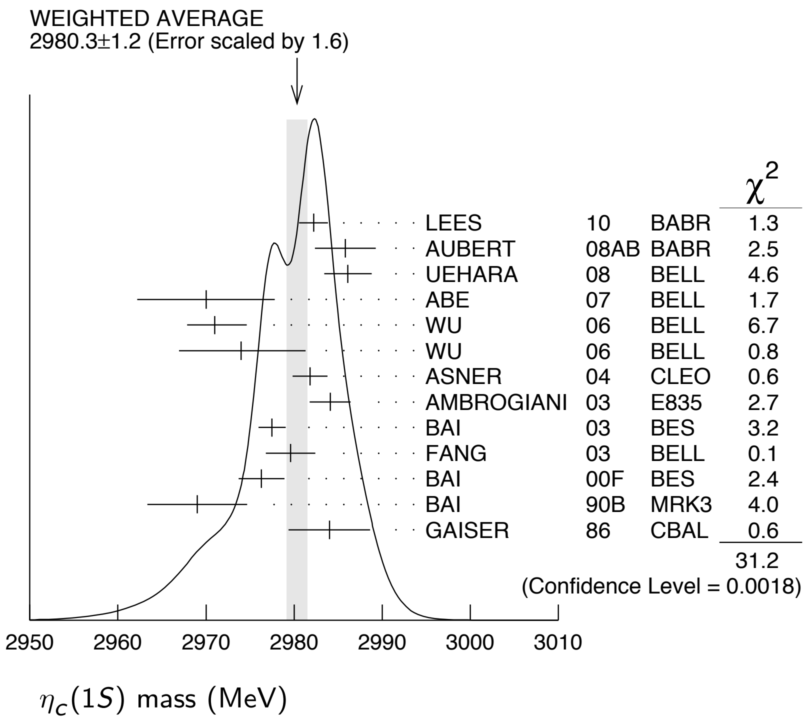
$\eta_c(1S)$

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

$\eta_c(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
2980.3± 1.2 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.			
2982.2± 0.4± 1.6	14k	[1] LEES	10	BABR	10.6 $e^+e^- \to e^+e^- K^0_S K^\pm \pi^\mp$
2985.8± 1.5± 3.1	921 ± 32	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	[2] 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	[3] AMBROGIANI	03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
2977.5± 1.0± 1.2		[4,5] BAI	03	BES	$J/\psi \to \gamma\eta_c$
2979.6± 2.3± 1.6	182 ± 25	FANG	03	BELL	$B \to \eta_c K$
2976.3± 2.3± 1.2		[5,6,7] BAI	00F	BES	$J/\psi \to \gamma\eta_c$ and $\psi(2S) \to \gamma\eta_c$
2969 ± 4 ± 4	80	[5] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^+K^-$
2984 ± 2.3± 4.0		[5] GAISER	86	CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2982.2± 0.6		[5] MITCHELL	09	CLEO	$e^+e^- \to \gamma X$
2982 ± 5	273 ± 43	[8] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
2982.5± 1.1± 0.9	2547 ± 90	[9] AUBERT	04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
2976.6± 2.9± 1.3	140	[5,6,10] BAI	00F	BES	$J/\psi \to \gamma\eta_c$
2980.4± 2.3± 0.6		[11] BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
2975.8± 3.9± 1.2		[6,10] 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		[5,10] BISELLO	91	DM2	$J/\psi \to \eta_c\gamma$
2956 ±12 ±12		[5] 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		[5,10] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
2976 ± 8		[5,12] BALTRUSAIT...	84	MRK3	$J/\psi \to 2\phi\gamma$
2982 ± 8	18	[13] HIMEL	80B	MRK2	e^+e^-
2980 ± 9		[13] PARTRIDGE	80B	CBAL	e^+e^-

[1] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
[2] From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.
[3] Using mass of $\psi(2S) = 3686.00$ MeV.
[4] From a simultaneous fit of five decay modes of the η_c.
[5] 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.
[6] Using an η_c width of 13.2 MeV.
[7] Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples.
[8] From the fit of the kaon momentum spectrum. Systematic errors not evaluated.
[9] Superseded by LEES 10.
[10] Average of several decay modes.
[11] Superseded by ASNER 04.
[12] $\eta_c \to \phi\phi$.
[13] Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.

