NODE=M059

$\eta_c(2S)$

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

Quantum numbers are quark model predictions.

NODE=M059

$\eta_c(2S)$ MASS

NODE=M059M

NODE=M059M

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
3637.8 ±0.6 OUR AVERAGE		Error includes scale factor of 1.1.			
3637.8 ±0.8 ±0.2	1.6k	ABLIKIM	24J	BES3	$\psi(2S) \to \gamma\eta_c \to \gamma K\overline{K}\pi$
3637.90±0.54±1.40	3.7k	AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$
3643.4 ±2.3 ±4.4	569	ABLIKIM	22Q	BES3	$\psi(2S) \to \gamma 3(\pi^+\pi^-)$
3635.1 ±3.7 ±2.9	106	XU	18	BELL	$e^+e^- \to e^+e^-\eta'\pi^+\pi^-$
3633.6 ±1.7 ±0.6	106	[1] AAIJ	17AD	LHCB	$pp \to B^+X \to p\overline{p}K^+X$
3636.4 ±4.1 ±0.7	365	[2] AAIJ	17BB	LHCB	$pp \to b\overline{b}X \to 2(K^+K^-)X$
3637.0 ±5.7 ±3.4	178	[3,4] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\pi^0$
3635.1 ±5.8 ±2.1	47	[3,5] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\eta$
3646.9 ±1.6 ±3.6	57	ABLIKIM	13K	BES3	$\psi(2S) \to \gamma K^0_S K^\pm\pi^\mp\pi^+\pi^-$
3637.6 ±2.9 ±1.6	127	[6] ABLIKIM	12G	BES3	$\psi(2S) \to \gamma K^0 K\pi$, $KK\pi^0$
3638.5 ±1.5 ±0.8	624	[3] DEL-AMO-SA...	11M	BABR	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$
3640.5 ±3.2 ±2.5	1201	[3] DEL-AMO-SA...	11M	BABR	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$
3636.1 $^{+3.9}_{-4.2}$ $^{+0.7}_{-2.0}$	128	[7] VINOKUROVA	11	BELL	$B^\pm \to K^\pm(K^0_S K^\pm\pi^\mp)$
3626 ±5 ±6	311	[8] ABE	07	BELL	$e^+e^- \to J/\psi(c\overline{c})$
3645.0 ±5.5 $^{+4.9}_{-7.8}$	121	AUBERT	05C	BABR	$e^+e^- \to J/\psi c\overline{c}$
3642.9 ±3.1 ±1.5	61	ASNER	04	CLEO	$\gamma\gamma \to \eta'_c \to K^0_S K^\pm\pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3639 ±7	98	[9] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$
3630.8 ±3.4 ±1.0	112	[10] AUBERT	04D	BABR	$\gamma\gamma \to \eta_c(2S) \to K\overline{K}\pi$
3654 ±6 ±8	39	[11] CHOI	02	BELL	$B \to KK_S K^-\pi^+$
3594 ±5		[12] EDWARDS	82C	CBAL	$e^+e^- \to \gamma X$

OCCUR=2

OCCUR=2

[1] AAIJ 17AD report $m_{\psi(2S)} - m_{\eta_c(2S)} = 52.5 \pm 1.7 \pm 0.6$ MeV. We use the current value $m_{\psi(2S)} = 3686.097 \pm 0.025$ MeV to obtain the quoted mass. NODE=M059M;LINKAGE=B

[2] From a fit of the $\phi\phi$ invariant mass with the width of $\eta_c(2S)$ fixed to the PDG 16 value. NODE=M059M;LINKAGE=C

[3] Ignoring possible interference with continuum. NODE=M059M;LINKAGE=DE

[4] With a width fixed to 11.3 MeV. NODE=M059M;LINKAGE=LE

[5] With a width fixed to 11.3 MeV. Using both $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays. NODE=M059M;LINKAGE=LS

[6] From a simultaneous fit to $K^0_S K^\pm\pi^\mp$ and $K^+K^-\pi^0$ decay modes. NODE=M059M;LINKAGE=AB

[7] Accounts for interference with non-resonant continuum. NODE=M059M;LINKAGE=VA

[8] From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G. NODE=M059M;LINKAGE=EB

[9] From the fit of the kaon momentum spectrum. Systematic errors not evaluated. NODE=M059M;LINKAGE=AU

