$\eta_c(1S)$

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

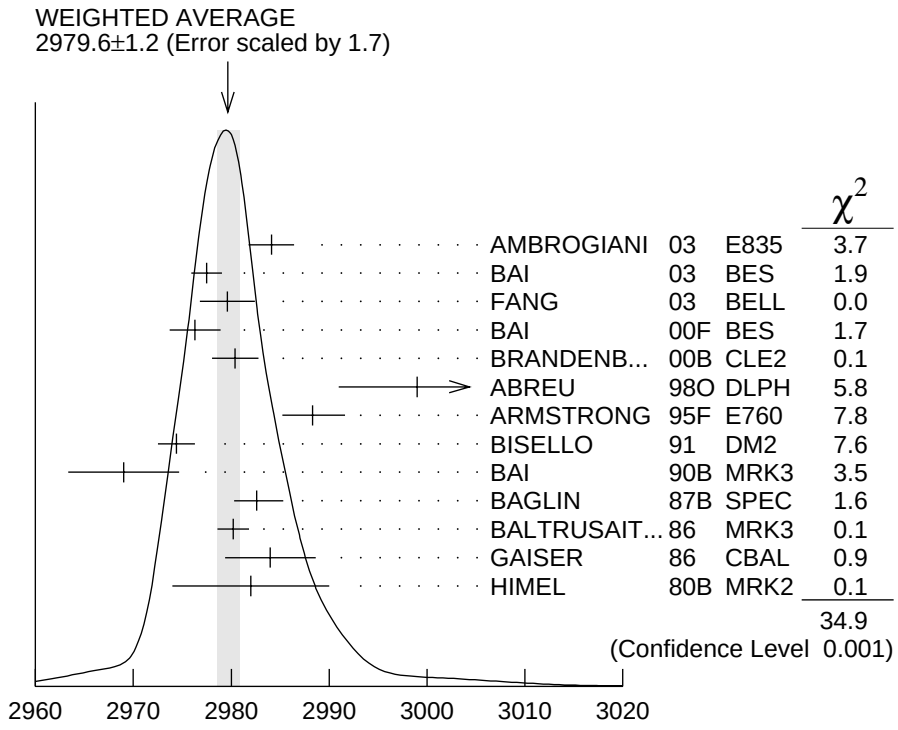
$\eta_c(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
2979.6± 1.2 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.			
2984.1± 2.1± 1.0	190	[4] AMBROGIANI	03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
2977.5± 1.0± 1.2		[1] 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 $\psi(2S) \to \gamma\eta_c$
2980.4± 2.3± 0.6		BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
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] BISELLO	91	DM2	$J/\psi \to \eta_c\gamma$
2969 ± 4 ± 4	80	BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^+K^-$
$2982.6^{+2.7}_{-2.3}$	12	BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
2980.2± 1.6		[5] BALTRUSAIT...	86	MRK3	$J/\psi \to \eta_c\gamma$
2984 ± 2.3± 4.0		GAISER	86	CBAL	$J/\psi \to \gamma$X, $\psi(2S) \to \gamma$X
2982 ± 8	18	[2] HIMEL	80B	MRK2	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2976.6± 2.9± 1.3	140	[5,6] BAI	00F	BES	$J/\psi \to \gamma\eta_c$
2975.8± 3.9± 1.2		[5,6] BAI	99B	BES	Sup. by BAI 00F
2956 ±12 ±12		BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^0_S K^0_L$
2976 ± 8		[3] BALTRUSAIT...	84	MRK3	$J/\psi \to 2\phi\gamma$
2980 ± 9		[2] PARTRIDGE	80B	CBAL	e^+e^-

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

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

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



[4] Using mass of $\psi(2S) = 3686.00$ MeV.
[5] Average of several decay modes.
[6] Using an η_c width of 13.2 MeV.
[7] Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples.

$\eta_c(1S)$ WIDTH

VALUE (MeV)	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$17.3^{+2.7}_{-2.5}$ OUR AVERAGE Error includes scale factor of 1.1.						
$20.4^{+7.7}_{-6.7} \pm 2.0$		190	AMBROGIANI	03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
$17.0 \pm 3.7 \pm 7.4$			[8] BAI	03	BES	$J/\psi \to \gamma\eta_c$
$29 \pm 8 \pm 6$		182 ± 25	FANG	03	BELL	$B \to \eta_c K$
$11.0 \pm 8.1 \pm 4.1$			[10] BAI	00F	BES	$J/\psi \to \gamma\eta_c$ and $\psi(2S) \to \gamma\eta_c$
$27.0 \pm 5.8 \pm 1.4$			BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^{\pm} K^0_S \pi^{\mp}$
$23.9^{+12.6}_{-7.1}$			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	[9] 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. • • •

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

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

[9] Positive and negative errors correspond to 90% confidence level.