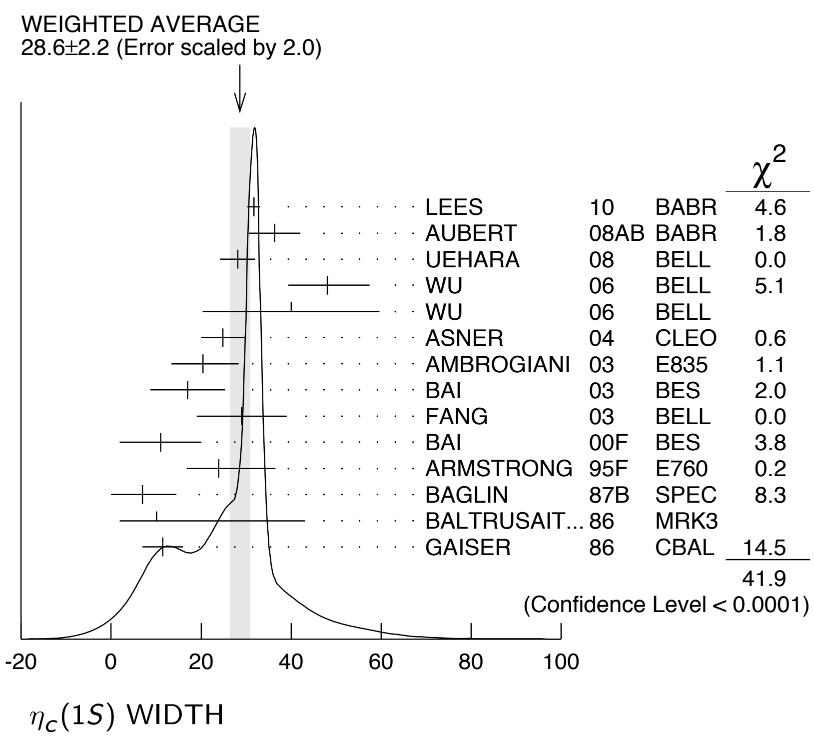


$\eta_c(1S)$ WIDTH

VALUE (MeV)	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
28.6± 2.2 OUR AVERAGE			Error includes scale factor of 2.0. See the ideogram below.			
31.7± 1.2±0.8		14k	[14] LEES	10	BABR	10.6 $e^+e^- \to e^+e^- K^0_S K^\pm \pi^\mp$
$36.3^{+3.7}_{-3.6}$±4.4		921 ± 32	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
$48\ ^{+8}_{-7}$ ±5		195	WU	06	BELL	$B^+ \to p\overline{p}K^+$
40 ±19 ±5		20	WU	06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$

$24.8\pm 3.4\pm 3.5$		592	ASNER	04	CLEO $\gamma\gamma\to\eta_c\to K^0_S K^\pm\pi^\mp$
$20.4^{+7.7}_{-6.7}\pm 2.0$		190	AMBROGIANI	03	E835 $\overline{p}p\to\eta_c\to\gamma\gamma$
$17.0\pm 3.7\pm 7.4$			[15] BAI	03	BES $J/\psi\to\gamma\eta_c$
$29\ \pm 8\ \pm 6$		182 ± 25	FANG	03	BELL $B\to\eta_c K$
$11.0\pm 8.1\pm 4.1$			[16] BAI	00F	BES $J/\psi\to\gamma\eta_c$ and $\psi(2S)\to\gamma\eta_c$
$23.9^{+12.6}_{-7.1}$			ARMSTRONG	95F	E760 $\overline{p}p\to\gamma\gamma$
$7.0^{+7.5}_{-7.0}$		12	BAGLIN	87B	SPEC $\overline{p}p\to\gamma\gamma$
$10.1^{+33.0}_{-8.2}$		23	[17] BALTRUSAIT...	86	MRK3 $J/\psi\to\gamma p\overline{p}$
11.5 ± 4.5			GAISER	86	CBAL $J/\psi\to\gamma X$, $\psi(2S)\to\gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$34.3\pm 2.3\pm 0.9$		2547 ± 90	[18] AUBERT	04D	BABR $\gamma\gamma\to\eta_c(1S)\to K\overline{K}\pi$
$27.0\pm 5.8\pm 1.4$			[19] BRANDENB...	00B	CLE2 $\gamma\gamma\to\eta_c\to K^\pm K^0_S\pi^\mp$
< 40	90	18	HIMEL	80B	MRK2 e^+e^-
< 20	90		PARTRIDGE	80B	CBAL e^+e^-