[10] Superseded by DEL-AMO-SANCHEZ 11M. NODE=M059M;LINKAGE=AR

[11] Superseded by VINOKUROVA 11. NODE=M059M;LINKAGE=CH

[12] Assuming mass of $\psi(2S) = 3686$ MeV. NODE=M059M;LINKAGE=A

$\eta_c(2S)$ WIDTH

NODE=M059W

NODE=M059W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
11.6 ± 1.4 OUR AVERAGE						
10.5 ± 1.7 ±3.5		1.6k	ABLIKIM	24J	BES3	$\psi(2S) \to \gamma\eta_c \to \gamma K\overline{K}\pi$
10.77± 1.62±1.08		3.7k	AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$
19.8 ± 3.9 ±3.1		569	ABLIKIM	22Q	BES3	$\psi(2S) \to \gamma 3(\pi^+\pi^-)$
9.9 ± 4.8 ±2.9		57	ABLIKIM	13K	BES3	$\psi(2S) \to \gamma K^0_S K^\pm\pi^\mp\pi^+\pi^-$

16.9 $\pm$ 6.4 $\pm$4.8		127	[1] ABLIKIM	12G	BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi$, $K K \pi^0$	
13.4 $\pm$ 4.6 $\pm$3.2		624	[2] DEL-AMO-SA...	11M	BABR	$\gamma\gamma \rightarrow K^0_S K^{\pm} \pi^{\mp}$	
6.6 $^{+8.4}_{-5.1}$ $^{+2.6}_{-0.9}$		128	[3] VINOKUROVA	11	BELL	$B^{\pm} \rightarrow K^{\pm}(K^0_S K^{\pm} \pi^{\mp})$	
6.3 $\pm$12.4 $\pm$4.0		61	ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow K^0_S K^{\pm} \pi^{\mp}$	

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

< 23	90	98	[4] AUBERT	06E	BABR	$B^{\pm} \rightarrow K^{\pm} X_{c\overline{c}}$
22 $\pm$14		121	AUBERT	05C	BABR	$e^+ e^- \rightarrow J/\psi c \overline{c}$
17.0 $\pm$ 8.3 $\pm$2.5		112	[5] AUBERT	04D	BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K \overline{K} \pi$
<55	90	39	[6] CHOI	02	BELL	$B \rightarrow K K_S K^- \pi^+$
<8.0	95		[7] EDWARDS	82C	CBAL	$e^+ e^- \rightarrow \gamma X$

[1] From a simultaneous fit to $K^0_S K^{\pm} \pi^{\mp}$ and $K^+ K^- \pi^0$ decay modes. NODE=M059W;LINKAGE=AB
[2] Ignoring possible interference with continuum. NODE=M059W;LINKAGE=DE
[3] Accounts for interference with non-resonant continuum. NODE=M059W;LINKAGE=VA
[4] From the fit of the kaon momentum spectrum. Systematic errors not evaluated. NODE=M059W;LINKAGE=AU
[5] Superseded by DEL-AMO-SANCHEZ 11M. NODE=M059W;LINKAGE=AR
[6] For a mass value of 3654 $\pm$ 6 MeV. Superseded by VINOKUROVA 11. NODE=M059W;LINKAGE=W2
[7] For a mass value of 3594 $\pm$ 5 MeV NODE=M059W;LINKAGE=W