[10] 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.

$\eta_c(1S)$ 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	$\rho\rho$	(2.6 ±0.9)	%	
Γ_3	$K^*(892)^0 K^-\pi^+ +$ c.c.	(2.0 ±0.7)	%	
Γ_4	$K^*(892)\overline{K}^*(892)$	(8.5 ±3.1)	$\times 10^{-3}$	
Γ_5	$\phi K^+ K^-$	(2.9 ±1.4)	$\times 10^{-3}$	
Γ_6	$\phi\phi$	(2.6 ±0.9)	$\times 10^{-3}$	
Γ_7	$a_0(980)\pi$	< 2	%	90%
Γ_8	$a_2(1320)\pi$	< 2	%	90%
Γ_9	$K^*(892)\overline{K} +$ c.c.	< 1.28	%	90%
Γ_{10}	$f_2(1270)\eta$	< 1.1	%	90%
Γ_{11}	$\omega\omega$	< 3.1	$\times 10^{-3}$	90%
	Decays into stable hadrons			
Γ_{12}	$K\overline{K}\pi$	(5.7 ±1.6)	%	
Γ_{13}	$\eta\pi\pi$	(4.9 ±1.8)	%	
Γ_{14}	$\pi^+\pi^- K^+ K^-$	(1.5 ±0.6)	%	
Γ_{15}	$2(K^+ K^-)$	(1.5 ±0.7)	$\times 10^{-3}$	
Γ_{16}	$2(\pi^+\pi^-)$	(1.20±0.30)	%	
Γ_{17}	$p\overline{p}$	(1.3 ±0.4)	$\times 10^{-3}$	
Γ_{18}	$K\overline{K}\eta$	< 3.1	%	90%
Γ_{19}	$\pi^+\pi^- p\overline{p}$	< 1.2	%	90%
Γ_{20}	$\Lambda\overline{\Lambda}$	< 2	$\times 10^{-3}$	90%
	Radiative decays			
Γ_{21}	$\gamma\gamma$	(4.3 ±1.5)	$\times 10^{-4}$	

$\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$ Γ_{21}

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
7.4± 0.9± 2.1 OUR EVALUATION					Treating systematic errors as corrected.
$7.0^{+\ 1.0}_{-\ 0.9}$ OUR AVERAGE					
13.9± 2.0± 3.0	41	[19] ABDALLAH	03J	DLPH	$\gamma\gamma \to \eta_c$

$3.8^{+\ 1.1+\ 1.9}_{-\ 1.0-\ 1.0}$	190	[11] AMBROGIANI	03	E835	$\overline{p}p \to \eta_c \to \gamma\gamma$
$7.6 \pm 0.8 \pm 2.3$		[12] BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
$6.9 \pm 1.7 \pm 2.1$	76	[13] ACCIARRI	99T	L3	$e^+e^- \to e^+e^- \eta_c$
$27 \pm 16 \pm 10$	5	[12] SHIRAI	98	AMY	58 e^+e^-
$6.7^{+\ 2.4}_{-\ 1.7} \pm 2.3$		[14] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
11.3 ± 4.2		[15] ALBRECHT	94H	ARG	$e^+e^- \to e^+e^- \eta_c$
$5.9^{+\ 2.1}_{-\ 1.8} \pm 1.9$		[11] CHEN	90B	CLEO	$e^+e^- \to e^+e^- \eta_c$
$6.4^{+\ 5.0}_{-\ 3.4}$		[16] AIHARA	88D	TPC	$e^+e^- \to e^+e^- X$
$4.3^{+\ 3.4}_{-\ 3.7} \pm 2.4$		[14] BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
28 ± 15		[12,17] BERGER	86	PLUT	$\gamma\gamma \to K\overline{K}\pi$

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

$8.0 \pm 2.3 \pm 2.4$	17	[18] ADRIANI	93N	L3	$e^+e^- \to e^+e^- \eta_c$

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

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

[13] Normalized to the sum of 9 branching ratios.

[14] Normalized to $B(\eta_c \to p\overline{p}) = (1.2 \pm 0.4) \times 10^{-3}$.

