$\eta_c(1S)$

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

$\eta_c(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
2984.1 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.2.			
2985.01 ± 0.17 ± 0.89	35k	AAIJ	23AH	LHCB	$B^+ \to K^+ (K^0_S K \pi)$
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] $\eta_c \to \phi\phi$.

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

$\eta_c(1S)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
30.5± 0.5 OUR FIT Error includes scale factor of 1.2.				
30.5± 0.5 OUR AVERAGE Error includes scale factor of 1.1.				
29.7± 0.5±0.2	35k	AAIJ 23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$
33.8± 1.6±4.1	1705	ABLIKIM 19AV	BES3	$J/\psi \to \gamma\omega\omega$
$30.8^{+2.3}_{-2.2}\pm2.9$	2673	XU 18	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
34.0± 1.9±1.3	11k	AAIJ 17AD	LHCB	$pp \to B^+X \to p\overline{p}K^+X$
31.4± 3.5±2.0	6.4k	[1] AAIJ 17BB	LHCB	$pp \to b\overline{b}X \to 2(K^+K^-)X$
$27.2\pm3.1^{+5.4}_{-2.6}$		[2] ANASHIN 14	KEDR	$J/\psi \to \gamma\eta_c$
25.2± 2.6±2.4	4.5k	[3,4] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\pi^0$
34.8± 3.1±4.0	900	[3,4,5] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\eta$
32.0± 1.2±1.0		[6,7] ABLIKIM 12F	BES3	$\psi(2S) \to \gamma\eta_c$
36.4± 3.2±1.7	832	[3] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0\gamma$ hadrons
$37.8^{+5.8}_{-5.3}\pm3.1$	486	ZHANG 12A	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
36.2± 2.8±3.0	11k	DEL-AMO-SA...11M	BABR	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$
$35.1\pm3.1^{+1.0}_{-1.6}$	920	[7] VINOKUROVA 11	BELL	$B^\pm \to K^\pm(K^0_S K^\pm\pi^\mp)$
31.7± 1.2±0.8	14k	[8] LEES 10	BABR	10.6 $e^+e^- \to e^+e^-K^0_S K^\pm\pi^\mp$
$36.3^{+3.7}_{-3.6}\pm4.4$	0.9k	AUBERT 08AB	BABR	$B \to \eta_c(1S)K^{(*)} \to K\overline{K}\pi K^{(*)}$
28.1± 3.2±2.2	7.5k	UEHARA 08	BELL	$\gamma\gamma \to \eta_c \to$ hadrons
$48\ ^{+8}_{-7}\ \pm5$	195	WU 06	BELL	$B^+ \to p\overline{p}K^+$
40 ±19 ±5	20	WU 06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$
24.8± 3.4±3.5	592	ASNER 04	CLEO	$\gamma\gamma \to \eta'_c \to K^0_S K^\pm\pi^\mp$
$20.4^{+7.7}_{-6.7}\pm2.0$	190	AMBROGIANI 03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
$23.9^{+12.6}_{-7.1}$		ARMSTRONG 95F	E760	$\overline{p}p \to \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
32.1± 1.1±1.3	12k	[9] DEL-AMO-SA...11M	BABR	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$
34.3± 2.3±0.9	2.5k	[10] AUBERT 04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
17.0± 3.7±7.4		[11] BAI 03	BES	$J/\psi \to \gamma\eta_c$
29 ± 8 ±6	180	[12] FANG 03	BELL	$B \to \eta_c K$
11.0± 8.1±4.1		[13] BAI 00F	BES	$J/\psi \to \gamma\eta_c$ and $\psi(2S) \to \gamma\eta_c$
27.0± 5.8±1.4		[14] BRANDENB... 00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S\pi^\mp$
$7.0^{+7.5}_{-7.0}$	12	BAGLIN 87B	SPEC	$\overline{p}p \to \gamma\gamma$
$10.1^{+33.0}_{-8.2}$	23	[15] BALTRUSAIT...86	MRK3	$J/\psi \to \gamma p\overline{p}$
11.5± 4.5		GAISER 86	CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$
< 40 90% CL	18	HIMEL 80B	MRK2	e^+e^-
< 20 90% CL		PARTRIDGE 80B	CBAL	e^+e^-

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

$\eta_c(1S)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Decays involving hadronic resonances		
Γ_1	$\eta'(958)\pi\pi$	(2.0 ± 0.4) %	S=1.4
Γ_2	$\eta'(958)K\overline{K}$	(1.73 ± 0.35) %	
Γ_3	$\eta'(958)\eta\eta$	$(3.4 \pm 0.6) \times 10^{-3}$	
Γ_4	$\rho\rho$	(1.8 ± 0.4) %	
Γ_5	$K^*(892)^0 K^-\pi^+ +$ c.c.	(1.8 ± 0.5) %	
Γ_6	$K^*(892)\overline{K}^*(892)$	$(7.0 \pm 1.2) \times 10^{-3}$	
Γ_7	$K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-$	(1.4 ± 0.6) %	
Γ_8	ϕK^+K^-	$(3.3\ ^{+1.2}_{-1.1}) \times 10^{-3}$	
Γ_9	$\phi\phi$	$(1.8 \pm 0.4) \times 10^{-3}$	S=2.3
Γ_{10}	$\phi 2(\pi^+\pi^-)$	$< 4 \times 10^{-3}$	CL=90%
Γ_{11}	$a_0(980)\pi$	seen	
Γ_{12}	$a_2(1320)\pi$	seen	
Γ_{13}	$K^*(892)\overline{K} +$ c.c.	< 1.28 %	CL=90%
Γ_{14}	$f_2(1270)\eta$	seen	
Γ_{15}	$f_2(1270)\eta'$	seen	
Γ_{16}	$\omega\omega$	$(2.7 \pm 0.9) \times 10^{-3}$	S=2.1
Γ_{17}	$\omega\phi$	$< 2.5 \times 10^{-4}$	CL=90%
Γ_{18}	$f_2(1270)f_2(1270)$	(1.08 ± 0.27) %	
Γ_{19}	$f_2(1270)f'_2(1525)$	$(9.7 \pm 3.2) \times 10^{-3}$	
Γ_{20}	$f_0(500)\eta$	seen	
Γ_{21}	$f_0(500)\eta'$	seen	
Γ_{22}	$f_0(980)\eta$	seen	
Γ_{23}	$f_0(980)\eta'$	seen	
Γ_{24}	$f_0(1500)\eta$	seen	