$\eta_c(2S)$ DECAY MODES

NODE=M059215;NODE=M059

	Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1	hadrons	seen		DESIG=1;OUR EST;→ UNCHECKED ←
Γ_2	$K \overline{K} \pi$	$(1.9^{+1.2}_{-1.0})$ %		DESIG=4
Γ_3	$K \overline{K} \eta$	$(7\ ^{+5}_{-4}) \times 10^{-3}$		DESIG=20
Γ_4	$K \overline{K} \eta'$	$(2.1\pm1.6) \times 10^{-3}$		DESIG=35
Γ_5	$2\pi^+ 2\pi^-$	$< 2.6 \times 10^{-3}$	90%	DESIG=5
Γ_6	$a_0(1450)\pi$	seen		DESIG=27
Γ_7	$a_2(1700)\pi$	seen		DESIG=28
Γ_8	$a_0(1710)\pi$	seen		DESIG=26
Γ_9	$\rho^0 \rho^0$	$< 2.3 \times 10^{-3}$	90%	DESIG=16
Γ_{10}	$3\pi^+ 3\pi^-$	$(1.7^{+0.9}_{-1.1})$ %		DESIG=8
Γ_{11}	$K^+ K^- \pi^+ \pi^-$	$< 2.5 \times 10^{-3}$	90%	DESIG=6
Γ_{12}	$K^{*0} \overline{K}^{*0}$	$< 4 \times 10^{-3}$	90%	DESIG=17
Γ_{13}	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.5^{+1.0}_{-0.9})$ %		DESIG=9
Γ_{14}	$K^+ K^- 2\pi^+ 2\pi^-$	< 1.8 %	90%	DESIG=10
Γ_{15}	$K^0_S K^- 2\pi^+ \pi^- +$ c.c.	$(1.4^{+0.8}_{-1.0})$ %		DESIG=11
Γ_{16}	$2K^+ 2K^-$	$< 1.4 \times 10^{-3}$	90%	DESIG=7
Γ_{17}	$K^*_2(1430)\overline{K} +$ c.c.	seen		DESIG=24
Γ_{18}	$K^*_0(1950)\overline{K} +$ c.c.	seen		DESIG=25
Γ_{19}	$K^*_0(2600)\overline{K} +$ c.c.	seen		DESIG=29
Γ_{20}	$\phi\phi$	$< 1.4 \times 10^{-3}$	90%	DESIG=18
Γ_{21}	$\omega\omega$	$< 1.9 \times 10^{-3}$	90%	DESIG=33
Γ_{22}	$\omega\phi$	$< 3.4 \times 10^{-4}$	90%	DESIG=34
Γ_{23}	$p\overline{p}$	$< 3.2 \times 10^{-4}$	90%	DESIG=3
Γ_{24}	$p\overline{p}\pi^+\pi^-$	seen		DESIG=22
Γ_{25}	$p\overline{p}K^+K^-$	$(3.6\pm2.9) \times 10^{-4}$		DESIG=30
Γ_{26}	$\gamma\gamma$	$(1.8^{+1.0}_{-1.1}) \times 10^{-4}$		DESIG=2
Γ_{27}	$\gamma J/\psi(1S)$	< 1.8 %	90%	DESIG=21
Γ_{28}	$\pi^+\pi^-\eta$	$(5.5^{+3.3}_{-4.0}) \times 10^{-3}$		DESIG=12
Γ_{29}	$2\pi^+ 2\pi^- \eta$	$(1.6^{+0.9}_{-1.0})$ %		DESIG=31
Γ_{30}	$\pi^+\pi^-\eta'$	$(2.7^{+2.0}_{-1.8}) \times 10^{-3}$		DESIG=13
Γ_{31}	$\pi^+\pi^-\eta_c(1S)$	< 4 %	90%	DESIG=15

FIT INFORMATION

A multiparticle fit to $\eta_c(2S)$ and $\psi(2S)$ with 4 branching ratios uses 5 measurements to determine 3 parameters. The overall fit has a $\chi^2 = 2.6$ for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle\delta x_i \delta x_j\right\rangle/(\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{total}$.

x_3	92
	x_2

$\eta_c(2S)$ PARTIAL WIDTHS

NODE=M059216

$\Gamma(\gamma\gamma)$ — Γ_{26}

NODE=M059W1
NODE=M059W1

VALUE (keV)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.44 ± 0.14	106	[1] XU	18	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
1.3 ± 0.6		[2] ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c' \rightarrow K_S^0 K^\pm \pi^\mp$

[1] Assuming that the branching fraction into $\eta' \pi^+ \pi^-$ is the same as for $\eta_c(1S)$.

NODE=M059W1;LINKAGE=A

[2] They measure $\Gamma(\eta_c(2S)\gamma\gamma)$ B$(\eta_c(2S) \rightarrow K\overline{K}\pi) = (0.18 \pm 0.05 \pm 0.02)$ $\Gamma(\eta_c(1S)\gamma\gamma)$ B$(\eta_c(1S) \rightarrow K\overline{K}\pi)$. 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.

NODE=M059W1;LINKAGE=AS

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

NODE=M059218

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_2\Gamma_{26}/\Gamma$

NODE=M059G04
NODE=M059G04

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
39 ±6 OUR AVERAGE					
$41 \pm 4 \pm 6$	624	DEL-AMO-SA..11M		BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
$33.6 \pm 7.2 \pm 8.1$		[1] NAKAZAWA	08	BELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

[1] NAKAZAWA 08 reports B$(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp) \times \Gamma(\gamma\gamma) = 11.2 \pm 2.4 \pm 2.7$ eV which we multiplied by 3 to account for isospin symmetry.

NODE=M059G04;LINKAGE=A

$\Gamma(2\pi^+ 2\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_5\Gamma_{26}/\Gamma$

NODE=M059G01
NODE=M059G01

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6.5	90	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(\pi^+\pi^-)$

$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{11}\Gamma_{26}/\Gamma$

NODE=M059G02
NODE=M059G02

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

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{13}\Gamma_{26}/\Gamma$

NODE=M059G05
NODE=M059G05

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

$\Gamma(2K^+ 2K^-) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{16}\Gamma_{26}/\Gamma$

NODE=M059G03
NODE=M059G03

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

$\Gamma(\pi^+ \pi^- \eta') \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{30}\Gamma_{26}/\Gamma$

NODE=M059R29
NODE=M059R29

VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT
$5.6^{+1.2}_{-1.1} \pm 1.1$	106	XU	18	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{31}\Gamma_{26}/\Gamma$

