

$\eta_c(2S)$

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

Quantum numbers are quark model predictions.

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3638.9 ± 1.3 OUR AVERAGE				
3638.5 ± 1.5 ± 0.8	624	¹ DEL-AMO-SA..11M BABR		$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5 ± 3.2 ± 2.5	1201	¹ DEL-AMO-SA..11M BABR		$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
3636.1 ^{+3.9+0.7} _{-4.2-2.0}	128	² VINOKUROVA 11 BELL		$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
3626 ± 5 ± 6	311	³ ABE 07 BELL		$e^+ e^- \rightarrow J/\psi c\bar{c}$
3645.0 ± 5.5 ^{+4.9} _{-7.8}	121 ± 27	AUBERT 05C BABR		$e^+ e^- \rightarrow J/\psi c\bar{c}$
3642.9 ± 3.1 ± 1.5	61	ASNER 04 CLEO		$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3639 ± 7	98 ± 52	⁴ AUBERT 06E BABR		$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
3630.8 ± 3.4 ± 1.0	112 ± 24	⁵ AUBERT 04D BABR		$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
3654 ± 6 ± 8	39 ± 11	⁶ CHOI 02 BELL		$B \rightarrow K K_S K^- \pi^+$
3594 ± 5		⁷ EDWARDS 82C CBAL		$e^+ e^- \rightarrow \gamma X$

¹ Ignoring possible interference with continuum.² Accounts for interference with non-resonant continuum.³ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.⁴ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.⁵ Superseded by DEL-AMO-SANCHEZ 11M.⁶ Superseded by VINOKUROVA 11.⁷ Assuming mass of $\psi(2S) = 3686$ MeV.

$\eta_c(2S)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
10 ± 4 OUR AVERAGE					
13.4 ± 4.6 ± 3.2		624	⁸ DEL-AMO-SA..11M BABR		$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
6.6 ^{+8.4+2.6} _{-5.1-0.9}		128	⁹ VINOKUROVA 11 BELL		$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
6.3 ± 12.4 ± 4.0		61	ASNER 04 CLEO		$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<23	90	98 ± 52	¹⁰ AUBERT 06E BABR		$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
22 ± 14		121 ± 27	AUBERT 05C BABR		$e^+ e^- \rightarrow J/\psi c\bar{c}$
17.0 ± 8.3 ± 2.5		112 ± 24	¹¹ AUBERT 04D BABR		$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
<55	90	39 ± 11	¹² CHOI 02 BELL		$B \rightarrow K K_S K^- \pi^+$
<8.0	95		¹³ EDWARDS 82C CBAL		$e^+ e^- \rightarrow \gamma X$

- ⁸ Ignoring possible interference with continuum.
⁹ Accounts for interference with non-resonant continuum.
¹⁰ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.
¹¹ Superseded by DEL-AMO-SANCHEZ 11M.
¹² For a mass value of 3654 ± 6 MeV. Superseded by VINOKUROVA 11.
¹³ For a mass value of 3594 ± 5 MeV

$\eta_c(2S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	not seen	
Γ_2 $K\bar{K}\pi$	$(1.9 \pm 1.2) \%$	
Γ_3 $2\pi^+ 2\pi^-$	not seen	
Γ_4 $\rho^0 \rho^0$	not seen	
Γ_5 $3\pi^+ 3\pi^-$	not seen	
Γ_6 $K^+ K^- \pi^+ \pi^-$	not seen	
Γ_7 $K^{*0} \bar{K}^{*0}$	not seen	
Γ_8 $K^+ K^- \pi^+ \pi^- \pi^0$	$(1.4 \pm 1.0) \%$	
Γ_9 $K^+ K^- 2\pi^+ 2\pi^-$	not seen	
Γ_{10} $K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	not seen	
Γ_{11} $2K^+ 2K^-$	not seen	
Γ_{12} $\phi\phi$	not seen	
Γ_{13} $\rho\bar{\rho}$		
Γ_{14} $\gamma\gamma$	$< 5 \times 10^{-4}$	90%
Γ_{15} $\pi^+ \pi^- \eta$	not seen	
Γ_{16} $\pi^+ \pi^- \eta'$	not seen	
Γ_{17} $K^+ K^- \eta$	not seen	
Γ_{18} $\pi^+ \pi^- \eta_c(1S)$	not seen	

$\eta_c(2S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$				Γ_{14}
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	

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

1.3 ± 0.6 ¹⁴ ASNER 04 CLEO $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$

¹⁴ They measure $\Gamma(\eta_c(2S)\gamma\gamma) B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (0.18 \pm 0.05 \pm 0.02) \Gamma(\eta_c(1S)\gamma\gamma) B(\eta_c(1S) \rightarrow K\bar{K}\pi)$. The value for $\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)$ is derived assuming that the branching fractions for $\eta_c(2S)$ and $\eta_c(1S)$ decays to $K_S K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV.

$\eta_c(2S)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(2\pi^+ 2\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_3 \Gamma_{14}/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<6.5	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(\pi^+ \pi^-)$

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{14}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
41±4±6	624	¹⁵ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

¹⁵ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_{14}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	UEHARA 08	BELL	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_8\Gamma_{14}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
30±6±5	1201	¹⁶ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

¹⁶ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

$\Gamma(2K^+2K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{11}\Gamma_{14}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	UEHARA 08	BELL	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(K^+K^-)$

$\eta_c(2S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma^2(\text{total})$

$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{13}/\Gamma \times \Gamma_{14}/\Gamma$

VALUE (units 10 ⁻⁸)	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6	90 ^{17,18,19}	AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$

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

< 8.0 90^{17,18,20} AMBROGIANI 01 E835 $\bar{p}p \rightarrow \gamma\gamma$

<12.0 90 18,20 AMBROGIANI 01 E835 $\bar{p}p \rightarrow \gamma\gamma$

¹⁷ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.

