

$\eta_c(1S)$ 

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

 $\eta_c(1S)$  MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2984.09 ± 0.30 OUR AVERAGE</b>		Error includes scale factor of 1.2.		
2984.14 ± 0.13 ± 0.38		<sup>1</sup> ABLIKIM	25R BES3	$\psi(2S) \rightarrow \gamma \eta_c \rightarrow \gamma 2(\pi^+ \pi^-) \eta$
2985.01 ± 0.17 ± 0.89	35k	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
2983.9 ± 0.7 ± 0.1		<sup>2</sup> AAIJ	20H LHCB	$pp \rightarrow bX \rightarrow p \bar{p} X$
2985.9 ± 0.7 ± 2.1	1705	ABLIKIM	19AV BES3	$J/\psi \rightarrow \gamma \omega \omega$
2984.6 ± 0.7 ± 2.2	2673	XU	18 BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
2986.7 ± 0.5 ± 0.9	11k	<sup>3</sup> AAIJ	17AD LHCB	$pp \rightarrow B^+ X \rightarrow p \bar{p} K^+ X$
2982.8 ± 1.0 ± 0.5	6.4k	<sup>4</sup> AAIJ	17BB LHCB	$pp \rightarrow b \bar{b} X \rightarrow 2(K^+ K^-) X$
2982.2 ± 1.5 ± 0.1	2.0k	<sup>5</sup> AAIJ	15BI LHCB	$pp \rightarrow \eta_c(1S) X$
2983.5 ± 1.4 $\begin{smallmatrix} + 1.6 \\ - 3.6 \end{smallmatrix}$		<sup>6</sup> ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma \eta_c$
2979.8 ± 0.8 ± 3.5	4.5k	<sup>7,8</sup> LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^0$
2984.1 ± 1.1 ± 2.1	900	<sup>7,8,9</sup> LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \eta$
2984.3 ± 0.6 ± 0.6		<sup>10,11</sup> ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma \eta_c$
2984.49 ± 1.16 ± 0.52	832	<sup>7</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \text{ hadrons}$
2982.7 ± 1.8 ± 2.2	486	ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
2985.4 ± 1.5 $\begin{smallmatrix} + 0.5 \\ - 2.0 \end{smallmatrix}$	920	<sup>11</sup> VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	<sup>12</sup> LEES	10 BABR	$10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K(*) \rightarrow K \bar{K} \pi K(*)$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08 BELL	$\gamma \gamma \rightarrow \eta_c \rightarrow \text{hadrons}$
2970 ± 5 ± 6	501	<sup>13</sup> ABE	07 BELL	$e^+ e^- \rightarrow J/\psi (c \bar{c})$
2971 ± 3 $\begin{smallmatrix} + 2 \\ - 1 \end{smallmatrix}$	195	WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$
2974 ± 7 $\begin{smallmatrix} + 2 \\ - 1 \end{smallmatrix}$	20	WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
2981.8 ± 1.3 ± 1.5	592	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta_c' \rightarrow K_S^0 K^\pm \pi^\mp$
2984.1 ± 2.1 ± 1.0	190	<sup>14</sup> AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2982.5 ± 0.4 ± 1.4	12k	<sup>15</sup> DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
2982.2 ± 0.6		<sup>16</sup> MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
2982 ± 5	270	<sup>17</sup> AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c \bar{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	<sup>18</sup> AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
2977.5 ± 1.0 ± 1.2		<sup>16,19</sup> BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$