Γ_{25}	$f_0(1710)\eta'$		seen	
Γ_{26}	$f_0(2100)\eta'$		seen	
Γ_{27}	$f_0(2200)\eta$		seen	
Γ_{28}	$a_0(1320)\pi$		seen	
Γ_{29}	$a_0(1450)\pi$		seen	
Γ_{30}	$a_2(1700)\pi$		seen	
Γ_{31}	$a_0(1710)\pi$		seen	
Γ_{32}	$a_0(1950)\pi$		seen	
Γ_{33}	$K_0^*(1430)\overline{K}+$ c.c.		seen	
Γ_{34}	$K_2^*(1430)\overline{K}+$ c.c.		seen	
Γ_{35}	$K_0^*(1950)\overline{K}+$ c.c.		seen	
Γ_{36}	$K_0^*(2600)\overline{K}+$ c.c.		seen	

Decays into stable hadrons

Γ_{37}	$K\overline{K}\pi$		(7.1 ± 0.4) %	S=1.1
Γ_{38}	$K\overline{K}\eta$		(1.32 ± 0.15) %	
Γ_{39}	$\eta\pi^+\pi^-$		(1.6 ± 0.4) %	
Γ_{40}	$\eta 2(\pi^+\pi^-)$		(4.3 ± 1.3) %	
Γ_{41}	$K^+K^-\pi^+\pi^-$		$(8.3 \pm 1.8) \times 10^{-3}$	S=1.9
Γ_{42}	$K^+K^-\pi^+\pi^-\pi^0$		(3.4 ± 0.6) %	
Γ_{43}	$K^0K^-\pi^+\pi^-\pi^+ +$ c.c.		(5.4 ± 1.5) %	
Γ_{44}	$K^+K^-2(\pi^+\pi^-)$		$(8.4 \pm 2.4) \times 10^{-3}$	
Γ_{45}	$2(K^+K^-)$		$(1.4 \pm 0.4) \times 10^{-3}$	S=1.4
Γ_{46}	$\pi^+\pi^-\pi^0$		$< 4 \times 10^{-4}$	CL=90%
Γ_{47}	$\pi^+\pi^-\pi^0\pi^0$		(4.6 ± 1.0) %	
Γ_{48}	$2(\pi^+\pi^-)$		$(9.6 \pm 1.5) \times 10^{-3}$	S=1.4
Γ_{49}	$2(\pi^+\pi^-\pi^0)$		(15.9 ± 2.0) %	
Γ_{50}	$3(\pi^+\pi^-)$		(1.89 ± 0.34) %	
Γ_{51}	$p\overline{p}$		$(1.33\pm 0.11) \times 10^{-3}$	S=1.1
Γ_{52}	$p\overline{p}\pi^0$		$(3.4 \pm 1.3) \times 10^{-3}$	
Γ_{53}	$p\overline{p}\pi^+\pi^-$		$(3.7 \pm 0.5) \times 10^{-3}$	
Γ_{54}	$\Lambda\overline{\Lambda}$		$(1.10\pm 0.28) \times 10^{-3}$	S=1.5
Γ_{55}	$K^+\overline{p}\Lambda+$ c.c.		$(2.5 \pm 0.4) \times 10^{-3}$	
Γ_{56}	$\overline{\Lambda}(1520)\Lambda+$ c.c.		$(3.0 \pm 1.3) \times 10^{-3}$	
Γ_{57}	$\Sigma^+\overline{\Sigma}^-$		$(2.6 \pm 0.5) \times 10^{-3}$	
Γ_{58}	$\Xi^-\overline{\Xi}^+$		$(1.07\pm 0.24) \times 10^{-3}$	

Radiative decays

Γ_{59}	$\gamma\gamma$		$(1.66\pm 0.13) \times 10^{-4}$	S=1.2

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

Γ_{60}	$\pi^+\pi^-$	P,CP	$< 1.3 \times 10^{-4}$	CL=90%
Γ_{61}	$\pi^0\pi^0$	P,CP	$< 4 \times 10^{-5}$	CL=90%
Γ_{62}	K^+K^-	P,CP	$< 7 \times 10^{-4}$	CL=90%

Γ_{63}	$K^0_S K^0_S$	P,CP	$<$ 4	$\times 10^{-4}$	CL=90%

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and $B^{\pm}$ with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 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, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$.

	x_1	x_6	x_9	x_{16}	x_{18}	x_{37}	x_{38}	x_{41}	x_{45}	x_{48}
x_6	14									
x_9	11	13								
x_{16}	7	8	8							
x_{18}	9	11	11	7						
x_{37}	25	25	22	12	17					
x_{38}	13	13	11	6	9	51				
x_{41}	7	7	6	4	5	15	8			
x_{45}	5	5	5	2	3	12	6	4		
x_{48}	13	17	17	10	15	26	13	8	5	
x_{51}	19	20	20	11	16	39	20	11	11	24
x_{53}	7	7	8	4	5	22	11	5	10	8
x_{54}	5	7	7	4	6	12	6	3	4	10
x_{59}	−38	−35	−27	−16	−22	−63	−32	−17	−12	−31
Γ	−1	−1	−1	0	−1	−2	−1	0	0	−1

	x_{51}	x_{53}	x_{54}	x_{59}
x_{53}	21			
x_{54}	13	9		
x_{59}	−47	−17	−11	
Γ	1	0	0	−20

$\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ Γ_{59}

VALUE (keV)	*EVTS*	*DOCUMENT ID*	*TECN*	*COMMENT*
5.1± 0.4 OUR FIT Error includes scale factor of 1.2.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.8± 1.1	486	[1] ZHANG 12A	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$

5.2± 1.2	273 ± 43	[2,3] AUBERT	06E	BABR	$B^{\pm} \to K^{\pm} X_{c\overline{c}}$
5.5± 1.2± 1.8	157 ± 33	[4] KUO	05	BELL	$\gamma\gamma \to p\overline{p}$
7.4± 0.4± 2.3		[5] ASNER	04	CLEO	$\gamma\gamma \to \eta_c' \to K_S^0 K^{\pm}\pi^{\mp}$
13.9± 2.0± 3.0	41	[6] ABDALLAH	03J	DLPH	$\gamma\gamma \to \eta_c$
$3.8^{+1.1}_{-1.0}{}^{+1.9}_{-1.0}$	190	[7] AMBROGIANI	03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
7.6± 0.8± 2.3		[5,8] BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^{\pm}K_S^0\pi^{\mp}$
6.9± 1.7± 2.1	76	[9] ACCIARRI	99T	L3	$e^+e^- \to e^+e^-\eta_c$
27 ±16 ±10	5	[5] SHIRAI	98	AMY	58 e^+e^-
$6.7^{+2.4}_{-1.7}$± 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± 2.3± 2.4	17	[11] ADRIANI	93N	L3	$e^+e^- \to e^+e^-\eta_c$
$5.9^{+2.1}_{-1.8}$± 1.9		[7] CHEN	90B	CLEO	$e^+e^- \to e^+e^-\eta_c$
$6.4^{+5.0}_{-3.4}$		[12] AIHARA	88D	TPC	$e^+e^- \to e^+e^-X$
$4.3^{+3.4}_{-3.7}$± 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 $B(\eta_c \to K^{\pm}K_S^0\pi^{\mp})$.
[6] Average of $K_S^0 K^{\pm}\pi^{\mp}$, $\pi^+\pi^-K^+K^-$, and $2(K^+K^-)$ decay modes.
[7] Normalized to the sum of $B(\eta_c \to K^{\pm}K_S^0\pi^{\mp})$, $B(\eta_c \to K^+K^-\pi^+\pi^-)$, 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 $B(\eta_c \to K^{\pm}K_S^0\pi^{\mp})$, $B(\eta_c \to \phi\phi)$, $B(\eta_c \to K^+K^-\pi^+\pi^-)$, and $B(\eta_c \to 2\pi^+2\pi^-)$.
[11] Superseded by ACCIARRI 99T.
[12] Normalized to the sum of $B(\eta_c \to K^{\pm}K_S^0\pi^{\mp})$, $B(\eta_c \to 2K^+2K^-)$, $B(\eta_c \to K^+K^-\pi^+\pi^-)$, 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)