[14] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.
[15] From a simultaneous fit of five decay modes of the η_c.
[16] 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.
[17] Positive and negative errors correspond to 90% confidence level.
[18] Superseded by LEES 10.
[19] Superseded by ASNER 04.



$\eta_c(1S)$ 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	$\rho\rho$		(2.0 ± 0.7) %	
Γ_3	$K^*(892)^0 K^- \pi^+ +$ c.c.		(2.0 ± 0.7) %	
Γ_4	$K^*(892)\overline{K}^*(892)$		$(9.2 \pm 3.4) \times 10^{-3}$	
Γ_5	$K^{*0}\overline{K}^{*0}\pi^+\pi^-$		(1.1 ± 0.5) %	
Γ_6	$\phi K^+ K^-$		$(2.9 \pm 1.4) \times 10^{-3}$	
Γ_7	$\phi\phi$		$(2.7 \pm 0.9) \times 10^{-3}$	
Γ_8	$\phi 2(\pi^+\pi^-)$		$< 3.5 \times 10^{-3}$	90%
Γ_9	$a_0(980)\pi$		< 2 %	90%
Γ_{10}	$a_2(1320)\pi$		< 2 %	90%
Γ_{11}	$K^*(892)\overline{K} +$ c.c.		< 1.28 %	90%
Γ_{12}	$f_2(1270)\eta$		< 1.1 %	90%
Γ_{13}	$\omega\omega$		$< 3.1 \times 10^{-3}$	90%
Γ_{14}	$\omega\phi$		$< 1.7 \times 10^{-3}$	90%
Γ_{15}	$f_2(1270) f_2(1270)$		$(7.6 {}^{+3.0}_{-3.4}) \times 10^{-3}$	
Γ_{16}	$f_2(1270) f'_2(1525)$		(2.7 ± 1.5) %	
	Decays into stable hadrons			
Γ_{17}	$K\overline{K}\pi$		(7.0 ± 1.2) %	
Γ_{18}	$\eta\pi\pi$		(4.9 ± 1.8) %	
Γ_{19}	$\pi^+\pi^- K^+ K^-$		(1.5 ± 0.6) %	
Γ_{20}	$K^+ K^- 2(\pi^+\pi^-)$		$(7.1 \pm 2.9) \times 10^{-3}$	
Γ_{21}	$2(K^+ K^-)$		$(1.6 \pm 0.7) \times 10^{-3}$	
Γ_{22}	$2(\pi^+\pi^-)$		(1.20 ± 0.30) %	
Γ_{23}	$3(\pi^+\pi^-)$		(1.5 ± 0.5) %	
Γ_{24}	$p\overline{p}$		$(1.3 \pm 0.4) \times 10^{-3}$	
Γ_{25}	$\Lambda\overline{\Lambda}$		$(1.04 \pm 0.31) \times 10^{-3}$	
Γ_{26}	$K\overline{K}\eta$		< 3.1 %	90%
Γ_{27}	$\pi^+\pi^- p\overline{p}$		< 1.2 %	90%
	Radiative decays			
Γ_{28}	$\gamma\gamma$		$(6.3 \pm 2.9) \times 10^{-5}$	
	Charge conjugation (*C*), Parity (*P*), Lepton family number (*LF*) violating modes			
Γ_{29}	$\pi^+\pi^-$	P,CP	$< 6 \times 10^{-4}$	90%
Γ_{30}	$\pi^0\pi^0$	P,CP	$< 4 \times 10^{-4}$	90%
Γ_{31}	$K^+ K^-$	P,CP	$< 6 \times 10^{-4}$	90%
Γ_{32}	$K^0_S K^0_S$	P,CP	$< 3.1 \times 10^{-4}$	90%

