$\eta_c(1S)$

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

$\eta_c(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2983.9 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
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	[1] AAIJ 17AD	LHCB	$pp \to B^+X \to p\overline{p}K^+X$
2982.8 ± 1.0 ± 0.5	6.4k	[2] AAIJ 17BB	LHCB	$pp \to b\overline{b}X \to 2(K^+K^-)X$
2982.2 ± 1.5 ± 0.1	2.0k	[3] AAIJ 15BI	LHCB	$pp \to \eta_c(1S)X$
2983.5 ± 1.4 $^{+1.6}_{-3.6}$		[4] ANASHIN 14	KEDR	$J/\psi \to \gamma\eta_c$
2979.8 ± 0.8 ± 3.5	4.5k	[5,6] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\pi^0$
2984.1 ± 1.1 ± 2.1	900	[5,6,7] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\eta$
2984.3 ± 0.6 ± 0.6		[8,9] ABLIKIM 12F	BES3	$\psi(2S) \to \gamma\eta_c$
2984.49 ± 1.16 ± 0.52	832	[5] 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	[9] VINOKUROVA 11	BELL	$B^\pm \to K^\pm(K^0_S K^\pm\pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	[10] 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	[11] 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	[12] 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	[13] DEL-AMO-SA..11M	BABR	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$
2982.2 ± 0.6		[14] MITCHELL 09	CLEO	$e^+e^- \to \gamma X$
2982 ± 5	270	[15] AUBERT 06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	[16] AUBERT 04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
2977.5 ± 1.0 ± 1.2		[14,17] BAI 03	BES	$J/\psi \to \gamma\eta_c$
2979.6 ± 2.3 ± 1.6	180	[18] FANG 03	BELL	$B \to \eta_c K$
2976.3 ± 2.3 ± 1.2		[14,19] BAI 00F	BES	$J/\psi,\ \psi(2S) \to \gamma\eta_c$
2976.6 ± 2.9 ± 1.3	140	[14,20] BAI 00F	BES	$J/\psi \to \gamma\eta_c$

$2980.4 \pm 2.3 \pm 0.6$		[21] BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
$2975.8 \pm 3.9 \pm 1.2$		[20] 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		[14,22] BISELLO	91	DM2	$J/\psi \to \eta_c\gamma$
$2969 \pm 4 \pm 4$	80	[14] BAI	90B	MRK3	$J/\psi \to \gamma K^+ K^- K^+ K^-$
$2956 \pm 12 \pm 12$		[14] 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		[14,22] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$
$2984 \pm 2.3 \pm 4.0$		[14] GAISER	86	CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$
2976 ± 8		[14,23] BALTRUSAIT...84		MRK3	$J/\psi \to 2\phi\gamma$
2982 ± 8	18	[24] HIMEL	80B	MRK2	e^+e^-
2980 ± 9		[24] PARTRIDGE	80B	CBAL	e^+e^-

[1] 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.

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

[3] 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.

[4] Taking into account an asymmetric photon lineshape.

[5] With floating width.

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

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

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

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

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

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

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

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

[14] 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.

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

[16] Superseded by LEES 10.

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

[18] Superseded by VINOKUROVA 11.