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_1\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
102 ±18 OUR FIT Error includes scale factor of 1.5.					
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. • • •					
$75.8^{+6.3}_{-6.2}$± 8.4	486	[1] ZHANG	12A	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$

[1] Superseded by XU 18.

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_4\Gamma_{59}/\Gamma$

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

$\Gamma(K^*(892)\overline{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_6\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
35 ±6 OUR FIT					
32.4±4.2±5.8	882 ± 115	UEHARA	08	BELL	$\gamma\gamma \to \pi^+\pi^- K^+ K^-$

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_9\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
9.2 ±2.2 OUR FIT Error includes scale factor of 2.7.					
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)%.

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{16}\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
13 ±5 OUR FIT Error includes scale factor of 2.2.					
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)%.

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{17}\Gamma_{59}/\Gamma$

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)%.

$\Gamma(f_2(1270) f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{18}\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
55±14 OUR FIT					
69±17±12	3182±766	UEHARA	08	BELL	$\gamma\gamma \to 2(\pi^+\pi^-)$

$\Gamma(f_2(1270) f'_2(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{19}\Gamma_{59}/\Gamma$

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

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{37}\Gamma_{59}/\Gamma$

VALUE (keV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.360±0.022 OUR FIT Error includes scale factor of 1.5.						
0.396±0.016 OUR AVERAGE						
0.386±0.008±0.021		12k	DEL-AMO-SA...	11M	BABR	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
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 $\pm$0.87 $\pm$0.27		[3] SHIRAI	98	AMY	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
0.84 $\pm$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 $\pm$0.41 $\pm$0.27	11	[3] BRAUNSCH...	89	TASS	$\gamma\gamma \to K \overline{K} \pi$
1.5 $^{+0.60}_{-0.45}$ $\pm$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. • • •

0.418$\pm$0.044$\pm$0.022		[3,5] 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 $\pm$ 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 $\pm$ 0.4)%.
[5] Superseded by ASNER 04.

$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{41}\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
42 $\pm$ 9 OUR FIT Error includes scale factor of 2.1.					
27 $\pm$ 6 OUR AVERAGE					
25.7$\pm$ 3.2$\pm$ 4.9	2019$\pm$248	UEHARA	08	BELL	$\gamma\gamma \to \pi^+\pi^- K^+ K^-$
280 $\pm$100 $\pm$60	42	[1] ABDALLAH	03J	DLPH	$\gamma\gamma \to \pi^+\pi^- K^+ K^-$
170 $\pm$ 80 $\pm$20	13.9 $\pm$ 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 $\pm$ 0.7)%.

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{42}\Gamma_{59}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
0.190$\pm$0.006$\pm$0.028	11k	DEL-AMO-SA..11M		BABR	$\gamma\gamma \to K^+ K^- \pi^+ \pi^- \pi^0$

$\Gamma(2(K^+ K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{45}\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
7.2$\pm$ 2.1 OUR FIT Error includes scale factor of 1.5.					
5.8$\pm$ 1.9 OUR AVERAGE					
5.6$\pm$ 1.1$\pm$ 1.6	216 $\pm$ 42	UEHARA	08	BELL	$\gamma\gamma \to 2(K^+ K^-)$
350 $\pm$90 $\pm$60	46	[1] ABDALLAH	03J	DLPH	$\gamma\gamma \to 2(K^+ K^-)$
231 $\pm$90 $\pm$23	9.1 $\pm$ 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 $\eta_c \to \phi\phi$.

$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{48}\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
48 $\pm$ 7 OUR FIT Error includes scale factor of 1.5.				
42 $\pm$ 6 OUR AVERAGE				

40.7 $\pm$ 3.7 $\pm$ 5.3	5381 $\pm$ 492	UEHARA	08	BELL	$\gamma\gamma \to 2(\pi^+\pi^-)$
180 $\pm$70 $\pm$20	21.4 $\pm$ 8.6	ALBRECHT	94H	ARG	$\gamma\gamma \to 2(\pi^+\pi^-)$

$\Gamma(p\overline{p}) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{51}\Gamma_{59}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
6.7 $\pm$0.6 OUR FIT Error includes scale factor of 1.1.					
6.2 $^{+1.1}_{-1.0}$ OUR AVERAGE Error includes scale factor of 1.1.					
7.20$\pm$1.53$^{+0.67}_{-0.75}$	157 $\pm$ 33	[1] KUO	05	BELL	$\gamma\gamma \to p\overline{p}$
4.6 $^{+1.3}_{-1.1}$ $\pm$0.4	190	AMBROGIANI	03	E835	$\overline{p}p \to \gamma\gamma$
8.1 $^{+2.9}_{-2.0}$		ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$

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

$\eta_c(1S)$ BRANCHING RATIOS

HADRONIC DECAYS

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.859$\pm$0.052$\pm$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.