$\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ — Γ_{28}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.2± 0.7± 2.0 OUR EVALUATION Error includes scale factor of 1.3. Treating systematic errors as correlated.				
$6.7^{+0.9}_{-0.8}$ OUR AVERAGE				
5.5± 1.2± 1.8	157 ± 33	[20] KUO	05 BELL	$\gamma\gamma \to p\overline{p}$
7.4± 0.4± 2.3		[21] ASNER	04 CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm \pi^\mp$
13.9± 2.0± 3.0	41	[22] ABDALLAH	03J DLPH	$\gamma\gamma \to \eta_c$
$3.8^{+1.1+1.9}_{-1.0-1.0}$	190	[23] AMBROGIANI	03 E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
6.9± 1.7± 2.1	76	[24] ACCIARRI	99T L3	$e^+e^- \to e^+e^-\eta_c$
27 ±16 ±10	5	[21] SHIRAI	98 AMY	58 e^+e^-
$6.7^{+2.4}_{-1.7}$± 2.3		[20] ARMSTRONG	95F E760	$\overline{p}p \to \gamma\gamma$
11.3± 4.2		[25] ALBRECHT	94H ARG	$e^+e^- \to e^+e^-\eta_c$
$5.9^{+2.1}_{-1.8}$± 1.9		[23] CHEN	90B CLEO	$e^+e^- \to e^+e^-\eta_c$
$6.4^{+5.0}_{-3.4}$		[26] AIHARA	88D TPC	$e^+e^- \to e^+e^-X$
$4.3^{+3.4}_{-3.7}$± 2.4		[20] BAGLIN	87B SPEC	$\overline{p}p \to \gamma\gamma$
28 ±15		[21,27] BERGER	86 PLUT	$\gamma\gamma \to K\overline{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.2± 1.2	273 ± 43	[28,29] AUBERT	06E BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
7.6± 0.8± 2.3		[21,30] BRANDENB...	00B CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
8.0± 2.3± 2.4	17	[31] ADRIANI	93N L3	$e^+e^- \to e^+e^-\eta_c$

[20] Normalized to B($\eta_c \to p\overline{p}$)= $(1.3 \pm 0.4) \times 10^{-3}$.
[21] Normalized to B($\eta_c \to K^\pm K^0_S \pi^\mp$).
[22] Average of $K^0_S K^\pm \pi^\mp$, $\pi^+\pi^- K^+K^-$, and $2(K^+K^-)$ decay modes.
[23] Normalized to the sum of B($\eta_c \to K^\pm K^0_S \pi^\mp$), B($\eta_c \to K^+K^-\pi^+\pi^-$), and B($\eta_c \to 2\pi^+2\pi^-$).
[24] Normalized to the sum of 9 branching ratios.
[25] 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($\eta_c \to 2\pi^+2\pi^-$).
[26] 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($\eta_c \to 2\pi^+2\pi^-$).
[27] Re-evaluated by AIHARA 88D.
[28] 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 ± 1.8)% from AUBERT 06E.
[29] Systematic errors not evaluated.
[30] Superseded by ASNER 04.
[31] Superseded by ACCIARRI 99T.