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

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

[17] Re-evaluated by AIHARA 88D.

[18] Superseded by ACCIARRI 99T.

[19] Average of $K^0_S K^\pm \pi^\mp$, $\pi^+\pi^- K^+K^-$, and $2(K^+K^-)$ decay modes.

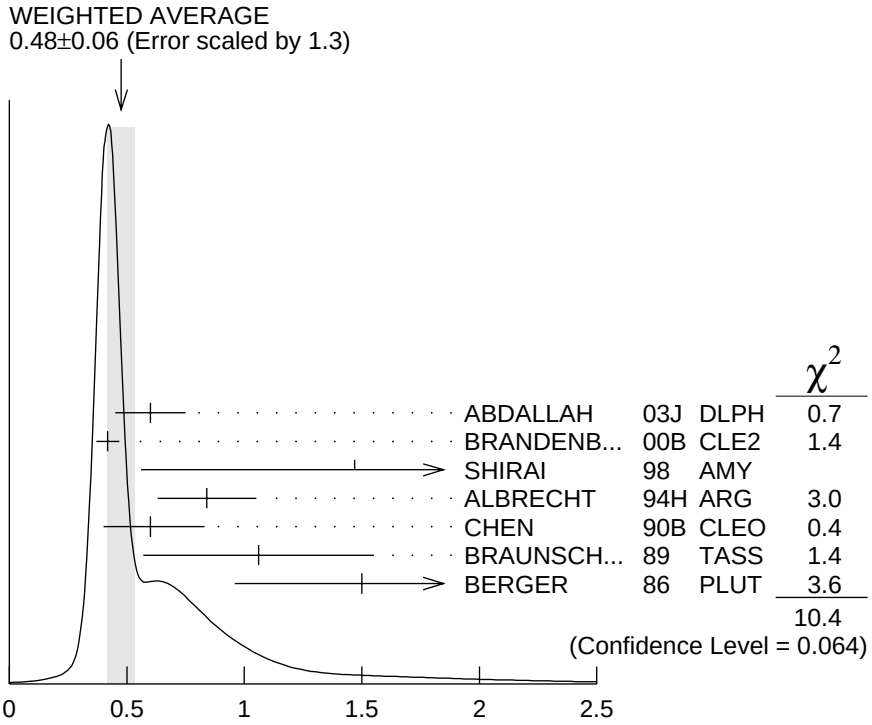
$\eta_c(1S)$ Γ(i)Γ(γγ)/Γ(total)

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{12}\Gamma_{21}/\Gamma$

VALUE (keV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.48 ±0.06 OUR AVERAGE			Error includes scale factor of 1.3. See the ideogram below.			
$0.60 \pm 0.12 \pm 0.09$		41	[20,21] ABDALLAH	03J	DLPH	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
$0.418 \pm 0.044 \pm 0.022$			[21] BRANDENB...	00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
$1.47 \pm 0.87 \pm 0.27$			[21] SHIRAI	98	AMY	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$
0.84 ± 0.21			[21] ALBRECHT	94H	ARG	$\gamma\gamma \to K^\pm K^0_S \pi^\mp$
$0.60\ ^{+0.23}_{-0.20}$			[21] CHEN	90B	CLEO	$\gamma\gamma \to \eta_c K^\pm K^0_S \pi^\mp$
$1.06 \pm 0.41 \pm 0.27$		11	[21] BRAUNSCH...	89	TASS	$\gamma\gamma \to K\overline{K}\pi$
$1.5\ ^{+0.60}_{-0.45} \pm 0.3$		7	[21] BERGER	86	PLUT	$\gamma\gamma \to K\overline{K}\pi$

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

<0.63	95	[21] BEHREND	89	CELL	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$	
<4.4	95	ALTHOFF	85B	TASS	$\gamma\gamma \to K\overline{K}\pi$	



$\Gamma\left(K\overline{K}\pi\right) \times \Gamma\left(\gamma\gamma\right)/\Gamma_{\text{total}}$ $\Gamma_{12}\Gamma_{21}/\Gamma$

$\Gamma(\pi^+\pi^- K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{14}\Gamma_{21}/\Gamma$

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.21±0.07 OUR AVERAGE					
0.28±0.10±0.06	42	[22] ABDALLAH	03J	DLPH	$\gamma\gamma \to \pi^+\pi^- K^+ K^-$
0.17±0.08±0.02	13.9± 6.6	ALBRECHT	94H	ARG	$\gamma\gamma \to \pi^+\pi^- K^+ K^-$