$\Gamma(\eta'(958)\eta\eta)/\Gamma_{total}$ — Γ_3/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
3.4$\pm$0.5$\pm$0.3	[1] ABLIKIM	21C	BES3	$J/\psi(1S) \to \gamma\eta\eta\eta'$

[1] ABLIKIM 21C reports $[\Gamma(\eta_c(1S) \to \eta'(958)\eta\eta)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (4.86 \pm 0.62 \pm 0.45) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\rho\rho)/\Gamma_{total}$ — Γ_4/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.1$\pm$0.5$\pm$0.1		72	[1] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^+\pi^-\gamma$
2.3$\pm$0.5$\pm$0.2		113	[2,3] BISELLO	91	DM2	$J/\psi \to \gamma\rho^0\rho^0$
2.1$\pm$1.0$\pm$0.2		32	[4,5] BISELLO	91	DM2	$J/\psi \to \gamma\rho^+\rho^-$
<14	90		[6] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

[1] ABLIKIM 05L reports $[\Gamma(\eta_c(1S) \to \rho\rho)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.6 \pm 0.6 \pm 0.4) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[2] BISELLO 91 reports $[\Gamma(\eta_c(1S) \to \rho\rho)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (3.30 \pm 0.30 \pm 0.60) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) =$

$(1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[3] The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

[4] BISELLO 91 reports $[\Gamma(\eta_c(1S) \to \rho\rho)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (3.0 \pm 1.3 \pm 0.6) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[5] The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

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

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.8 \pm 0.4 \pm 0.2$	63	[1] BALTRUSAIT...86	MRK3	$J/\psi \to \eta_c \gamma$

[1] BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \to K^*(892)^0 K^- \pi^+ + c.c.)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (2.6 \pm 0.6) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^*(892)^0 \overline{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$135 \pm 57 \pm 13$	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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. 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_8/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.9^{+0.9}_{-0.8} \pm 1.1$	$14.1^{+4.4}_{-3.7}$	[1] HUANG 03	BELL	$B^+ \to (\phi K^+ K^-) K^+$

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

$\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{total}$ — Γ_{10}/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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.

$\Gamma(a_0(980)\pi)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
seen		AAIJ 23AH	LHCB	$B^+ \to K^+ (K^0_S K \pi)$

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 ratio uses 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_{12}/Γ

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

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

<0.02	90	[1] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

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

$\Gamma(K^*(892)\overline{K}+c.c.)/\Gamma_{total}$ — Γ_{13}/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_{14}/Γ

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

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

<0.011	90	[1] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

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

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

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

$\Gamma(\omega\phi)/\Gamma_{total}$ — Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 2.5 \times 10^{-4}$	90	[1] ABLIKIM	17P	BES3	$J/\psi \to \pi^+\pi^-\pi^0K^+K^-\gamma$

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

$<17 \times 10^{-4}$	90	[2] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^0K^+K^-\gamma$

[1] Using B($J/\psi \to \gamma\eta_c$)= 0.017 ± 0.004.
[2] The quoted branching ratio uses B($J/\psi(1S) \to \gamma\eta_c(1S)$) = 0.0127 ± 0.0036.

$\Gamma(f_0(500)\eta)/\Gamma_{total}$ — Γ_{20}/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_{21}/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_{22}/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_{23}/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_{24}/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_{25}/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_{26}/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_{27}/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_{28}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\pi^0$

$\Gamma(a_0(1450)\pi)/\Gamma_{total}$ — Γ_{29}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+\pi^-\eta$
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\pi^0$

$\Gamma(a_2(1700)\pi)/\Gamma_{total}$ — Γ_{30}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

$\Gamma(a_0(1710)\pi)/\Gamma_{total}$ — Γ_{31}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to \pi^+ \pi^- \eta'$

$\Gamma(a_0(1950)\pi)/\Gamma_{total}$ — Γ_{32}/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.

$\Gamma(K_0^*(1430)\overline{K}+c.c.)/\Gamma_{total}$ — Γ_{33}/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.

$\Gamma(K_2^*(1430)\overline{K}+c.c.)/\Gamma_{total}$ — Γ_{34}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AAIJ	23AH	LHCB	$B^+ \to K^+ (K_S^0 K \pi)$
seen	LEES	21A	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \eta'$
seen	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+ K^- \pi^0$

$\Gamma(K_0^*(1950)\overline{K}+c.c.)/\Gamma_{total}$ — Γ_{35}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen		AAIJ	23AH	LHCB	$B^+ \to K^+ (K_S^0 K \pi)$
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.

$\Gamma(K_0^*(2600)\overline{K}+c.c.)/\Gamma_{total}$ — Γ_{36}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
seen	AAIJ	23AH	LHCB	$B^+ \to K^+ (K_S^0 K \pi)$

$\Gamma(K\overline{K}\pi)/\Gamma_{total}$ — Γ_{37}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
7.1±0.4 OUR FIT Error includes scale factor of 1.1.					
7.4±0.6 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	$h_c \to \gamma \eta_c$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.1±1.2±0.6	55	[3,4] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma K^+ K^- \pi^0$
7.6±1.3±0.8	107	[5,6] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0 \gamma K_S^0 K^\mp \pi^\pm$
8.5±1.8		[7] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
4.7±1.2±0.5	0.6k	[8,9] BAI	04	BES	$J/\psi \to \gamma K^\pm \pi^\mp K_S^0$
6.2±1.7±0.6	33	[10,11] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- \pi^0$

$4.9\pm1.2\pm0.5$	68	[12,13] BISELLO	91	DM2	$J/\psi \to \gamma K^{\pm}\pi^{\mp}K^0_S$
4.8 ± 1.7	95	[14,15] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$
$5.5\pm2.1\pm0.5$	32	[16,17] BALTRUSAIT..86		MRK3	$J/\psi \to \gamma K^+K^-\pi^0$
$4.0\pm1.1\pm0.4$	63	[18,19] BALTRUSAIT..86		MRK3	$J/\psi \to \gamma K^{\pm}\pi^{\mp}K^0_S$
$13\ ^{+7}_{-5}\ \pm2$		[20] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$
<10.7 90% CL		[15] 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 $B(\psi(2S) \to \pi^0 h_c) \cdot B(h_c \to \gamma\eta_c) \cdot B(\eta_c \to K^+K^-\pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.

[4] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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 $B(\psi(2S) \to \pi^0 h_c) \cdot B(h_c \to \gamma\eta_c) \cdot B(\eta_c \to K^0_S K^{\pm}\pi^{\mp}) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.

[6] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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] BAI 04 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^{\pm}K^0_S\pi^{\mp}) = (2.2 \pm 0.3 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

[9] BAI 04 reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (6.6 \pm 0.9 \pm 1.5) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[10] BISELLO 91 reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (8.76 \pm 1.80 \pm 1.68) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[11] BISELLO 91 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^+K^-\pi^0) = (1.46 \pm 0.30 \pm 0.28) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.

[12] BISELLO 91 reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (6.9 \pm 1.2 \pm 1.2) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[13] BISELLO 91 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^{\pm}K^0_S\pi^{\mp}) = (2.3 \pm 0.4 \pm 0.4) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

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

[15] 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.

[16] BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (7.8 \pm 3.0) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[17] BALTRUSAITIS 86 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^+K^-\pi^0) = (1.3 \pm 0.5) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.