NODE=M059G06
NODE=M059G06

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
<133	90	LEES	12AE	BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

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

NODE=M059217

$\Gamma(p\overline{p})/\Gamma_{total} \times \Gamma(\gamma\gamma)/\Gamma_{total}$ — $\Gamma_{23}/\Gamma \times \Gamma_{26}/\Gamma$

NODE=M059G1
NODE=M059G1

VALUE (units 10^{-8})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6	90	[1,2,3] AMBROGIANI 01	E835	$\overline{p}p \to \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 8.0	90	[1,2,4] AMBROGIANI 01	E835	$\overline{p}p \to \gamma\gamma$
<12.0	90	[2,4] AMBROGIANI 01	E835	$\overline{p}p \to \gamma\gamma$

OCCUR=2
OCCUR=3

[1] Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.
[2] For a total width Γ=5 MeV.
[3] For the resonance mass region 3589–3599 MeV/c^2.
[4] For the resonance mass region 3575–3660 MeV/c^2.

NODE=M059G1;LINKAGE=A
NODE=M059G1;LINKAGE=B
NODE=M059G1;LINKAGE=C1
NODE=M059G1;LINKAGE=C2

$\eta_c(2S)$ BRANCHING RATIOS

NODE=M059220

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

NODE=M059R1
NODE=M059R1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	ABREU 98O	DLPH	$e^+e^- \to e^+e^- + \text{hadrons}$
seen	[1] EDWARDS 82C	CBAL	$e^+e^- \to \gamma X$

[1] For a mass value of 3594 ± 5 MeV

NODE=M059R;LINKAGE=W

$\Gamma(K\overline{K}\pi)/\Gamma_{total}$ — Γ_2/Γ

NODE=M059R3
NODE=M059R3

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.9^{+1.2}_{-1.0}$ OUR FIT				
1.9±0.4±1.1	59 ± 12	[1] AUBERT 08AB	BABR	$B \to \eta_c(2S)K \to K\overline{K}\pi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	127 ± 18	ABLIKIM 12G	BES3	$\psi(2S) \to \gamma K\overline{K}\pi$
seen	39 ± 11	[2] CHOI 02	BELL	$B \to K K_S K^- \pi^+$

[1] Derived from a measurement of $[B(B^+ \to \eta_c(2S)K^+) \times B(\eta_c(2S) \to K\overline{K}\pi)]$ / $[B(B^+ \to \eta_c K^+) \times B(\eta_c \to K\overline{K}\pi)] = (9.6^{+2.0}_{-1.9} \pm 2.5)\%$ and using $B(B^+ \to \eta_c(2S)K^+) = (3.4 \pm 1.8) \times 10^{-4}$, and $[B(B^+ \to \eta_c K^+) \times B(\eta_c \to K\overline{K}\pi)] = (6.88 \pm 0.77^{+0.55}_{-0.66}) \times 10^{-5}$.
[2] For a mass value of 3654 ± 6 MeV

NODE=M059R3;LINKAGE=AU
NODE=M059R;LINKAGE=W2

$\Gamma(K\overline{K}\eta)/\Gamma(K\overline{K}\pi)$ — Γ_3/Γ_2

NODE=M059R26
NODE=M059R26

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
39 ±10 OUR FIT Error includes scale factor of 1.3.				
27.3± 7.0±9.0	225	[1] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\gamma\gamma$

[1] LEES 14E reports $B(\eta_c(2S) \to K^+K^-\eta)/B(\eta_c(2S) \to K^+K^-\pi^0) = 0.82 \pm 0.21 \pm 0.27$, which we divide by 3 to account for isospin symmetry.

NODE=M059R26;LINKAGE=LE

$\Gamma(2\pi^+2\pi^-)/\Gamma_{total}$ — Γ_5/Γ

NODE=M059R01
NODE=M059R01

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	UEHARA 08	BELL	$\gamma\gamma \to \eta_c(2S)$

$\Gamma(a_0(1450)\pi)/\Gamma_{total}$ — Γ_6/Γ

NODE=M059R38
NODE=M059R38

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[1] AAIJ 23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

[1] From a Dalitz plot analysis of $\eta_c(2S) \to K^0_S K^+\pi^-$ + c.c..

NODE=M059R38;LINKAGE=A

$\Gamma(a_2(1700)\pi)/\Gamma_{total}$ — Γ_7/Γ

NODE=M059R39
NODE=M059R39

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[1] AAIJ 23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

[1] From a Dalitz plot analysis of $\eta_c(2S) \to K^0_S K^+\pi^-$ + c.c..

NODE=M059R39;LINKAGE=A

$\Gamma(a_0(1710)\pi)/\Gamma_{total}$ — Γ_8/Γ

NODE=M059R37
NODE=M059R37

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[1] AAIJ 23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

[1] From a Dalitz plot analysis of $\eta_c(2S) \to K^0_S K^+\pi^-$ + c.c..