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

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{17}\Gamma_{28}/\Gamma$

VALUE (keV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.407±0.027 OUR AVERAGE			Error includes scale factor of 1.2.			
0.374±0.009±0.031		14k	[32] LEES	10	BABR	10.6 $e^+e^- \to e^+e^- K^0_S K^\pm \pi^\mp$
0.407±0.022±0.028			[33,34] ASNER	04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm \pi^\mp$
0.60 ±0.12 ±0.09		41	[34,35] ABDALLAH	03J	DLPH	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
1.47 ±0.87 ±0.27			[34] SHIRAI	98	AMY	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
0.84 ±0.21			[34] ALBRECHT	94H	ARG	$\gamma\gamma \to K^\pm K^0_S \pi^\mp$
0.60 $^{+0.23}_{-0.20}$			[34] CHEN	90B	CLEO	$\gamma\gamma \to \eta_c K^\pm K^0_S \pi^\mp$
1.06 ±0.41 ±0.27		11	[34] BRAUNSCH...	89	TASS	$\gamma\gamma \to K\overline{K}\pi$
1.5 $^{+0.60}_{-0.45}$ ±0.3		7	[34] BERGER	86	PLUT	$\gamma\gamma \to K\overline{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.418±0.044±0.022			[34,36] BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
<0.63	95		[34] BEHREND	89	CELL	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
<4.4	95		ALTHOFF	85B	TASS	$\gamma\gamma \to K\overline{K}\pi$

$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{19}\Gamma_{28}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
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	[37] ABDALLAH	03J	DLPH	$\gamma\gamma \to \pi^+\pi^-K^+K^-$
170 ± 80 ±20	13.9 ± 6.6	ALBRECHT	94H	ARG	$\gamma\gamma \to \pi^+\pi^-K^+K^-$

$\Gamma(K^*(892)\overline{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{4}\Gamma_{28}/\Gamma$

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

$\Gamma(f_2(1270)f'_2(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{16}\Gamma_{28}/\Gamma$

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

$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{21}\Gamma_{28}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
5.8± 1.9 OUR AVERAGE					
5.6± 1.1± 1.6	216 ± 42	UEHARA	08	BELL	$\gamma\gamma \to 2(K^+K^-)$
350 ±90 ±60	46	[38] ABDALLAH	03J	DLPH	$\gamma\gamma \to 2(K^+K^-)$
231 ±90 ±23	9.1 ± 3.3	[39] ALBRECHT	94H	ARG	$\gamma\gamma \to 2(K^+K^-)$

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{7}\Gamma_{28}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
6.8±1.2±1.3	132 ± 23	UEHARA	08	BELL	$\gamma\gamma \to 2(K^+K^-)$

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{22}\Gamma_{28}/\Gamma$

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

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{2}\Gamma_{28}/\Gamma$

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

$\Gamma(f_2(1270) f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{15}\Gamma_{28}/\Gamma$

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

$\Gamma(p\overline{p}) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{24}\Gamma_{28}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
$6.2^{+1.1}_{-1.0}$ OUR AVERAGE Error includes scale factor of 1.1.					
$7.20 \pm 1.53^{+0.67}_{-0.75}$	157 ± 33	[40] KUO	05	BELL	$\gamma\gamma \to p\overline{p}$
$4.6^{+1.3}_{-1.1} \pm 0.4$	190	[40] AMBROGIANI	03	E835	$\overline{p}p \to \gamma\gamma$
$8.1^{+2.9}_{-2.0}$		[40] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$

[32] From the corrected and unfolded mass spectrum.
[33] Calculated by us from the value reported in ASNER 04 that assumes B($\eta_c \to K\overline{K}\pi$) = 5.5 ± 1.7%
[34] We have multiplied $K^\pm K^0_S \pi^\mp$ measurement by 3 to obtain $K\overline{K}\pi$.
[35] 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)%.
[36] Superseded by ASNER 04.
[37] Calculated by us from the value reported in ABDALLAH 03J, which uses B($\eta_c \to \pi^+\pi^- K^+ K^-$) = (2.0 ± 0.7)%.
[38] Calculated by us from the value reported in ABDALLAH 03J, which uses B($\eta_c \to$) $2(K^+K^-)$ = (2.1 ± 1.2)%.
[39] Includes all topological modes except $\eta_c \to \phi\phi$.
[40] Not independent from the $\Gamma_{\gamma\gamma}$ reported by the same experiment.