[18] BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (5.7 \pm 1.5) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[19] BALTRUSAITIS 86 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^\pm K^0_S\pi^\mp) = (1.9 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

[20] HIMEL 80B reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total}] \times [B(\psi(2S) \to \gamma\eta_c(1S))] = (4.5^{+2.4}_{-1.8}) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \to \gamma\eta_c(1S)) = (3.6 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\phi K^+K^-)/\Gamma(K\overline{K}\pi)$ — Γ_8/Γ_{37}

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_{38}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$0.9 \pm 0.5 \pm 0.1$		7	[1,2] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\eta K^+K^-$
<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 $[\Gamma(\eta_c(1S) \to K\overline{K}\eta)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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_{38}/Γ_{37}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.186 ± 0.018 OUR FIT					
$0.190 \pm 0.008 \pm 0.017$	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_{39}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$1.6 \pm 0.4 \pm 0.2$	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 $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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_{40}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.3±1.2±0.4	39	[1] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0 \gamma \eta 2(\pi^+\pi^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \eta 2(\pi^+\pi^-))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma \eta_c(1S))] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\overline{K}\pi)$ — Γ_{42}/Γ_{37}

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_{43}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.4±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 $[\Gamma(\eta_c(1S) \to K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.})/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma \eta_c(1S))] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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_{44}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.4±2.4 OUR AVERAGE				
8 ±4 ±1	10	[1] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0 \gamma K^+K^- 2(\pi^+\pi^-)$
8.6±2.8±0.8	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 $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to$

$\gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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 $[\Gamma(\eta_c(1S) \to K^+K^-2(\pi^+\pi^-))/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.21\pm0.32\pm0.24)\times10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{46}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<4 \times 10^{-4}$	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 $B(\psi(2S) \to \gamma\eta_c(1S)) = 3.6 \times 10^{-3}$.

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
4.6±0.9±0.5	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 $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{total}$ Γ_{49}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
15.9±2.0 OUR AVERAGE					
15.3±1.8±1.8	333	ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
16.8±2.8±1.7	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 $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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_{50}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
18.9±3.4 OUR AVERAGE					
20 ±5 ±2	51	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma3(\pi^+\pi^-)$
18 ±4 ±2	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 $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. 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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. 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_{51}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
13.3± 1.1 OUR FIT	Error includes scale factor of 1.1.				
12.0± 2.6±1.5	34	ABLIKIM	19AP	BES3	$h_c \to \gamma\eta_c$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
15 ± 5 ±1	15	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}$
$12.9^{+1.8}_{-2.1}\pm0.8$	195	[2] WU	06	BELL	$B^+ \to p\overline{p}K^+$
13.5± 3.0±1.3	213	[3] BAI	04	BES	$J/\psi \to \gamma p\overline{p}$
9.2± 3.5±0.9	18	[4] BISELLO	91	DM2	$J/\psi \to \gamma p\overline{p}$
10 ± 5 ±1	23	[5] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
$22\ ^{+22}_{-11}\ \pm3$		[6] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

[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 $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

[2] WU 06 reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (1.42\pm0.11^{+0.16}_{-0.20})\times 10^{-6}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[3] BAI 04 reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.9 \pm 0.3 \pm 0.3) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[4] BISELLO 91 reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (0.13 \pm 0.04 \pm 0.03) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[5] BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.4 \pm 0.7) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[6] HIMEL 80B reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(\psi(2S) \to \gamma\eta_c(1S))] = (8^{+8}_{-4}) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to \gamma\eta_c(1S)) = (3.6 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\phi\phi)/\Gamma_{total}$ $\Gamma_{51}/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
0.24±0.07 OUR FIT	Error includes scale factor of 1.9.			
$4.0\ ^{+3.5}_{-3.2}$	BAGLIN	89	SPEC	$\overline{p}p \to K^+K^-K^+K^-$

$\Gamma(p\overline{p}\pi^0)/\Gamma_{total}$ Γ_{52}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.34±0.12±0.03	14	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}\pi^0$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p}\pi^0)/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] \times [B(h_c(1P) \to \gamma\eta_c(1S))] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \to \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(K^+\overline{p}\Lambda + c.c.)/\Gamma_{total}$ Γ_{55}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{2.46^{+0.33}_{-0.32} \pm 0.16}$	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 $B(B^+ \to \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{\Lambda}(1520)\Lambda + c.c.)/\Gamma_{total}$ Γ_{56}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.0±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 $[\Gamma(\eta_c(1S) \to \overline{\Lambda}(1520)\Lambda + c.c.)/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)]$ assuming $B(B^+ \to \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \to \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Sigma^+\overline{\Sigma}^-)/\Gamma_{total}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.6±0.4±0.2	112	[1] ABLIKIM	13C	BES3	$J/\psi \to \gamma p\overline{p}\pi^0\pi^0$

[1] ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \to \Sigma^+\overline{\Sigma}^-)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Xi^-\overline{\Xi}^+)/\Gamma_{total}$ Γ_{58}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.07±0.22±0.10	78	[1] ABLIKIM	13C	BES3	$J/\psi \to \gamma\Lambda\overline{\Lambda}\pi^+\pi^-$

[1] ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \to \Xi^-\overline{\Xi}^+)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. 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_{59}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.66±0.13 OUR FIT Error includes scale factor of 1.2.					

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

3.2 ±1.0 ±0.3		[1] ABLIKIM	13I	BES3	
0.9 $^{+1.9}_{-0.8}$ ±0.1	$1.2^{+2.8}_{-1.1}$	[2] ADAMS	08	CLEO	$\psi(2S) \to \pi^+\pi^- J/\psi$
2.0 $^{+0.9}_{-0.7}$ ±0.1	13	[3] WICHT	08	BELL	$B^\pm \to K^\pm\gamma\gamma$
$1.87\pm0.32^{+0.95}_{-0.50}$		[4] AMBROGIANI	03	E835	$\overline{p}p \to \gamma\gamma$
$2.80^{+0.67}_{-0.58}\pm1.0$		[4] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
<9	90	[5] BISELLO	91	DM2	$J/\psi \to \gamma\gamma\gamma$
6 $^{+4}_{-3}$ ±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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. 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 $[\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] = (1.2^{+2.7}_{-1.1} \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. 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 $B(B^+ \to \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. 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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{51}/\Gamma \times \Gamma_{59}/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
0.221±0.019 OUR FIT Error includes scale factor of 1.2.					
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_{60}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<13	90	[1] ABLIKIM	11G	BES3	$J/\psi \to \gamma\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<80	90	[2] ABLIKIM	06B	BES2	$J/\psi \to \pi^+\pi^-\gamma$

[1] ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \to \pi^+\pi^-)/\Gamma_{\rm total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 1.82\times10^{-6}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.41\times10^{-2}$.

[2] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to \pi^+\pi^-)/\Gamma_{\rm total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 1.1\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.41\times10^{-2}$.