NODE=M059R37;LINKAGE=A

$\Gamma(\rho^0\rho^0)/\Gamma_{total}$ — Γ_9/Γ

NODE=M059R15
NODE=M059R15

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	ABLIKIM	11H	BES3	$\psi(2S) \to \gamma 2\pi^+ 2\pi^-$

$\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{total}$ — Γ_{11}/Γ

NODE=M059R02
NODE=M059R02

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	UEHARA	08	BELL	$\gamma\gamma \to \eta_c(2S)$

$\Gamma(K^{*0}\overline{K}^{*0})/\Gamma_{total}$ — Γ_{12}/Γ

NODE=M059R16
NODE=M059R16

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	ABLIKIM	11H	BES3	$\psi(2S) \to \gamma K^+K^-\pi^+\pi^-$

$\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\overline{K}\pi)$ — Γ_{13}/Γ_2

NODE=M059R21
NODE=M059R21

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.73\pm0.17\pm0.17$	1201	[1] DEL-AMO-SA..11M		BABR	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$

[1] Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M. 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 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\overline{K}\pi)$.

NODE=M059R21;LINKAGE=DE

$\Gamma(K^0_S K^- 2\pi^+\pi^- + \text{c.c.})/\Gamma_{total}$ — Γ_{15}/Γ

NODE=M059R22
NODE=M059R22

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	57 ± 17	ABLIKIM	13K	BES3	$\psi(2S) \to \gamma K^0_S K^\pm\pi^\mp\pi^+\pi^-$

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

NODE=M059R03
NODE=M059R03

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	UEHARA	08	BELL	$\gamma\gamma \to \eta_c(2S)$

$\Gamma(K_2^*(1430)\overline{K} + \text{c.c.})/\Gamma_{total}$ — Γ_{17}/Γ

NODE=M059R34
NODE=M059R34

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[1] AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

[1] From a Dalitz plot analysis of $\eta_c(2S) \to K^0_S K^+\pi^- +$ c.c..

NODE=M059R34;LINKAGE=A

$\Gamma(K_0^*(1950)\overline{K} + \text{c.c.})/\Gamma_{total}$ — Γ_{18}/Γ

NODE=M059R35
NODE=M059R35

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[1] AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

[1] From a Dalitz plot analysis of $\eta_c(2S) \to K^0_S K^+\pi^- +$ c.c..

NODE=M059R35;LINKAGE=A

$\Gamma(K_0^*(2600)\overline{K} + \text{c.c.})/\Gamma_{total}$ — Γ_{19}/Γ

NODE=M059R40
NODE=M059R40

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[1] AAIJ	23AH	LHCB	$B^+ \to K^+(K^0_S K\pi)$

[1] From a Dalitz plot analysis of $\eta_c(2S) \to K^0_S K^+\pi^- +$ c.c..

NODE=M059R40;LINKAGE=A

$\Gamma(\phi\phi)/\Gamma_{total}$ — Γ_{20}/Γ

NODE=M059R17
NODE=M059R17

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	ABLIKIM	11H	BES3	$\psi(2S) \to \gamma K^+K^-K^+K^-$

$\Gamma(p\overline{p})/\Gamma_{total}$ — Γ_{23}/Γ

NODE=M059R04
NODE=M059R04

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	106	[1] AAIJ	17AD	LHCB	$pp \to B^+X \to p\overline{p}K^+X$

OCCUR=2

[1] AAIJ 17AD report a 6.4 standard deviation signal, with $B(B^+ \to \eta_c(2S)K^+ \to p\overline{p}K^+)/B(B^+ \to J/\psi K^+ \to p\overline{p}K^+) = (1.58 \pm 0.33 \pm 0.09) \times 10^{-2}$.

NODE=M059R04;LINKAGE=A

$\Gamma(p\overline{p}\pi^+\pi^-)/\Gamma_{total}$ Γ_{24}/Γ

NODE=M059R30

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	110	[1] CHILIKIN 19	BELL	$e^+e^- \to \Upsilon(4S)$

[1] CHILIKIN 19 reports signals in $B^+ \to \eta_c(2S)K^+$ and $B^0 \to \eta_c(2S)K^0_S$ with 12.3 and 5.9 standard deviations, respectively.

NODE=M059R30;LINKAGE=A

$\Gamma(\gamma\gamma)/\Gamma_{total}$ Γ_{26}/Γ

NODE=M059R2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<4 \times 10^{-4}$	90	[1] WICHT 08	BELL	$B^\pm \to K^\pm\gamma\gamma$
not seen		AMBROGIANI 01	E835	$\overline{p}p \to \gamma\gamma$
<0.01	90	LEE 85	CBAL	$\psi' \to$ photons

[1] WICHT 08 reports $[\Gamma(\eta_c(2S) \to \gamma\gamma)/\Gamma_{total}] \times [B(B^+ \to \eta_c(2S)K^+)] < 0.18\times10^{-6}$ which we divide by our best (shown rounded) value $B(B^+ \to \eta_c(2S)K^+) = 4.4\times10^{-4}$.