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

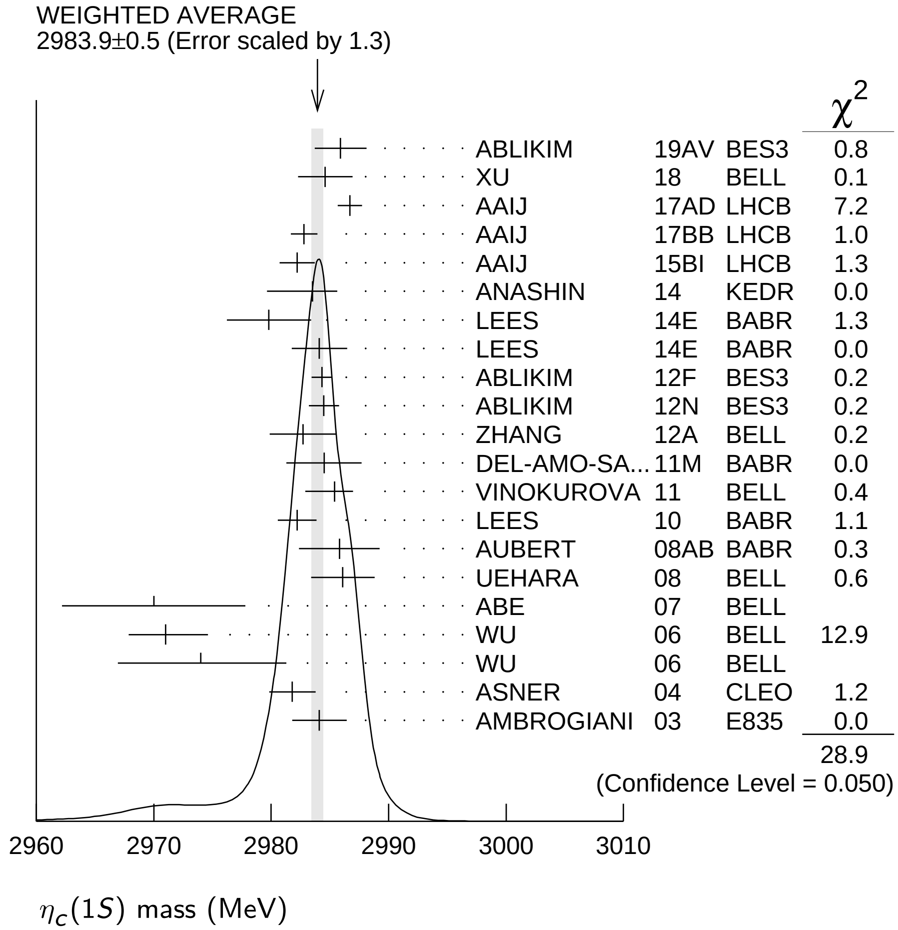
[20] Average of several decay modes. Using an η_c width of 13.2 MeV.

[21] Superseded by ASNER 04.

[22] Average of several decay modes.

[23] $\eta_c \to \phi\phi$.

[24] 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	$J/\psi \rightarrow \gamma\omega\omega$
$30.8^{+2.3}_{-2.2}\pm2.9$	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
$37.8^{+5.8}_{-5.3}\pm3.1$	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	$B^\pm \rightarrow K^\pm(K^0_S K^\pm\pi^\mp)$

$31.7 \pm 1.2 \pm 0.8$	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	$B \rightarrow \eta_c(1S) K^{(*)} \rightarrow K\overline{K}\pi K^{(*)}$
$28.1 \pm 3.2 \pm 2.2$	7.5k	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons
$48\ ^{+8}_{-7} \pm 5$	195	WU	06	BELL	$B^+ \rightarrow p\overline{p}K^+$
$40 \pm 19 \pm 5$	20	WU	06	BELL	$B^+ \rightarrow \Lambda\overline{\Lambda}K^+$
$24.8 \pm 3.4 \pm 3.5$	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. • • •					
$32.1 \pm 1.1 \pm 1.3$	12k	[9] DEL-AMO-SA...	11M	BABR	$\gamma\gamma \rightarrow K^0_S K^\pm \pi^\mp$
$34.3 \pm 2.3 \pm 0.9$	2.5k	[10] AUBERT	04D	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\overline{K}\pi$
$17.0 \pm 3.7 \pm 7.4$		[11] BAI	03	BES	$J/\psi \rightarrow \gamma\eta_c$
$29 \pm 8 \pm 6$	180	[12] FANG	03	BELL	$B \rightarrow \eta_c K$
$11.0 \pm 8.1 \pm 4.1$		[13] BAI	00F	BES	$J/\psi \rightarrow \gamma\eta_c$ and $\psi(2S) \rightarrow \gamma\eta_c$
$27.0 \pm 5.8 \pm 1.4$		[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, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ 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 $\psi(2S) \rightarrow \gamma\eta_c$ and $J/\psi(1S) \rightarrow \gamma\eta_c$ 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	$K^*(892)\overline{K}^*(892)$	(7.0 ±1.3) $\times 10^{-3}$	
Γ_5	$K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-$	(1.1 ±0.5) %	
Γ_6	ϕK^+K^-	(2.9 ±1.4) $\times 10^{-3}$	
Γ_7	$\phi\phi$	(1.77±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 ±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 ±2.5) $\times 10^{-3}$	
Γ_{16}	$f_2(1270)f'_2(1525)$	(9.7 ±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 ±0.5) %	
Γ_{30}	$\eta 2(\pi^+\pi^-)$	(4.4 ±1.3) %	
Γ_{31}	$K^+K^-\pi^+\pi^-$	(6.9 ±1.0) $\times 10^{-3}$	
Γ_{32}	$K^+K^-\pi^+\pi^-\pi^0$	(3.5 ±0.6) %	
Γ_{33}	$K^0K^-\pi^+\pi^-\pi^+ +$c.c.	(5.6 ±1.5) %	
Γ_{34}	$K^+K^-2(\pi^+\pi^-)$	(7.5 ±2.4) $\times 10^{-3}$	
Γ_{35}	$2(K^+K^-)$	(1.46±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 ±1.0) %	
Γ_{38}	$2(\pi^+\pi^-)$	(9.7 ±1.2) $\times 10^{-3}$	
Γ_{39}	$2(\pi^+\pi^-\pi^0)$	(16.1 ±2.0) %	
Γ_{40}	$3(\pi^+\pi^-)$	(1.8 ±0.4) %	