$\Gamma(\pi^0\pi^0)/\Gamma_{\rm total}$ — Γ_{61}/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. • • •					
<50	90	[2] ABLIKIM	06B	BES2	$J/\psi \to \pi^0\pi^0\gamma$

[1] ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \to \pi^0\pi^0)/\Gamma_{\rm total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 6.0\times10^{-7}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.41\times10^{-2}$.

[2] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to \pi^0\pi^0)/\Gamma_{\rm total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.71\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.41\times10^{-2}$.

$\Gamma(K^+K^-)/\Gamma_{\rm total}$ — Γ_{62}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<70	90	[1] ABLIKIM	06B	BES2	$J/\psi \to K^+K^-\gamma$

[1] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to K^+K^-)/\Gamma_{\rm total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.96\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.41\times10^{-2}$.

$\Gamma(K^0_S K^0_S)/\Gamma_{\rm total}$ — Γ_{63}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<40	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	[2,3] UEHARA	13	BELL	$\gamma\gamma \to K^0_S K^0_S$
< 5.6	90	[4,5] UEHARA	13	BELL	$\gamma\gamma \to K^0_S K^0_S$

[1] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to K^0_S K^0_S)/\Gamma_{\rm total}] \times [B(J/\psi(1S) \to \gamma\eta_c(1S))] < 0.53\times10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.41\times10^{-2}$.

[2] Using $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$ keV. UEHARA 13 reports $\Gamma(\gamma\gamma)\times B(K^0_S K^0_S) < 1.6$ eV.

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

[4] Using $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$ keV. UEHARA 13 reports $\Gamma(\gamma\gamma)\times B(K^0_S K^0_S) < 0.29$ eV.

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

$\eta_c(1S)$ CROSS-PARTICLE BRANCHING RATIOS

$\Gamma(\eta_c(1S) \to \eta'(958)\pi\pi)/\Gamma_{\rm total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{\rm total}$ — $\Gamma_1/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.8 ±0.5 OUR FIT	Error includes scale factor of 1.4.				
5.25±1.65	14	[1] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

[1] The value reported by BALTRUSAITIS 86 has been multiplied by 3/2 to account for isospin symmetry.

$\Gamma(\eta_c(1S) \to \rho\rho)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_4/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.6 ±0.6 OUR AVERAGE	Error includes scale factor of 1.2.				
1.6 ±0.6 ±0.4	72	ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^+\pi^-\gamma$
3.30±0.30±0.60	113	[1] BISELLO	91	DM2	$J/\psi \to \gamma\rho^0\rho^0$
3.0 ±1.3 ±0.6	32	[2] BISELLO	91	DM2	$J/\psi \to \gamma\rho^+\rho^-$

[1] The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

[2] The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

$\Gamma(\eta_c(1S) \to K^*(892)^0 K^-\pi^+ + c.c.)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_5/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.6±0.6	63	BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

$\Gamma(\eta_c(1S) \to K^*(892)\overline{K}^*(892))/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_6/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
0.99±0.17 OUR FIT					
1.17±0.29 OUR AVERAGE					
1.4 ±0.3 ±0.5	60	ABLIKIM	05L	BES2	$J/\psi \to K^+K^-\pi^+\pi^-\gamma$
1.04±0.36±0.18	14	[1] BISELLO	91	DM2	$e^+e^- \to \gamma K^+K^-\pi^+\pi^-$
1.2 ±0.6	9	[1] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

[1] The reported value has been multiplied by 2 to account for isospin symmetry.

$\Gamma(\eta_c(1S) \to K^*(892)^0\overline{K}^*(892)^0\pi^+\pi^-)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_7/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.91±0.64±0.48	45	ABLIKIM	06A	BES2	$J/\psi \to K^{*0}\overline{K}^{*0}\pi^+\pi^-\gamma$

$\Gamma(\eta_c(1S) \to \phi K^+K^-)/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ $\Gamma_8/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma^{B^\pm}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
$3.6^{+1.1}_{-0.9}$±0.8	$14.1^{+4.4}_{-3.7}$	HUANG	03	BELL	$B^+ \to (\phi K^+K^-)K^+$

$\Gamma(\eta_c(1S) \to \phi\phi)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_9/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
2.6±0.6 OUR FIT	Error includes scale factor of 2.2.				
4.1±0.6 OUR AVERAGE	Error includes scale factor of 1.2.				
$4.3\pm0.5^{+0.5}_{-1.2}$	1.2k	ABLIKIM	17P	BES3	$J/\psi \to \gamma K^+K^-K^+K^-$
3.3±0.6±0.6	72	ABLIKIM	05L	BES2	$J/\psi \to \gamma K^+K^-K^+K^-$
3.9±0.9±0.7	19	BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^+K^-$

$3.8^{+2.3}_{-1.5}\pm0.7$	5	BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- K^0_S K^0_L$
$9.3\pm2.0\pm1.6$	80	BAI	90B	MRK3	$J/\psi \to \gamma K^+ K^- K^+ K^-$
$8.5\pm2.7\pm1.8$		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. • • •

$3.3\pm0.6\pm0.6$	357	[1] BAI	04	BES	$J/\psi \to \gamma K^+ K^- K^+ K^-$

[1] Superseded by ABLIKIM 05L.

$\Gamma(\eta_c(1S) \to \phi\phi)/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ $\Gamma_9/\Gamma \times \Gamma^{B^\pm}_{270}/\Gamma^{B^\pm}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0±0.5 OUR FIT Error includes scale factor of 2.2.				
$\mathbf{3.3^{+1.2}_{-1.0}}$ **OUR AVERAGE** Error includes scale factor of 1.5.				
$4.7\pm1.2\pm0.5$		AUBERT,B 04B	BABR	$B^\pm \to K^\pm \eta_c$
$2.2^{+1.0}_{-0.7}\pm0.5$	7	HUANG 03	BELL	$B^\pm \to K^\pm \phi\phi$

$\Gamma(\eta_c(1S) \to \omega\omega)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{16}/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.7 ±1.2 OUR FIT Error includes scale factor of 2.1.				
4.90±0.17±0.77	1705	ABLIKIM 19AV	BES3	$J/\psi \to \gamma\omega\omega$

$\Gamma(\eta_c(1S) \to f_2(1270) f_2(1270))/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{18}/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.5±0.4 OUR FIT				
$\mathbf{1.3\pm0.3^{+0.3}_{-0.4}}$	91.2 ± 19.8	ABLIKIM 04M	BES	$J/\psi \to \gamma 2\pi^+ 2\pi^-$