NODE=M059R2;LINKAGE=WI

$\Gamma(\pi^+\pi^-\eta_c(1S))/\Gamma(K\overline{K}\pi)$ Γ_{31}/Γ_2

NODE=M059R23

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<3.33	90	[1] LEES 12AE	BABR	$e^+e^- \to e^+e^-\pi^+\pi^-\eta_c$

[1] We divided the reported limit by 3 to take into account isospin relations.

NODE=M059R23;LINKAGE=LE

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

NODE=M059230

$\Gamma(\eta_c(2S) \to K\overline{K}\pi)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$ $\Gamma_2/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R42

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.03±0.12 OUR FIT Error includes scale factor of 1.2.				
1.00±0.10 OUR AVERAGE				
0.97±0.06±0.09	1.6k	ABLIKIM 24J	BES3	$\psi(2S) \to \gamma\eta_c \to \gamma K\overline{K}\pi$
1.30±0.20±0.30	127	ABLIKIM 12G	BES3	$\psi(2S) \to \gamma\eta_c \to \gamma K\overline{K}\pi$

$\Gamma(\eta_c(2S) \to K\overline{K}\eta)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$ $\Gamma_3/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R25

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ±1.0 OUR FIT Error includes scale factor of 1.3.					
4.78±0.64±0.68		362	[1] ABLIKIM 24BW	BES3	$\psi(2S) \to \gamma K^+K^-\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<11.8	90		[2] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma K^+K^-\eta$

[1] ABLIKIM 24BW reports a value of $(2.39 \pm 0.32 \pm 0.34) \times 10^{-6}$ for the decay $\eta_c(2S) \to K^+K^-\eta$ which we multiply by 2 to account for isospin symmetry.

NODE=M059R25;LINKAGE=A

[2] CRONIN-HENNESSY 10 reports a limit of $< 5.9 \times 10^{-6}$ for the decay $\eta_c(2S) \to K^+K^-\eta$ which we multiply by 2 account for isospin symmetry. It assumes $\Gamma(\eta_c(2S))$ = 14 MeV. It also gives the analytic dependence of limits on width.

NODE=M059R25;LINKAGE=CR

$\Gamma(\eta_c(2S) \to K\overline{K}\eta')/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$ $\Gamma_4/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R45

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
11.56±4.86±1.9	[1] ABLIKIM 25I	BES3	$\psi(2S) \to \gamma K^+K^-\eta'$

[1] ABLIKIM 25I reports a value of $(5.78 \pm 2.43 \pm 0.95) \times 10^{-7}$ for $K^+K^-\eta'$ which we multiply by 2 to account for isospin symmetry.

NODE=M059R45;LINKAGE=A

$\Gamma(\eta_c(2S) \to 2\pi^+2\pi^-)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$ $\Gamma_5/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R05

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.43 \times 10^{-6}$	90	ABLIKIM 24BT	BES3	$\psi(2S) \to \gamma 2\pi^+2\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<14.6 \times 10^{-6}$	90	[1] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma 2\pi^+2\pi^-$

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

NODE=M059R05;LINKAGE=CR

$\Gamma(\eta_c(2S) \to \rho^0\rho^0)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_9/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R18
NODE=M059R18

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

$\Gamma(\eta_c(2S) \to 3\pi^+3\pi^-)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_{10}/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R06
NODE=M059R06

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
9.2±1.0±1.2		569	ABLIKIM	22Q	BES3	$\psi(2S) \to \gamma 3(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<13.2	90		[1] CRONIN-HEN..10		CLEO	$\psi(2S) \to \gamma 3\pi^+ 3\pi^-$

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

NODE=M059R06;LINKAGE=CR

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

$\Gamma_{11}/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R07
NODE=M059R07

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<9.6 × 10^{-6}	90	[1] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma K^+K^-\pi^+\pi^-$

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

NODE=M059R07;LINKAGE=CR

$\Gamma(\eta_c(2S) \to K^{*0}\overline{K}^{*0})/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_{12}/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R19
NODE=M059R19

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

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

$\Gamma_{13}/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R08
NODE=M059R08

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<43.0 × 10^{-6}	90	[1] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma K^+K^-\pi^+\pi^-\pi^0$

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

NODE=M059R08;LINKAGE=CR

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

$\Gamma_{14}/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R09
NODE=M059R09