$\eta_c(1S)$ 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	[41] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
20 ± 7 OUR EVALUATION			(Treating systematicerrors as correlated.)			
18 ± 5 OUR AVERAGE						
12.6± 3.8±5.1		72	[41] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^+\pi^-\gamma$
26.0± 2.4±8.8		113	[41] BISELLO	91	DM2	$J/\psi \to \gamma\rho^0\rho^0$
23.6±10.6±8.2		32	[41] BISELLO	91	DM2	$J/\psi \to \gamma\rho^+\rho^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<14	90		[41] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.02±0.007	63	[41] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
92±34 OUR EVALUATION		(Treating systematicerrors as correlated.)			
91±26 OUR AVERAGE					
108±25±44	60	[41] ABLIKIM	05L	BES2	$J/\psi \to K^+K^-\pi^+\pi^-\gamma$
82±28±27	14	[41] BISELLO	91	DM2	$e^+e^- \to \gamma K^+K^-\pi^+\pi^-$
90±50	9	[41] BALTRUSAIT...86		MRK3	$J/\psi \to \eta_c\gamma$

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
112±47±26	45	[42] ABLIKIM	06A	BES2	$J/\psi \to K^{*0}\overline{K}^{*0}\pi^+\pi^-\gamma$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{2.9^{+0.9}_{-0.8}\pm 1.1}$	$14.1^{+4.4}_{-3.7}$	[43] HUANG	03	BELL	$B^+ \to (\phi K^+K^-)\ K^+$

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
27 ± 9 OUR EVALUATION		(Treating systematic errors as correlated.)			
27 ± 5 OUR AVERAGE					
25.3± 5.1± 9.1	72	[41] ABLIKIM	05L	BES2	$J/\psi \to K^+K^-K^+K^-\gamma$
26 ± 9	357 ± 64	[41] BAI	04	BES	$J/\psi \to \gamma K^+K^-K^+K^-$
$18\ ^{+8}_{-6}\ \pm 7$	$7.0^{+3.0}_{-2.3}$	[43] HUANG	03	BELL	$B^+ \to (\phi\phi)\ K^+$
31 ± 7 ±10	19	[41] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^+K^-$
$30\ ^{+18}_{-12}\ \pm 10$	5	[41] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^0_S K^0_L$
74 ±18 ±24	80	[41] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^+K^-$
67 ±21 ±24		[41] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^0_S K^0_L$

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<35	90	[44] ABLIKIM	06A	BES2	$J/\psi \to \phi 2(\pi^+\pi^-)\gamma$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.02	90	[41,45] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.02	90	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$

$\Gamma(K^*(892)\overline{K}+c.c.)/\Gamma_{total}$ — 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	[41] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- \pi^0$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.011	90	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0031	90	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.0063	90	[41] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^0\pi^+\pi^-\pi^0\gamma$
<0.0063		[41] BISELLO	91	DM2	$J/\psi \to \gamma\omega\omega$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0017	90	[41] ABLIKIM	05L	BES2	$J/\psi \to \pi^+\pi^-\pi^0 K^+ K^- \gamma$

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$0.76^{+0.25}_{-0.29}\pm0.18$	91.2 ± 19.8	[46] ABLIKIM	04M	BES	$J/\psi \to \gamma 2\pi^+ 2\pi^-$

$\Gamma(K\overline{K}\pi)/\Gamma_{total}$ — Γ_{17}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
7.0 ±1.2 OUR EVALUATION (Treating systematic errors as correlated.)						
6.1 ±0.8 OUR AVERAGE						
8.5 ±1.8			[47] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
5.1 ±2.1		609 ± 71	[41] BAI	04	BES	$J/\psi \to \gamma K^\pm \pi^\mp K^0_S$
6.90±1.42±1.32		33	[41] BISELLO	91	DM2	$J/\psi \to \gamma K^+ K^- \pi^0$
5.43±0.94±0.94		68	[41] BISELLO	91	DM2	$J/\psi \to \gamma K^\pm \pi^\mp K^0_S$
4.8 ±1.7		95	[41,48] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c \gamma$
$16.1\ ^{+9.2}_{-7.3}$			[49] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 10.7	90		[41] PARTRIDGE	80B	CBAL	$J/\psi \to \eta_c \gamma$