¹⁸ For a total width $\Gamma=5$ MeV.

¹⁹ For the resonance mass region 3589–3599 MeV/ c^2 .

²⁰ For the resonance mass region 3575–3660 MeV/ c^2 .

$\eta_c(2S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABREU 980	DLPH	$e^+e^- \rightarrow e^+e^- + \text{hadrons}$

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

seen ²¹ EDWARDS 82C CBAL $e^+e^- \rightarrow \gamma X$

²¹ For a mass value of 3594 ± 5 MeV

$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.4±1.1	59 ± 12	²² AUBERT 08AB	BABR	$B \rightarrow \eta_c(2S)K \rightarrow K\bar{K}\pi K$

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

seen 39 ± 11 ²³ CHOI 02 BELL $B \rightarrow K K_S K^- \pi^+$

²² Derived from a measurement of $[B(B^+ \rightarrow \eta_c(2S)K^+) \times B(\eta_c(2S) \rightarrow K\bar{K}\pi)] / [B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (9.6_{-1.9}^{+2.0} \pm 2.5)\%$ and using $B(B^+ \rightarrow \eta_c(2S)K^+) = (3.4 \pm 1.8) \times 10^{-4}$, and $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77_{-0.66}^{+0.55}) \times 10^{-5}$.

²³ For a mass value of 3654 ± 6 MeV

$\Gamma(2\pi^+2\pi^-)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S)$	

$\Gamma(\rho^0\rho^0)/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	ABLIKIM	11H	BES3 $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$	

$\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$				Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S)$	

$\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\bar{K}\pi)$				Γ_8/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.73±0.17±0.17	1201	²⁴ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

²⁴ We have multiplied the value of $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\bar{K}\pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

$\Gamma(K^*0\bar{K}^*0)/\Gamma_{\text{total}}$				Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	ABLIKIM	11H	BES3 $\psi(2S) \rightarrow \gamma K^+K^-\pi^+\pi^-$	

$\Gamma(2K^+2K^-)/\Gamma_{\text{total}}$				Γ_{11}/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S)$	

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$				Γ_{12}/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	ABLIKIM	11H	BES3 $\psi(2S) \rightarrow \gamma K^+K^-K^+K^-$	

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				Γ_{14}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5 × 10⁻⁴	90	²⁵ WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma\gamma$

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

not seen		AMBROGIANI	01	E835	$\bar{p}p \rightarrow \gamma\gamma$
<0.01	90	LEE	85	CBAL	$\psi' \rightarrow \text{photons}$

²⁵ WICHT 08 reports $[\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c(2S)K^+)] < 0.18 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c(2S)K^+) = 3.4 \times 10^{-4}$.

$\eta_c(2S)$ CROSS-PARTICLE BRANCHING RATIOS

$$\Gamma(\eta_c(2S) \rightarrow 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.6 \times 10^{-6}$	90	²⁶ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

²⁶ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\Gamma(\eta_c(2S) \rightarrow \rho^0 \rho^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<12.7 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

$$\Gamma(\eta_c(2S) \rightarrow 3\pi^+ 3\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<13.2 \times 10^{-6}$	90	²⁷ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

²⁷ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \quad \Gamma_6 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.6 \times 10^{-6}$	90	²⁸ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

²⁸ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\Gamma(\eta_c(2S) \rightarrow K^{*0} \bar{K}^{*0}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \quad \Gamma_7 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<19.6 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \quad \Gamma_8 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<43.0 \times 10^{-6}$	90	²⁹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

²⁹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma \times \Gamma_{113}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	³⁰ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$

³⁰ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\frac{\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}}{\Gamma_{10}/\Gamma \times \Gamma_{113}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<15.2 \times 10^{-6}$	90	³¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

³¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\frac{\Gamma(\eta_c(2S) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}}{\Gamma_{12}/\Gamma \times \Gamma_{113}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.8 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

$$\frac{\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}}{\Gamma_{15}/\Gamma \times \Gamma_{113}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.3 \times 10^{-6}$	90	³² CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$

³² Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\frac{\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta')/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}}{\Gamma_{16}/\Gamma \times \Gamma_{113}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.2 \times 10^{-6}$	90	³³ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta'$

³³ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\frac{\Gamma(\eta_c(2S) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}}{\Gamma_{17}/\Gamma \times \Gamma_{113}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.9 \times 10^{-6}$	90	³⁴ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$

³⁴ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$$\frac{\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}}{\Gamma_{18}/\Gamma \times \Gamma_{113}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-4}$	90	³⁵ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta_c(1S)$

³⁵ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

$\eta_c(2S)$ REFERENCES

ABLIKIM	11H	PR D84 091102	M. Ablikim <i>et al.</i>	(BES III Collab.)
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
CRONIN-HEN...	10	PR D81 052002	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)
AUBERT	08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	05C	PR D72 031101R	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
CHOI	02	PRL 89 102001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
AMBROGIANI	01	PR D64 052003	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
LEE	85	SLAC 282	R.A. Lee	(SLAC)
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