Γ_{41}	$p\overline{p}$		$(1.45\pm0.14)\times10^{-3}$	
Γ_{42}	$p\overline{p}\pi^0$		$(3.6\ \pm1.3\ )\times10^{-3}$	
Γ_{43}	$\Lambda\overline{\Lambda}$		$(1.07\pm0.24)\times10^{-3}$	
Γ_{44}	$K^+\overline{p}\Lambda+$ c.c.		$(2.6\ \pm0.4\ )\times10^{-3}$	
Γ_{45}	$\overline{\Lambda}(1520)\Lambda+$ c.c.		$(3.1\ \pm1.4\ )\times10^{-3}$	
Γ_{46}	$\Sigma^+\overline{\Sigma}^-$		$(2.1\ \pm0.6\ )\times10^{-3}$	
Γ_{47}	$\Xi^-\overline{\Xi}^+$		$(9.0\ \pm2.6\ )\times10^{-4}$	
Γ_{48}	$\pi^+\pi^-p\overline{p}$		$(5.3\ \pm1.8\ )\times10^{-3}$	

Radiative decays

Γ_{49}	$\gamma\gamma$		$(1.58\pm0.11)\times10^{-4}$	

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

Γ_{50}	$\pi^+\pi^-$	P,CP	$< 1.1\times10^{-4}$	90%
Γ_{51}	$\pi^0\pi^0$	P,CP	$< 4\times10^{-5}$	90%
Γ_{52}	K^+K^-	P,CP	$< 6\times10^{-4}$	90%
Γ_{53}	$K^0_SK^0_S$	P,CP	$< 3.1\times10^{-4}$	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 $\chi^2 = 121.6$ 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_7	15									
x_{15}	3	5								
x_{27}	17	33	6							
x_{28}	7	15	3	45						
x_{31}	9	17	3	19	9					
x_{35}	7	12	2	20	9	8				
x_{38}	11	21	4	24	11	13	9			
x_{41}	10	19	3	25	11	11	9	14		
x_{43}	2	4	1	6	3	3	2	3	23	
x_{49}	−26	−49	−9	−56	−25	−30	−22	−37	−36	−8
Γ	−1	−2	0	−3	−1	−2	−1	−2	6	1

	x_{49}
Γ	−29

Mode	Rate (MeV)