$\Gamma(\phi\phi)/\Gamma(K\overline{K}\pi)$ — Γ_7/Γ_{17}

VALUE	DOCUMENT ID		TECN	COMMENT
0.055±0.014±0.005	AUBERT,B	04B	BABR	$B^{\pm} \to K^{\pm}\eta_c$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.049±0.018 OUR EVALUATION					
0.047±0.015 OUR AVERAGE					
0.054±0.020	75	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
0.037±0.013±0.020	18	[41] PARTRIDGE	80B	CBAL	$J/\psi \to \eta\pi^+\pi^-\gamma$

$\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{total}$ — Γ_{19}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.015 ±0.006 OUR EVALUATION					
0.0142±0.0033 OUR AVERAGE					
0.012 ±0.004	413 ± 54	[41] BAI	04	BES	$J/\psi \to \gamma K^+K^-\pi^+\pi^-$
0.021 ±0.007	110	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
0.014 $^{+0.022}_{-0.009}$		[49] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{total}$ — Γ_{20}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
71±23±16	100	[50] ABLIKIM	06A	BES2	$J/\psi \to K^+K^-2(\pi^+\pi^-)\gamma$

$\Gamma(2(K^+K^-))/\Gamma_{total}$ — Γ_{21}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0015±0.0007 OUR AVERAGE					
0.0014$^{+0.0005}_{-0.0004}$±0.0006	14.5$^{+4.6}_{-3.0}$	[43] HUANG	03	BELL	$B^+ \to 2(K^+K^-)K^+$
0.021 ±0.010 ±0.006		[51] ALBRECHT	94H	ARG	$\gamma\gamma \to K^+K^-K^+K^-$

$\Gamma(2(K^+K^-))/\Gamma(K\overline{K}\pi)$ — Γ_{21}/Γ_{17}

VALUE	DOCUMENT ID		TECN	COMMENT
0.023±0.007±0.006	AUBERT,B	04B	BABR	$B^{\pm} \to K^{\pm}\eta_c$

$\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ — Γ_{22}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.2 ±0.3 OUR EVALUATION					
1.15±0.26 OUR AVERAGE					
1.0 ±0.5	542 ± 75	[41] BAI	04	BES	$J/\psi \to \gamma\, 2(\pi^+\pi^-)$
1.05±0.17±0.34	137	[41] BISELLO	91	DM2	$J/\psi \to \gamma 2\pi^+2\pi^-$
1.3 ±0.6	25	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
2.0 $^{+1.5}_{-1.0}$		[49] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(3(\pi^+\pi^-))/\Gamma_{total}$ — Γ_{23}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
152±33±35	479	[52] ABLIKIM	06A	BES2	$J/\psi \to 3(\pi^+\pi^-)\gamma$

$\Gamma(p\overline{p})/\Gamma_{total}$ — Γ_{24}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
13 ± 4 OUR EVALUATION		(Treating systematic errors as correlated.)			
14.0 ± 2.2 OUR AVERAGE					
$15.5^{+2.1}_{-2.5}\pm 2.1$	195	[53] WU	06	BELL	$B^+ \to p\overline{p}K^+$
15 ± 6	213 ± 33	[41] BAI	04	BES	$J/\psi \to \gamma p\overline{p}$
$10 \pm 3 \pm 4$	18	[41] BISELLO	91	DM2	$J/\psi \to \gamma p\overline{p}$
11 ± 6	23	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
29^{+29}_{-15}		[49] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\phi\phi)/\Gamma_{total}$ — $\Gamma_{24}/\Gamma \times \Gamma_7/\Gamma$