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9.7 × 10^{-6}	90	[1] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma K^+K^-2\pi^+2\pi^-$

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

NODE=M059R09;LINKAGE=CR

$\Gamma(\eta_c(2S) \to K^0_S K^-2\pi^+\pi^- + c.c.)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_{15}/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R10
NODE=M059R10

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
7.9 ±1.8 OUR AVERAGE						
9.31±0.72±2.77		3140	ABLIKIM	24Q	BES3	$\psi(2S) \to \gamma K^0_S K^-2\pi^+\pi^-$ +c.c.
7.03±2.10±0.7		60	ABLIKIM	13K	BES3	$\psi(2S) \to \gamma K^0_S K^-2\pi^+\pi^-$ +c.c.
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 15.2	90		[1] CRONIN-HEN..10		CLEO	$\psi(2S) \to \gamma K^0_S K^-2\pi^+\pi^-$ +c.c.

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

NODE=M059R10;LINKAGE=CR

$\Gamma(\eta_c(2S) \to \phi\phi)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_{20}/\Gamma \times \Gamma_{200}^{\psi(2S)}/\Gamma^{\psi(2S)}$

NODE=M059R20
NODE=M059R20

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

$\Gamma(\eta_c(2S) \to p\bar{p})/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_{23}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R24
NODE=M059R24

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.4 × 10⁻⁷ (CL = 90%) [$<1.4 \times 10^{-6}$ (CL = 90%) OUR 2025 BEST LIMIT]				
$<2.4 \times 10^{-7}$	90	ABLIKIM 25H	BES3	$\psi(2S) \to \gamma p\bar{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<1.4 \times 10^{-6}$	90	[1] ABLIKIM 13V	BES3	$\psi(2S) \to \gamma p\bar{p}$

[1] Superseded by ABLIKIM 25H.

NODE=M059R24;LINKAGE=A

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

$\Gamma_{25}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R43
NODE=M059R43

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
1.98±0.41±0.99	84	ABLIKIM 25V	BES3	$e^+e^- \to \psi(2S)$

$\Gamma(\eta_c(2S) \to \gamma J/\psi(1S))/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_{27}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R27
NODE=M059R27

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	33	[1] ABLIKIM 17N	BES3	$\psi(2S) \to \gamma\gamma J/\psi$

[1] Uses B($J/\psi \to e^+e^-$) = (5.971 ± 0.032)% and B($J/\psi \to \mu^+\mu^-$) = (5.961 ± 0.033)%.

NODE=M059R27;LINKAGE=A

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

$\Gamma_{28}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R11
NODE=M059R11

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.97±0.81±0.26		106	ABLIKIM 23Q	BES3	$\psi(2S) \to \gamma\pi^+\pi^-\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<4.3	90		[1] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma\pi^+\pi^-\eta$

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

NODE=M059R11;LINKAGE=CR

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

$\Gamma_{29}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R44
NODE=M059R44

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.85±0.04±0.13	565	ABLIKIM 25R	BES3	$e^+e^- \to \psi(2S)$

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

$\Gamma_{30}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R12
NODE=M059R12

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<14.2 \times 10^{-6}$	90	[1] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma\pi^+\pi^-\eta'$

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

NODE=M059R12;LINKAGE=CR

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

$\Gamma_{31}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R14
NODE=M059R14

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.21 \times 10^{-5}$	90	[1] ABLIKIM 24Q	BES3	$\psi(2S) \to \gamma\pi^+\pi^-\eta_c(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<1.7 \times 10^{-4}$	90	[2] CRONIN-HEN..10	CLEO	$\psi(2S) \to \gamma\pi^+\pi^-\eta_c(1S)$

[1] $\eta_c(1S)$ reconstructed in the final states $K^+K^-\pi^0$ and $K^0_S K^\pm\pi^\mp$.

NODE=M059R14;LINKAGE=A

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

NODE=M059R14;LINKAGE=CR

$\Gamma(\eta_c(2S) \to \omega\omega)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$

$\Gamma_{21}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R46
NODE=M059R46

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.04 \times 10^{-6}$	90	ABLIKIM 25K	BES3	$\psi(2S) \to \gamma 2(\pi^+\pi^-\pi^0)$

$\Gamma(\eta_c(2S) \to \omega\phi)/\Gamma_{total} \times \Gamma(\psi(2S) \to \gamma\eta_c(2S))/\Gamma_{total}$ $\Gamma_{22}/\Gamma \times \Gamma^{\psi(2S)}_{200}/\Gamma^{\psi(2S)}$

NODE=M059R47
NODE=M059R47

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.85 \times 10^{-7}$	90	ABLIKIM	25K	BES3	$\psi(2S) \to \gamma\pi^+\pi^-\pi^0 K^+ K^-$