$\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{37}/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.1 ±0.9 OUR FIT Error includes scale factor of 1.5.				
6.7 ±0.8 OUR AVERAGE				
$6.6\pm0.9\pm1.5$	0.6k	[1] BAI 04	BES	$J/\psi \to \gamma K^\pm \pi^\mp K^0_S$
$8.76\pm1.80\pm1.68$	33	[2] BISELLO 91	DM2	$J/\psi \to \gamma K^+ K^- \pi^0$
$6.9\pm1.2\pm1.2$	68	[3] BISELLO 91	DM2	$J/\psi \to \gamma K^\pm \pi^\mp K^0_S$
7.8 ± 3.0	32	[4] BALTRUSAIT...86	MRK3	$J/\psi \to \gamma K^+ K^- \pi^0$
5.7 ± 1.5	63	[5] BALTRUSAIT...86	MRK3	$J/\psi \to \gamma K^\pm \pi^\mp K^0_S$

[1] BAI 04 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^\pm K^0_S \pi^\mp) = (2.2 \pm 0.3 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.
[2] BISELLO 91 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^+ K^- \pi^0) = (1.46 \pm 0.30 \pm 0.28) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.
[3] BISELLO 91 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^\pm K^0_S \pi^\mp) = (2.3 \pm 0.4 \pm 0.4) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.
[4] BALTRUSAITIS 86 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^+ K^- \pi^0) = (1.3 \pm 0.5) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.
[5] BALTRUSAITIS 86 reports $B(J/\psi \to \gamma\eta_c) \cdot B(\eta_c \to K^\pm K^0_S \pi^\mp) = (1.9 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

$\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ $\Gamma_{37}/\Gamma \times \Gamma^{B^\pm}_{270}/\Gamma^{B^\pm}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
7.9 ±0.5 OUR FIT Error includes scale factor of 1.1.			
7.5 ±0.8 OUR AVERAGE			
$8.01 \pm 0.42 ^{+1.71}_{-1.65}$	[1] VINOKUROVA 11	BELL	$e^+ e^- \to \Upsilon(4S)$
$7.4 \pm 0.5 \pm 0.7$	AUBERT,B 04B	BABR	$B^\pm \to K^\pm \eta_c$

[1] VINOKUROVA 11 reports $B(B^+ \to \eta_c K^+,\ \eta_c \to K^0_S K^\pm \pi^\mp) = (26.7 \pm 1.4 ^{+2.9}_{-2.6} \pm 4.9) \times 10^{-6}$, where the first uncertainty is statistical, the second is due to systematics, and the third comes from interference of $\eta_c(1S) \to K^0_S K^\pm \pi^\mp$ with nonresonant $K^0_S K^\pm \pi^\mp$. We combined both systematic uncertainties to single values. We multiply the reported result by 3 to account for isospin symmetry.

$\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{37}/\Gamma \times \Gamma^{\psi(2S)}_{184}/\Gamma^{\psi(2S)}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.6±0.4 OUR FIT Error includes scale factor of 1.3.			
$\mathbf{4.5^{+2.4}_{-1.8}}$	HIMEL 80B	MRK2	$\psi(2S) \to \eta_c \gamma$

$\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{37}/\Gamma \times \Gamma^{h_c(1P)}_{30}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.28±0.34 OUR FIT				
4.1 ±0.6 OUR AVERAGE				
$3.7 \pm 0.7 \pm 0.3$	55	[1,2] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0 \gamma K^+ K^- \pi^0$
$4.6 \pm 0.8 \pm 0.3$	107	[3,4] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0 \gamma K^0_S K^\mp \pi^\pm$

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

[2] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

[4] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K\overline{K}\pi)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to K\overline{K}\eta)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{38}/\Gamma \times \Gamma^{h_c(1P)}_{30}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.9±1.0 OUR FIT				
5.7±2.9±0.4	7	[1,2] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0 \gamma\eta K^+ K^-$

[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 $[\Gamma(\eta_c(1S) \to K\overline{K}\eta)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to \eta\pi^+\pi^-)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{39}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
9.7±2.5±0.7	33	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\eta\pi^+\pi^-$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \eta\pi^+\pi^-)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to \eta\pi^+\pi^-)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{39}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
4.2±0.9 OUR AVERAGE					
4.6±1.1	75	BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
3.1±1.1±1.5	18	PARTRIDGE	80B	CBAL	$J/\psi \to \eta\pi^+\pi^-\gamma$

$\Gamma(\eta_c(1S) \to \eta 2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{40}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.6±0.7±0.2	39	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\eta 2(\pi^+\pi^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \eta 2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to K^+K^-\pi^+\pi^-)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{41}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.17±0.26 OUR FIT Error includes scale factor of 2.0.					
1.9 ±0.6 OUR AVERAGE Error includes scale factor of 2.4.					
1.5 ±0.2 ±0.2	0.4k	BAI	04	BES	$J/\psi \to \gamma K^+K^-\pi^+\pi^-$
2.7 ±0.4	110	BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

$\Gamma(\eta_c(1S) \to K^+K^-\pi^+\pi^-)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{41}/\Gamma \times \Gamma_{184}^{\psi(2S)}/\Gamma^{\psi(2S)}$

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
3.0±0.8 OUR FIT Error includes scale factor of 1.7.				
$4.0^{+6.0}_{-2.5}$	HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(\eta_c(1S) \to K^+K^-\pi^+\pi^-)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{41}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
5.0±1.0 OUR FIT	Error includes scale factor of 1.7.				
5.6±1.3±0.4	38	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K^+K^-\pi^+\pi^-$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K^+K^-\pi^+\pi^-)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to K^0K^-\pi^+\pi^-\pi^+ + c.c.)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{43}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
3.2±0.8±0.2	[1,2] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K_S^0 K^\mp\pi^\mp 2\pi^\pm$

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

[2] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K^0K^-\pi^+\pi^-\pi^+ + c.c.)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to K^+K^-2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{44}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.21±0.32±0.24	100	ABLIKIM	06A	BES2	$J/\psi \to K^+K^-2(\pi^+\pi^-)\gamma$

$\Gamma(\eta_c(1S) \to K^+K^-2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{44}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
4.8±2.5±0.3	10	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma K^+K^-2(\pi^+\pi^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to K^+K^-2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to 2(K^+K^-))/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ — $\Gamma_{45}/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma^{B^\pm}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
1.6±0.4 OUR FIT	Error includes scale factor of 1.4.				
$1.8^{+0.6}_{-0.5}$	$14.5^{+4.6}_{-3.0}$	HUANG	03	BELL	$B^+ \to 2(K^+K^-)K^+$

$\Gamma(\eta_c(1S) \to 2(K^+K^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{45}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.85±0.24 OUR FIT	Error includes scale factor of 1.3.				
1.3 ±0.5 ±0.1	7	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 2(K^+K^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 2(K^+K^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to \pi^+\pi^-\pi^0\pi^0)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{47}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.7±0.5±0.2	118	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma\pi^+\pi^- 2\pi^0$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to \pi^+\pi^-\pi^0\pi^0)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{48}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
1.35±0.19 OUR FIT	Error includes scale factor of 1.3.				
1.36±0.23 OUR AVERAGE					
1.3 ±0.2 ±0.4	0.5k	BAI	04	BES	$J/\psi \to \gamma 2(\pi^+\pi^-)$
1.33±0.22±0.20	137	BISELLO	91	DM2	$J/\psi \to \gamma 2(\pi^+\pi^-)$
1.6 ±0.6	25	BALTRUSAIT...	86	MRK3	$J/\psi \to \gamma\eta_c$