Γ_4	$K^*(892)\overline{K}^*(892)$	0.22 $\pm$0.04
Γ_7	$\phi\phi$	0.057 $\pm$0.006
Γ_{15}	$f_2(1270)f_2(1270)$	0.31 $\pm$0.08
Γ_{27}	$K\overline{K}\pi$	2.33 $\pm$0.13
Γ_{28}	$K\overline{K}\eta$	0.43 $\pm$0.05
Γ_{31}	$K^+K^-\pi^+\pi^-$	0.220 $\pm$0.034
Γ_{35}	$2(K^+K^-)$	0.047 $\pm$0.010
Γ_{38}	$2(\pi^+\pi^-)$	0.31 $\pm$0.04
Γ_{41}	$p\overline{p}$	0.046 $\pm$0.005
Γ_{43}	$\Lambda\overline{\Lambda}$	0.034 $\pm$0.008
Γ_{49}	$\gamma\gamma$	0.00506$\pm$0.00034

$\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ Γ_{49}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.06$\pm$ 0.34 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.8 $\pm$ 1.1	486	[1] ZHANG 12A	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
5.2 $\pm$ 1.2	273 $\pm$ 43	[2,3] AUBERT 06E	BABR	$B^\pm \rightarrow K^\pm X_{c\overline{c}}$
5.5 $\pm$ 1.2 $\pm$ 1.8	157 $\pm$ 33	[4] KUO 05	BELL	$\gamma\gamma \rightarrow p\overline{p}$
7.4 $\pm$ 0.4 $\pm$ 2.3		[5] ASNER 04	CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K^0_S K^\pm\pi^\mp$
13.9 $\pm$ 2.0 $\pm$ 3.0	41	[6] ABDALLAH 03J	DLPH	$\gamma\gamma \rightarrow \eta_c$
3.8 $^{+1.1}_{-1.0}$ $^{+1.9}_{-1.0}$	190	[7] AMBROGIANI 03	E835	$\overline{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
7.6 $\pm$ 0.8 $\pm$ 2.3		[5,8] BRANDENB... 00B	CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K^0_S\pi^\mp$
6.9 $\pm$ 1.7 $\pm$ 2.1	76	[9] ACCIARRI 99T	L3	$e^+e^- \rightarrow e^+e^-\eta_c$
27 $\pm$16 $\pm$10	5	[5] SHIRAI 98	AMY	58 e^+e^-
6.7 $^{+2.4}_{-1.7}$ $\pm$ 2.3		[4] ARMSTRONG 95F	E760	$\overline{p}p \rightarrow \gamma\gamma$
11.3 $\pm$ 4.2		[10] ALBRECHT 94H	ARG	$e^+e^- \rightarrow e^+e^-\eta_c$
8.0 $\pm$ 2.3 $\pm$ 2.4	17	[11] ADRIANI 93N	L3	$e^+e^- \rightarrow e^+e^-\eta_c$
5.9 $^{+2.1}_{-1.8}$ $\pm$ 1.9		[7] CHEN 90B	CLEO	$e^+e^- \rightarrow e^+e^-\eta_c$
6.4 $^{+5.0}_{-3.4}$		[12] AIHARA 88D	TPC	$e^+e^- \rightarrow e^+e^-X$
4.3 $^{+3.4}_{-3.7}$ $\pm$ 2.4		[4] BAGLIN 87B	SPEC	$\overline{p}p \rightarrow \gamma\gamma$
28 $\pm$15		[5,13] BERGER 86	PLUT	$\gamma\gamma \rightarrow K\overline{K}\pi$

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

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

[3] Systematic errors not evaluated.

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

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

[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 $B(\eta_c \rightarrow K^\pm K^0_S\pi^\mp)$, $B(\eta_c \rightarrow K^+K^-\pi^+\pi^-)$, and $B(\eta_c \rightarrow 2\pi^+2\pi^-)$.

[8] Superseded by ASNER 04.
[9] Normalized to the sum of 9 branching ratios.
[10] Normalized to the sum of B($\eta_c \to K^\pm K^0_S \pi^\mp$), 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($\gamma\gamma$)/Γ(total)

Γ($\eta'(958)\pi\pi$) × Γ($\gamma\gamma$)/Γ$_{total}$ — $\Gamma_1\Gamma_{49}/\Gamma$

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.