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

$\Gamma(\Lambda\overline{\Lambda})/\Gamma_{total}$ — Γ_{25}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{10.4^{+2.9}_{-2.7}\pm 1.4}$		20	[54] WU	06	BELL	$B^+ \to \Lambda\overline{\Lambda}K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<20	90		[41] BISELLO	91	DM2	$e^+e^- \to \gamma\Lambda\overline{\Lambda}$

$\Gamma(\Lambda\overline{\Lambda})/\Gamma(p\overline{p})$ — Γ_{25}/Γ_{24}

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.67^{+0.19}_{-0.16}\pm 0.12}$	[55] WU	06	BELL	$B^+ \to p\overline{p}K^+$, $\Lambda\overline{\Lambda}K^+$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.031	90	[41] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$

$\Gamma(\pi^+\pi^-p\overline{p})/\Gamma_{total}$ — Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.012	90	HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

[41] 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.

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

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

[44] 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 $B(J/\psi(1S) \to \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

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

[46] 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.

[47] 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.

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

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

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

[51] 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 $B(\eta_c \to 2\pi^+2\pi^-)$.

[52] 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.

[53] WU 06 reports $[\Gamma(\eta_c(1S) \to p\overline{p})/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (1.42 \pm 0.11^{+0.16}_{-0.20}) \times 10^{-6}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (9.1 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[54] WU 06 reports $[\Gamma(\eta_c(1S) \to \Lambda\overline{\Lambda})/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (0.95^{+0.25}_{-0.22}{}^{+0.08}_{-0.11}) \times 10^{-6}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (9.1 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

RADIATIVE DECAYS

$\Gamma(\gamma\gamma)/\Gamma_{total}$ — Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
(1.8+0.6-0.5) OUR AVERAGE						
$1.4^{+0.7}_{-0.5} \pm 0.3$		$1.2^{+2.8}_{-1.1}$	[56] ADAMS	08	CLEO	$\psi(2S) \to \pi^+\pi^- J/\psi$
$2.4^{+1.1}_{-0.8} \pm 0.3$		13	[57] WICHT	08	BELL	$B^\pm \to K^\pm\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$2.80^{+0.67}_{-0.58} \pm 1.0$			[58] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
<9	90		[59] BISELLO	91	DM2	$J/\psi \to \gamma\gamma\gamma$
$6^{+4}_{-3} \pm 4$			[58] BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
<18	90		[60] BLOOM	83	CBAL	$J/\psi \to \eta_c\gamma$

[56] 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.

[57] WICHT 08 reports $[\Gamma(\eta_c(1S) \to \gamma\gamma)/\Gamma_{total}] \times [B(B^+ \to \eta_c K^+)] = (2.2^{+0.9}_{-0.7}{}^{+0.4}_{-0.2}) \times 10^{-7}$ which we divide by our best value $B(B^+ \to \eta_c K^+) = (9.1 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

[59] 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.

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

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{24}/\Gamma \times \Gamma_{28}/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
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_{29}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<60	90	[61] ABLIKIM	06B	BES2	$J/\psi \to \pi^+\pi^-\gamma$

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

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — Γ_{30}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<40	90	[62] ABLIKIM	06B	BES2	$J/\psi \to \pi^0\pi^0\gamma$

[62] 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_{31}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID		TECN	COMMENT
<60	90	[63] ABLIKIM	06B	BES2	$J/\psi \to K^+K^-\gamma$

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

$\Gamma(K^0_S K^0_S)/\Gamma_{total}$ Γ_{32}/Γ

VALUE (units 10^{-5})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<31	90	[64] ABLIKIM	06B	BES2	$J/\psi \to K^0_S K^0_S \gamma$

[64] ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \to K^0_S K^0_S)/\Gamma_{total}] \times [B(J/\psi(1S) \to \gamma \eta_c(1S))] < 0.53 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \to \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

$\eta_c(1S)$ REFERENCES

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	JPG 33 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 011101R	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+)