$\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{48}/\Gamma \times \Gamma_{184}^{\psi(2S)}/\Gamma^{\psi(2S)}$

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
3.4±0.7 OUR FIT	Error includes scale factor of 1.3.			
$5.7^{+3.9}_{-2.4}$	HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ — $\Gamma_{48}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.58±0.09 OUR FIT	Error includes scale factor of 1.3.				
1.01±0.19±0.07	100	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 2(\pi^+\pi^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-\pi^0))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{49}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
10.1±1.7±0.7	175	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 2(\pi^+\pi^-\pi^0)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 2(\pi^+\pi^-\pi^0))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to 3(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{50}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.59±0.32±0.47	471	ABLIKIM	06A	BES2	$J/\psi \to 3(\pi^+\pi^-)\gamma$

$\Gamma(\eta_c(1S) \to 3(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{50}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.19±0.30±0.08	51	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma 3(\pi^+\pi^-)$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to 3(\pi^+\pi^-))/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{51}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
1.88±0.18 OUR FIT	Error includes scale factor of 1.2.				
1.61±0.29 OUR AVERAGE					
1.9 ±0.3 ±0.3	213	BAI	04	BES	$J/\psi \to \gamma p\overline{p}$
1.3 ±0.4 ±0.3	18	BISELLO	91	DM2	$J/\psi \to \gamma p\overline{p}$
1.4 ±0.7	23	BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

$\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$

$\Gamma_{51}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
8.0±0.8 OUR FIT					
8.7±2.9±0.6	15	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{51}/\Gamma \times \Gamma^{\psi(2S)}_{184}/\Gamma^{\psi(2S)}$

VALUE (units 10^{-6})	DOCUMENT ID		TECN	COMMENT
4.8±0.7 OUR FIT Error includes scale factor of 1.2.				
8 $^{+8}_{-4}$	HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ $\Gamma_{51}/\Gamma \times \Gamma^{B^\pm}_{270}/\Gamma^{B^\pm}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
1.47±0.12 OUR FIT Error includes scale factor of 1.1.					
1.54±0.19 OUR AVERAGE Error includes scale factor of 1.1.					
$1.42\pm0.11^{+0.16}_{-0.20}$	195	WU	06	BELL	$B^+ \to p\overline{p}K^+$
$1.8\ ^{+0.3}_{-0.2}\ \pm0.2$		AUBERT,B	05L	BABR	$e^+e^- \to \Upsilon(4S)$

$\Gamma(\eta_c(1S) \to p\overline{p}\pi^0)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{52}/\Gamma \times \Gamma^{h_c(1P)}_{30}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
2.1±0.7±0.1	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}\pi^0$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p}\pi^0)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to p\overline{p}\pi^+\pi^-)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{53}/\Gamma \times \Gamma^{h_c(1P)}_{30}/\Gamma^{h_c(1P)}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.19±0.30 OUR FIT					
3.1 ±1.0 ±0.2	19	[1] ABLIKIM	12N	BES3	$\psi(2S) \to \pi^0\gamma p\overline{p}\pi^+\pi^-$

[1] ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \to p\overline{p}\pi^+\pi^-)/\Gamma_{total} \times \Gamma(h_c(1P) \to \gamma\eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \to h_c(1P)\pi^0)] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \to h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta_c(1S) \to p\overline{p}\pi^+\pi^-)/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ $\Gamma_{53}/\Gamma \times \Gamma^{B^\pm}_{270}/\Gamma^{B^\pm}$

VALUE (units 10^{-6})	DOCUMENT ID		TECN	COMMENT
4.0 ±0.4 OUR FIT				
$3.94^{+0.41}_{-0.39}{}^{+0.22}_{-0.18}$	CHILIKIN	19	BELL	$e^+e^- \to \Upsilon(4S)$

$\Gamma(\eta_c(1S) \to \Lambda\overline{\Lambda})/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{54}/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
1.5 ±0.4 OUR FIT Error includes scale factor of 1.5.				
1.98±0.21±0.32	ABLIKIM	12B	BES3	$J/\psi \to \Lambda\overline{\Lambda}\gamma$

$\Gamma(\eta_c(1S) \to \Lambda\overline{\Lambda})/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ $\Gamma_{54}/\Gamma \times \Gamma^{B^\pm}_{270}/\Gamma^{B^\pm}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
1.21±0.30 OUR FIT Error includes scale factor of 1.5.					
$\mathbf{0.95^{+0.25}_{-0.22}{}^{+0.08}_{-0.11}}$	20	WU	06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$

$\Gamma(\eta_c(1S) \to \Sigma^+\overline{\Sigma}^-)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{57}/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
3.60±0.48±0.31	112	ABLIKIM	13C	BES3	$J/\psi \to \gamma p\overline{p}\pi^0\pi^0$

$\Gamma(\eta_c(1S) \to \Xi^-\overline{\Xi}^+)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{58}/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
1.51±0.27±0.14	78	ABLIKIM	13C	BES3	$J/\psi \to \gamma\Lambda\overline{\Lambda}\pi^+\pi^-$

$\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total} \times \Gamma(J/\psi(1S) \to \gamma\eta_c(1S))/\Gamma_{total}$ $\Gamma_{59}/\Gamma \times \Gamma^{J/\psi(1S)}_{245}/\Gamma^{J/\psi(1S)}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
2.34±0.35 OUR FIT Error includes scale factor of 1.2.					
$\mathbf{3.8\ ^{+1.3}_{-1.0}}$ **OUR AVERAGE** Error includes scale factor of 1.1.					
$4.5\ \pm1.2\ \pm0.6$		ABLIKIM	13I	BES3	
$1.2\ ^{+2.7}_{-1.1}\ \pm0.3$	$1.2^{+2.8}_{-1.1}$	ADAMS	08	CLEO	$\psi(2S) \to \pi^+\pi^- J/\psi$

$\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total} \times \Gamma(B^+ \to \eta_c K^+)/\Gamma_{total}$ $\Gamma_{59}/\Gamma \times \Gamma^{B^\pm}_{270}/\Gamma^{B^\pm}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
0.183±0.022 OUR FIT Error includes scale factor of 1.2.					
$\mathbf{0.22\ ^{+0.09}_{-0.07}\ ^{+0.04}_{-0.02}}$	13	WICHT	08	BELL	$B^\pm \to K^\pm\gamma\gamma$

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