Γ($\rho\rho$) × Γ($\gamma\gamma$)/Γ$_{total}$ — $\Gamma_2\Gamma_{49}/\Gamma$

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

Γ($K^*(892)\overline{K}^*(892)$) × Γ($\gamma\gamma$)/Γ$_{total}$ — $\Gamma_4\Gamma_{49}/\Gamma$

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

Γ($\phi\phi$) × Γ($\gamma\gamma$)/Γ$_{total}$ — $\Gamma_7\Gamma_{49}/\Gamma$

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)%.

Γ($\omega\omega$) × Γ($\gamma\gamma$)/Γ$_{total}$ — $\Gamma_{13}\Gamma_{49}/\Gamma$

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)%.

Γ($\omega\phi$) × Γ($\gamma\gamma$)/Γ$_{total}$ — $\Gamma_{14}\Gamma_{49}/\Gamma$

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)%.

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

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

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

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

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

VALUE (keV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.369±0.020 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.

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

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
35 ± 5 OUR FIT					
27 ± 6 OUR AVERAGE					
25.7± 3.2± 4.9	2019 ± 248	UEHARA	08	BELL	$\gamma\gamma \to \pi^+\pi^- K^+ K^-$
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. • • •				
$0.190\pm0.006\pm0.028$	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
7.4± 1.5 OUR FIT				
5.8± 1.9 OUR AVERAGE				
$5.6\pm 1.1\pm 1.6$	216 ± 42	UEHARA 08	BELL	$\gamma\gamma \to 2(K^+K^-)$
$350\ \pm90\ \pm60$	46	[1] ABDALLAH 03J	DLPH	$\gamma\gamma \to 2(K^+K^-)$
$231\ \pm90\ \pm23$	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($\eta_c \to$) $2(K^+K^-) = (2.1\pm1.2)\%$.
[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
49 ± 6 OUR FIT				
42 ± 6 OUR AVERAGE				
$40.7\pm 3.7\pm 5.3$	5381 ± 492	UEHARA 08	BELL	$\gamma\gamma \to 2(\pi^+\pi^-)$
$180\ \pm70\ \pm20$	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				
$\mathbf{7.20\pm1.53^{+0.67}_{-0.75}}$	157 ± 33	[1] KUO 05	BELL	$\gamma\gamma \to p\overline{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4.6\ ^{+1.3}_{-1.1}\ \pm0.4$	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
70±13 OUR FIT					
91±26 OUR AVERAGE					
108±25±44	60	[1] ABLIKIM	05L	BES2	$J/\psi \to K^+K^-\pi^+\pi^-\gamma$
82±28±27	14	[1] BISELLO	91	DM2	$e^+e^- \to \gamma K^+K^-\pi^+\pi^-$
90±50	9	[1] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

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

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
113±47±24	45	[1] ABLIKIM	06A	BES2	$J/\psi \to K^{*0}\overline{K}^{*0}\pi^+\pi^-\gamma$

[1] ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \to K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$ 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
17.7± 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_7/Γ_{27}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0243±0.0025 OUR FIT				
$\mathbf{0.044\ ^{+0.012}_{-0.010}}$ **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 ± 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_{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 ±0.4 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 ±0.6	55	[3,4] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K^+K^-\pi^0$
7.9 ±1.4 ±0.7	107	[5,6] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K_S^0K^\mp\pi^\pm$
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 $B(\eta_c \to K_S^0K^\pm\pi^\mp) = (2.60 \pm 0.21 \pm 0.20) \times 10^{-2}$ which we multiply by 3 to account for isospin symmetry.

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

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

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

[6] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [\Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total} \times \Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
[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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$. 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 $B(\psi(2S) \to \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.
[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
$0.052^{+0.016}_{-0.014}\pm0.014$	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 $B(\psi(2S) \to \pi^0 h_c) \cdot B(h_c \to \gamma\eta_c) \cdot B(\eta_c \to K^+K^-\eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.
[2] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\eta)/\Gamma_{total}] \times [B(\psi(2S) \to \pi^0 h_c(1P))] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (51 \pm 6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.
[3] The quoted branching ratios use $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