$\eta_c(2S)$ REFERENCES

NODE=M059

ABLIKIM	25H	PR D111 012003	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63251
ABLIKIM	25I	PR D111 012004	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63252
ABLIKIM	25K	PR D111 032001	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63255
ABLIKIM	25R	PR D111 052013	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63262
ABLIKIM	25V	PR D111 072001	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63266
ABLIKIM	24BT	PR D110 072009	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63025
ABLIKIM	24BW	PR D110 092003	M. Ablikim *et al.*	(BESIII Collab.)	REFID=63028
ABLIKIM	24J	PR D109 032004	M. Ablikim *et al.*	(BESIII Collab.)	REFID=62660
ABLIKIM	24Q	PR D109 072017	M. Ablikim *et al.*	(BESIII Collab.)	REFID=62668
AAIJ	23AH	PR D108 032010	R. Aaij *et al.*	(LHCb Collab.)	REFID=62349
ABLIKIM	23Q	PR D107 052007	M. Ablikim *et al.*	(BESIII Collab.)	REFID=62060
ABLIKIM	22Q	PR D106 032014	M. Ablikim *et al.*	(BESIII Collab.)	REFID=61663
CHILIKIN	19	PR D100 012001	K. Chilikin *et al.*	(BELLE Collab.)	REFID=59899
XU	18	PR D98 072001	Q.N. Xu *et al.*	(BELLE Collab.)	REFID=59453
AAIJ	17AD	PL B769 305	R. Aaij *et al.*	(LHCb Collab.)	REFID=57896
AAIJ	17BB	EPJ C77 609	R. Aaij *et al.*	(LHCb Collab.)	REFID=58191
ABLIKIM	17N	PR D95 072004	M. Ablikim *et al.*	(BESIII Collab.)	REFID=57978
PDG	16	CP C40 100001	C. Patrignani *et al.*	(PDG Collab.)	REFID=57140
LEES	14E	PR D89 112004	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55937
ABLIKIM	13K	PR D87 052005	M. Ablikim *et al.*	(BESIII Collab.)	REFID=54956
ABLIKIM	13V	PR D88 112001	M. Ablikim *et al.*	(BESIII Collab.)	REFID=55583
ABLIKIM	12G	PRL 109 042003	M. Ablikim *et al.*	(BESIII Collab.)	REFID=54272
LEES	12AE	PR D86 092005	J.P. Lees *et al.*	(BABAR Collab.)	REFID=54752
ABLIKIM	11H	PR D84 091102	M. Ablikim *et al.*	(BESIII Collab.)	REFID=53929
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez *et al.*	(BABAR Collab.)	REFID=16751
VINOKUROVA	11	PL B706 139	A. Vinokurova *et al.*	(BELLE Collab.)	REFID=53927
CRONIN-HEN...	10	PR D81 052002	D. Cronin-Hennessey *et al.*	(CLEO Collab.)	REFID=53233
AUBERT	08AB	PR D78 012006	B. Aubert *et al.*	(BABAR Collab.)	REFID=52267
NAKAZAWA	08	NPBPS 184 220	H. Nakazawa	(BELLE Collab.)	REFID=63007
UEHARA	08	EPJ C53 1	S. Uehara *et al.*	(BELLE Collab.)	REFID=52064
WICHT	08	PL B662 323	J. Wicht *et al.*	(BELLE Collab.)	REFID=52204
ABE	07	PRL 98 082001	K. Abe *et al.*	(BELLE Collab.)	REFID=51627
AUBERT	06E	PRL 96 052002	B. Aubert *et al.*	(BABAR Collab.)	REFID=51059
AUBERT	05C	PR D72 031101	B. Aubert *et al.*	(BABAR Collab.)	REFID=50773
ABE	04G	PR D70 071102	K. Abe *et al.*	(BELLE Collab.)	REFID=50182
ASNER	04	PRL 92 142001	D.M. Asner *et al.*	(CLEO Collab.)	REFID=49745
AUBERT	04D	PRL 92 142002	B. Aubert *et al.*	(BABAR Collab.)	REFID=49746
ABE,K	02	PRL 89 142001	K. Abe *et al.*	(BELLE Collab.)	REFID=49188
CHOI	02	PRL 89 102001	S.-K. Choi *et al.*	(BELLE Collab.)	REFID=48760
AMBROGIANI	01	PR D64 052003	M. Ambrogiani *et al.*	(FNAL E835 Collab.)	REFID=48340
ABREU	98O	PL B441 479	P. Abreu *et al.*	(DELPHI Collab.)	REFID=46553
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong *et al.*	(FNAL, FERR, GENO+)	REFID=44623
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
EDWARDS	82C	PRL 48 70	C. Edwards *et al.*	(CIT, HARV, PRIN+)	REFID=22173