$\Gamma(2(K^+ K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{15}\Gamma_{21}/\Gamma$

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.28 ±0.07 OUR AVERAGE					
0.35 ±0.09 ±0.06	46	[23] ABDALLAH	03J	DLPH	$\gamma\gamma \to 2(K^+ K^-)$
0.231±0.090±0.023	9.1 ± 3.3	[24] ALBRECHT	94H	ARG	$\gamma\gamma \to 2(K^+ K^-)$

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{16}\Gamma_{21}/\Gamma$

VALUE (keV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.18±0.07±0.02	21.4± 8.6	ALBRECHT	94H	ARG	$\gamma\gamma \to 2(\pi^+\pi^-)$

[20] Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \to K^0_S K^\pm \pi^\mp) = (1.5 \pm 0.4)\%$.

[21] We have multiplied $K^\pm K^0_S \pi^\mp$ measurement by 3 to obtain $K\overline{K}\pi$.

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

[23] Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \to)\ 2(K^+K^-) = (2.1 \pm 1.2)\%$.
[24] Incudes all topological modes except $\eta_c \to \ \phi\phi$.

$\eta_c(1S)$ 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	[25] 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
26 ± 9 OUR EVALUATION			(Treating systematicerrors as correlated.)			
25 ± 8 OUR AVERAGE						
26.0± 2.4±8.8		113	[25] BISELLO	91	DM2	$J/\psi \to \ \gamma\rho^0\rho^0$
23.6±10.6±8.2		32	[25] BISELLO	91	DM2	$J/\psi \to \ \gamma\rho^+\rho^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<14	90		[25] BALTRUSAIT..86		MRK3	$J/\psi \to \ \eta_c\gamma$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.02 ±0.007	63	[25] 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
85±31 OUR AVERAGE					
82±28±27	14	[25] BISELLO	91	DM2	$e^+e^- \to \gamma K^+K^-\pi^+\pi^-$
90±50	9	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \ \eta_c\gamma$

$\Gamma(K^*(892)\overline{K} + \text{c.c.})/\Gamma_{total}$ **Γ_9/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	[25] BISELLO	91	DM2	$J/\psi \to \ \gamma K^+K^-\pi^0$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{2.9^{+0.9}_{-0.8}\pm1.1}$	$14.1^{+4.4}_{-3.7}$	[26] HUANG	03	BELL	$B^+ \to (\phi K^+K^-)\ K^+$

$\Gamma(\phi\phi)/\Gamma_{total}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
26± 9 OUR EVALUATION (Treating systematic errors as correlated.)					
28± 5 OUR AVERAGE					
26± 9	357 ± 64	[25] BAI	04	BES	$J/\psi \to \gamma K^+K^-K^+K^-$
$18^{+\ 8}_{-\ 6}\pm 7$	$7.0^{+3.0}_{-2.3}$	[26] HUANG	03	BELL	$B^+ \to (\phi\phi)\ K^+$
31± 7±10	19	[25] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^+K^-$
$30^{+18}_{-12}\pm 10$	5	[25] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-K^0_SK^0_L$
74±18±24	80	[25] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^+K^-$
67±21±24		[25] BAI	90B	MRK3	$J/\psi \to \gamma K^+K^-K^0_SK^0_L$

$\Gamma(a_0(980)\pi)/\Gamma_{total}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.02	90	[25,27] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$

$\Gamma(a_2(1320)\pi)/\Gamma_{total}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.02	90	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$

$\Gamma(f_2(1270)\eta)/\Gamma_{total}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.011	90	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$

$\Gamma(\omega\omega)/\Gamma_{total}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.0031	90	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.0063		[25] BISELLO	91	DM2	$J/\psi \to \gamma\omega\omega$

$\Gamma(K\overline{K}\pi)/\Gamma_{total}$ Γ_{12}/Γ

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.057 ±0.016 OUR EVALUATION (Treating systematic errors as correlated.)						
0.056 ±0.008 OUR AVERAGE						
0.051 ±0.021		609± 71	[25] BAI	04	BES	$J/\psi \to \gamma K^\pm\pi^\mp K^0_S$
0.0690±0.0142±0.0132		33	[25] BISELLO	91	DM2	$J/\psi \to \gamma K^+K^-\pi^0$
0.0543±0.0094±0.0094		68	[25] BISELLO	91	DM2	$J/\psi \to \gamma K^\pm\pi^\mp K^0_S$
0.048 ±0.017		95	[25,28] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$
$0.161\ ^{+0.092}_{-0.073}$			[29] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.107	90		[25] PARTRIDGE	80B	CBAL	$J/\psi \to \eta_c\gamma$