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

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

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

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

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

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

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

$\Gamma(\eta 2(\pi^+\pi^-))/\Gamma_{total}$ Γ_{30}/Γ

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

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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
6.9± 1.0 OUR FIT					
11.2± 1.9 OUR AVERAGE					
9.7± 2.2±0.9	38	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K^+K^-\pi^+\pi^-$
12 ± 4	0.4k	[2] BAI	04	BES	$J/\psi \to \gamma K^+K^-\pi^+\pi^-$
21 ± 7	110	[2] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$
14 $^{+22}_{-9}$		[3] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

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

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

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

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

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

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

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

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

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

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

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

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

$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ — Γ_{35}/Γ

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

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

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

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

$\Gamma(2(K^+K^-))/\Gamma(K\overline{K}\pi)$ — Γ_{35}/Γ_{27}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.020±0.004 OUR FIT					
0.024±0.007 OUR AVERAGE					
$0.023\pm0.007\pm0.006$		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 [$\Gamma(\eta_c(1S) \to \pi^+\pi^-\pi^0)/\Gamma_{total}$] × [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±0.4	118	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\pi^+\pi^-2\pi^0$

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

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.97±0.12 OUR FIT					
1.35±0.21 OUR AVERAGE					
$1.74\pm0.32\pm0.15$	100	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 2(\pi^+\pi^-)$
1.0 ± 0.5	542 ± 75	[2] BAI	04	BES	$J/\psi \to \gamma\, 2(\pi^+\pi^-)$
$1.05\pm0.17\pm0.34$	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 [$\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-))/\Gamma_{total}$] × [$\Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ × $\Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}$] = $(7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ × $\Gamma(\psi(2S) \to \pi^0 h_c(1P))/\Gamma_{total}$ = $(4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] The quoted branching ratios use B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 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
16.1±2.0 OUR AVERAGE					
15.3±1.8±1.8	333	ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
17.4±2.9±1.5	175	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 2(\pi^+\pi^-\pi^0)$

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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
18 ±4 OUR AVERAGE					
20 ±5 ±2	51	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 3(\pi^+\pi^-)$
15.4±3.4±3.3	479	[2] ABLIKIM	06A	BES2	$J/\psi \to 3(\pi^+\pi^-)\gamma$

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

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

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
14.5± 1.4 OUR FIT					
12.7± 2.0 OUR AVERAGE					
12.0± 2.6±1.5	34	ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
15 ± 5 ±1	15	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}$
15 ± 6	213 ± 33	[2] BAI	04	BES	$J/\psi \to \gamma p\overline{p}$
10 ± 3 ±4	18	[2] BISELLO	91	DM2	$J/\psi \to \gamma p\overline{p}$
11 ± 6	23	[2] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
$29\ ^{+29}_{-15}$		[3] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$13.4\ ^{+\ 1.8}_{-\ 2.1} \pm 1.1$	195	[4] WU	06	BELL	$B^+ \to p\overline{p}K^+$

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

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

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

[4] WU 06 reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{\rm total}] \times [B(B^+ \to \eta_c K^+)] = (1.42 \pm 0.11 ^{+0.16}_{-0.20}) \times 10^{-6}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (1.06 \pm 0.09) \times 10^{-3}$. 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
0.0199±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 $B(\eta_c \to K\overline{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

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

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
0.26±0.04 OUR FIT				
4.0 $^{+3.5}_{-3.2}$	BAGLIN	89	SPEC	$\overline{p}p \to K^+K^-K^+K^-$

$\Gamma(p\overline{p}\pi^0)/\Gamma_{\rm total}$ — Γ_{42}/Γ

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

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

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
10.7±2.4 OUR FIT						
11.8±2.3±2.5			[1] ABLIKIM	12B	BES3	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$8.9^{+2.5}_{-2.3}\pm0.7$		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 $[\Gamma(\eta_c(1S) \to \Lambda\overline{\Lambda})/\Gamma_{\rm total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (0.198 \pm 0.021 \pm 0.032) \times 10^{-4}$ 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 $[\Gamma(\eta_c(1S) \to \Lambda\overline{\Lambda})/\Gamma_{\rm total}] \times [B(B^+ \to \eta_c K^+)] = (0.95^{+0.25}_{-0.22}{}^{+0.08}_{-0.11}) \times 10^{-6}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (1.06 \pm 0.09) \times 10^{-3}$. 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
0.73±0.16 OUR FIT				
$0.67^{+0.19}_{-0.16}\pm0.12$	[1] WU	06	BELL	$B^+ \to p\overline{p}K^+$, $\Lambda\overline{\Lambda}K^+$

