
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	$J/\psi \to \gamma K^\pm \pi^\mp K^0_S$
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 $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \to h_c(1P)\pi^0)] \times [\text{B}(h_c(1P) \to \gamma \eta_c(1S))] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best values B($\psi(2S) \to h_c(1P)\pi^0$) = $(8.6 \pm 1.3) \times 10^{-4}$, 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 $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \to h_c(1P)\pi^0)] \times [\text{B}(h_c(1P) \to \gamma \eta_c(1S))] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best values B($\psi(2S) \to h_c(1P)\pi^0$) = $(8.6 \pm 1.3) \times 10^{-4}$, 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_7/Γ_{34}

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_{35}/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 $[\Gamma(\eta_c(1S) \to K\overline{K}\eta)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(K\overline{K}\eta)/\Gamma(K\overline{K}\pi)$ — Γ_{35}/Γ_{34}

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_{36}/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 $[\Gamma(\eta_c(1S) \to \eta\pi^+\pi^-)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{37}/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 $[\Gamma(\eta_c(1S) \to \eta 2(\pi^+\pi^-))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{38}/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 $[\Gamma(\eta_c(1S) \to K^+K^-\pi^+\pi^-)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{39}/Γ_{34}

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.

$\Gamma(K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.})/\Gamma_{total}$ Γ_{40}/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 $[\Gamma(\eta_c(1S) \to K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.})/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{total}$ Γ_{41}/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 $[\Gamma(\eta_c(1S) \to K^+K^-2(\pi^+\pi^-))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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 $[\Gamma(\eta_c(1S) \to K^+ K^- 2(\pi^+\pi^-))/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$ 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.

$\Gamma(2(K^+K^-))/\Gamma_{total}$ Γ_{42}/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	$B^+ \to 2(K^+K^-)\ K^+$
$21\ \pm 10\ \pm 6$		[3] ALBRECHT 94H	ARG	$\gamma\gamma \to K^+K^-K^+K^-$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 2(K^+K^-))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{42}/Γ_{34}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.020±0.004 OUR FIT				
0.024±0.007 OUR AVERAGE				
$0.023 \pm 0.007 \pm 0.006$		AUBERT,B 04B	BABR	$B^\pm \to K^\pm \eta_c$
$0.026^{+0.009}_{-0.007} \pm 0.007$	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 $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(\eta'(958)K\overline{K})/\Gamma(\eta'(958)\pi\pi)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.859±0.052±0.043	[1] LEES 21A	BABR	$\gamma\gamma \to \eta' K^+K^-$, $\eta'\pi^+\pi^-$

[1] Based on Dalitz-plot analysis of the $\eta_c \to \eta' K^+K^-$, $\eta'\pi^+\pi^-$ final states where the fit fractions and relative phases are determined for numerous two-body intermediate states.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{43}/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 $B(\psi(2S) \to \gamma\eta_c(1S)) = 3.4 \times 10^{-3}$.

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}$ — Γ_{44}/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 $[\Gamma(\eta_c(1S) \to \pi^+\pi^-\pi^0\pi^0)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{45}/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	$\psi(2S) \to \pi^0\gamma2(\pi^+\pi^-)$
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 $[\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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 $B(\psi(2S) \to \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{total}$ — Γ_{46}/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	$\psi(2S) \to \pi^0\gamma2(\pi^+\pi^-\pi^0)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-\pi^0))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{47}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
17 ±4 OUR AVERAGE				
20 ±5 ±5	51	[1] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0\gamma3(\pi^+\pi^-)$
15.4±3.4±3.3	479	[2] ABLIKIM 06A	BES2	$J/\psi \to 3(\pi^+\pi^-)\gamma$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 3(\pi^+\pi^-))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) =$

$(50 \pm 9) \times 10^{-2}$. 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_{48}/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 $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{48}/Γ_{34}

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

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\phi\phi)/\Gamma_{total}$ — $\Gamma_{48}/\Gamma \times \Gamma_8/\Gamma$

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_{49}/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 $[\Gamma(\eta_c(1S) \to p\overline{p}\pi^0)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. 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_{50}/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_{50}/Γ_{48}

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.

$\Gamma(K^+\overline{p}\Lambda + c.c.)/\Gamma_{total}$ Γ_{51}/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 $[\Gamma(\eta_c(1S) \to K^+\overline{p}\Lambda + c.c.)/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)]$ 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.

$\Gamma(\overline{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ — Γ_{52}/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 $[\Gamma(\eta_c(1S) \to \overline{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \to \eta_c K^+)]$ 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.

$\Gamma(\Sigma^+\overline{\Sigma}^-)/\Gamma_{\text{total}}$ — Γ_{53}/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 $[\Gamma(\eta_c(1S) \to \Sigma^+\overline{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$ 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.

$\Gamma(\Xi^-\overline{\Xi}^+)/\Gamma_{\text{total}}$ — Γ_{54}/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 $[\Gamma(\eta_c(1S) \to \Xi^-\overline{\Xi}^+)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$ 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.

$\Gamma(\pi^+\pi^- p\overline{p})/\Gamma_{\text{total}}$ — Γ_{55}/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 $[\Gamma(\eta_c(1S) \to \pi^+\pi^- p\overline{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (50 \pm 9) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

RADIATIVE DECAYS

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ — Γ_{56}/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 ±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. • • •

$2.0\ ^{+0.9}_{-0.7}\ \pm0.1$		13	[3] WICHT	08	BELL	$B^{\pm} \to K^{\pm}\gamma\gamma$
$2.80^{+0.67}_{-0.58}\pm1.0$			[4] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
<9	90		[5] BISELLO	91	DM2	$J/\psi \to \gamma\gamma\gamma$
$6\ ^{+4}_{-3}\ \pm4$			[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_{56}/Γ_{34}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.22±0.25 OUR FIT					
$\mathbf{3.2\ ^{+1.3}_{-1.0}\ ^{+0.8}_{-0.6}}$	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 $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{48}/\Gamma \times \Gamma_{56}/\Gamma$

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_{57}/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_{58}/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_{59}/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_{60}/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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ABLIKIM	13C	PR D87 012003	M. Ablikim *et al.*	(BESIII Collab.)
ABLIKIM	13I	PR D87 032003	M. Ablikim *et al.*	(BESIII Collab.)
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ABLIKIM	12F	PRL 108 222002	M. Ablikim *et al.*	(BESIII Collab.)
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KUO	05	PL B621 41	C.C. Kuo *et al.*	(BELLE Collab.)
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