$\Gamma(\eta\pi\pi)/\Gamma_{total}$ Γ_{13}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.049±0.018 OUR EVALUATION					
0.047±0.015 OUR AVERAGE					
0.054±0.020	75	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$
0.037±0.013±0.020	18	[25] PARTRIDGE	80B	CBAL	$J/\psi \to \eta\pi^+\pi^-\gamma$

$\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{total}$ Γ_{14}/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	[25] BAI	04	BES	$J/\psi \to \gamma K^+K^-\pi^+\pi^-$
0.021 ±0.007	110	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$
$0.014\ ^{+0.022}_{-0.009}$		[29] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ Γ_{16}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.012 ±0.003 OUR EVALUATION					
0.0115±0.0026 OUR AVERAGE					
0.010 ±0.005	542 ± 75	[25] BAI	04	BES	$J/\psi \to \gamma 2(\pi^+\pi^-)$
0.0105±0.0017±0.0034	137	[25] BISELLO	91	DM2	$J/\psi \to \gamma 2\pi^+2\pi^-$
0.013 ±0.006	25	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$
$0.020\ ^{+0.015}_{-0.010}$		[29] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(2(K^+K^-))/\Gamma_{total}$ Γ_{15}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0015±0.0007 OUR AVERAGE					
$0.0014\ ^{+0.0005}_{-0.0004}\pm0.0006$	$14.5\ ^{+4.6}_{-3.0}$	[26] HUANG	03	BELL	$B^+ \to 2(K^+K^-)K^+$
0.021 ±0.010 ±0.006		[30] ALBRECHT	94H	ARG	$\gamma\gamma \to K^+K^-K^+K^-$

$\Gamma(p\overline{p})/\Gamma_{total}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
13 ± 4 OUR EVALUATION		(Treating systematic errors as correlated.)			
12.5± 3.2 OUR AVERAGE					
15 ± 6	213 ± 33	[25] BAI	04	BES	$J/\psi \to \gamma p\overline{p}$
10 ± 3 ±4	18	[25] BISELLO	91	DM2	$J/\psi \to \gamma p\overline{p}$
11 ± 6	23	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$
$29\ ^{+29}_{-15}$		[29] HIMEL	80B	MRK2	$\psi(2S) \to \eta_c\gamma$

$\Gamma(K\overline{K}\eta)/\Gamma_{total}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.031	90	[25] BALTRUSAIT..86		MRK3	$J/\psi \to \eta_c\gamma$

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

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

$\Gamma(\Lambda\overline{\Lambda})/\Gamma_{total}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.002	90	[25] BISELLO	91	DM2	$e^+e^- \to \gamma\Lambda\overline{\Lambda}$

$\Gamma_i\Gamma_f/\Gamma^2_{total}$ in $p\overline{p} \to \eta_c(1S) \to \phi\phi$ $\Gamma_{17}\Gamma_6/\Gamma^2$

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

[25] 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.

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

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

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

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

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

RADIATIVE DECAYS

$\Gamma(\gamma\gamma)/\Gamma_{total}$ Γ_{21}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.80^{+0.67}_{-0.58} \pm 1.0$		[31] ARMSTRONG	95F	E760	$\overline{p}p \to \gamma\gamma$
< 9	90	[25] BISELLO	91	DM2	$J/\psi \to \gamma\gamma\gamma$
$6^{+4}_{-3} \pm 4$		[31] BAGLIN	87B	SPEC	$\overline{p}p \to \gamma\gamma$
<18	90	[32] BLOOM	83	CBAL	$J/\psi \to \eta_c\gamma$

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

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

$\Gamma_i\Gamma_f/\Gamma^2_{total}$ in $p\overline{p} \to \eta_c(1S) \to \gamma\gamma$ $\Gamma_{17}\Gamma_{21}/\Gamma^2$

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	$\overline{p}p \to \gamma\gamma$

$\eta_c(1S)$ REFERENCES

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.)
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+)

OTHER RELATED PAPERS

ARMSTRONG	89	PL B221 216	T.A. Armstrong *et al.*	(CERN, CDEF, BIRM+)