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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$2.56^{+0.35}_{-0.33}\pm0.21$	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 $[\Gamma(\eta_c(1S) \to K^+\overline{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \to \eta_c K^+)]$ assuming $B(B^+ \to \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \to \eta_c K^+) = (1.06 \pm 0.09) \times 10^{-3}$. 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_{45}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.1±1.4±0.3	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 $B(B^+ \to \eta_c K^+) = (1.06 \pm 0.09) \times 10^{-3}$. 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_{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 $[\Gamma(\eta_c(1S) \to \Sigma^+\overline{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$ 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_{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 $[\Gamma(\eta_c(1S) \to \Xi^-\overline{\Xi}^+)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$ 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.

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

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

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

RADIATIVE DECAYS

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.58±0.11 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. • • •						
2.1 $^{+0.9}_{-0.7}$ ±0.2		13	[3] WICHT	08	BELL	$B^{\pm} \to K^{\pm}\gamma\gamma$
$2.80^{+0.67}_{-0.58}$ ±1.0			[4] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
< 9	90		[5] BISELLO	91	DM2	$J/\psi \to \gamma\gamma\gamma$
6 $^{+4}_{-3}$ ±4			[4] BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
< 18	90		[6] BLOOM	83	CBAL	$J/\psi \to \eta_c\gamma$

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

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

[3] WICHT 08 reports $[\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (2.2^{+0.9}_{-0.7}{}^{+0.4}_{-0.2}) \times 10^{-7}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (1.06 \pm 0.09) \times 10^{-3}$. 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
2.17±0.23 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
0.230±0.022 OUR FIT					
0.26 ±0.05 OUR AVERAGE	Error includes scale factor of 1.4.				
$0.224^{+0.038}_{-0.037} \pm 0.020$	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 $[\Gamma(\eta_c(1S) \to \pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 1.82 \times 10^{-6}$ 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 $[\Gamma(\eta_c(1S) \to \pi^+\pi^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 1.1 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — 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 $[\Gamma(\eta_c(1S) \to \pi^0\pi^0)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 6.0 \times 10^{-7}$ 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_{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 $[\Gamma(\eta_c(1S) \to K^+K^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.96 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

$\Gamma(K^0_S K^0_S)/\Gamma_{total}$ — 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 $[\Gamma(\eta_c(1S) \to K^0_S K^0_S)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.53\times10^{-5}$ 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.

$\eta_c(1S)$ REFERENCES

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ABLIKIM	12B	PR D86 032008	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	12F	PRL 108 222002	M. Ablikim et al.	(BESIII Collab.)
ABLIKIM	12N	PR D86 092009	M. Ablikim et al.	(BESIII Collab.)
LIU	12B	PRL 108 232001	Z.Q. Liu et al.	(BELLE Collab.)
ZHANG	12A	PR D86 052002	C.C. Zhang et al.	(BELLE Collab.)
ABLIKIM	11G	PR D84 032006	M. Ablikim et al.	(BESIII Collab.)
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez et al.	(BABAR Collab.)
VINOKUROVA	11	PL B706 139	A. Vinokurova et al.	(BELLE Collab.)
LEES	10	PR D81 052010	J.P. Lees et al.	(BABAR Collab.)
MITCHELL	09	PRL 102 011801	R.E. Mitchell et al.	(CLEO Collab.)
ADAMS	08	PRL 101 101801	G.S. Adams et al.	(CLEO Collab.)
AUBERT	08AB	PR D78 012006	B. Aubert et al.	(BABAR Collab.)
UEHARA	08	EPJ C53 1	S. Uehara et al.	(BELLE Collab.)
WICHT	08	PL B662 323	J. Wicht et al.	(BELLE Collab.)
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+)