2979.6 ± 2.3 ± 1.6	180	<sup>20</sup> FANG	03	BELL	$B \rightarrow \eta_c K$
2976.3 ± 2.3 ± 1.2		<sup>16,21</sup> BAI	00F	BES	$J/\psi, \psi(2S) \rightarrow \gamma \eta_c$
2976.6 ± 2.9 ± 1.3	140	<sup>16,22</sup> BAI	00F	BES	$J/\psi \rightarrow \gamma \eta_c$
2980.4 ± 2.3 ± 0.6		<sup>23</sup> BRANDENB...	00B	CLE2	$\gamma \gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
2975.8 ± 3.9 ± 1.2		<sup>22</sup> BAI	99B	BES	Sup. by BAI 00F
2999 ± 8	25	ABREU	98O	DLPH	$e^+ e^- \rightarrow e^+ e^- + \text{hadrons}$
2988.3 <sup>+ 3.3</sup> <sub>- 3.1</sub>		ARMSTRONG	95F	E760	$\bar{p} p \rightarrow \gamma \gamma$
2974.4 ± 1.9		<sup>16,24</sup> BISELLO	91	DM2	$J/\psi \rightarrow \eta_c \gamma$
2969 ± 4 ± 4	80	<sup>16</sup> BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2956 ± 12 ± 12		<sup>16</sup> BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2982.6 <sup>+ 2.7</sup> <sub>- 2.3</sub>	12	BAGLIN	87B	SPEC	$\bar{p} p \rightarrow \gamma \gamma$
2980.2 ± 1.6		<sup>16,24</sup> BALTRUSAIT..	.86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
2984 ± 2.3 ± 4.0		<sup>16</sup> GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
2976 ± 8		<sup>16,25</sup> BALTRUSAIT..	.84	MRK3	$J/\psi \rightarrow 2\phi \gamma$
2982 ± 8	18	<sup>26</sup> HIMEL	80B	MRK2	$e^+ e^-$
2980 ± 9		<sup>26</sup> PARTRIDGE	80B	CBAL	$e^+ e^-$

<sup>1</sup> Average between constructive and destructive interference with background.

<sup>2</sup> AAIJ 20H report  $m_{J/\psi} - m_{\eta_c(1S)} = 113.0 \pm 0.7 \pm 0.1$  MeV. We use the current value  $m_{J/\psi} = 3096.900 \pm 0.006$  MeV to obtain the quoted mass.

<sup>3</sup> AAIJ 17AD report  $m_{J/\psi} - m_{\eta_c(1S)} = 110.2 \pm 0.5 \pm 0.9$  MeV. We use the current value  $m_{J/\psi} = 3096.900 \pm 0.006$  MeV to obtain the quoted mass.

<sup>4</sup> From a fit of the  $\phi\phi$  invariant mass with the mass and width of  $\eta_c(1S)$  as free parameters.

<sup>5</sup> AAIJ 15BI reports  $m_{J/\psi} - m_{\eta_c(1S)} = 114.7 \pm 1.5 \pm 0.1$  MeV from a sample of  $\eta_c(1S)$  and  $J/\psi$  produced in  $b$ -hadron decays. We have used current value of  $m_{J/\psi} = 3096.900 \pm 0.006$  MeV to arrive at the quoted  $m_{\eta_c(1S)}$  result.

<sup>6</sup> Taking into account an asymmetric photon lineshape.

<sup>7</sup> With floating width.

<sup>8</sup> Ignoring possible interference with the non-resonant  $0^-$  amplitude.

<sup>9</sup> Using both,  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^+ \pi^- \pi^0$  decays.

<sup>10</sup> From a simultaneous fit to six decay modes of the  $\eta_c$ .

<sup>11</sup> Accounts for interference with non-resonant continuum.

<sup>12</sup> Taking into account interference with the non-resonant  $J^P = 0^-$  amplitude.

<sup>13</sup> From a fit of the  $J/\psi$  recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

<sup>14</sup> Using mass of  $\psi(2S) = 3686.00$  MeV.

<sup>15</sup> Not independent from the measurements reported by LEES 10.

<sup>16</sup> MITCHELL 09 observes a significant asymmetry in the lineshapes of  $\psi(2S) \rightarrow \gamma \eta_c$  and  $J/\psi \rightarrow \gamma \eta_c$  transitions. If ignored, this asymmetry could lead to significant bias whenever the mass and width are measured in  $\psi(2S)$  or  $J/\psi$  radiative decays.

<sup>17</sup> From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

<sup>18</sup> Superseded by LEES 10.

<sup>19</sup> From a simultaneous fit of five decay modes of the  $\eta_c$ .

<sup>20</sup> Superseded by VINOKUROVA 11.

<sup>21</sup> Weighted average of the  $\psi(2S)$  and  $J/\psi(1S)$  samples. Using an  $\eta_c$  width of 13.2 MeV.

<sup>22</sup> Average of several decay modes. Using an  $\eta_c$  width of 13.2 MeV.

<sup>23</sup> Superseded by ASNER 04.

<sup>24</sup> Average of several decay modes.

<sup>25</sup>  $\eta_c \rightarrow \phi\phi$ .

<sup>26</sup> Mass adjusted by us to correspond to  $J/\psi(1S)$  mass = 3097 MeV.

### $\eta_c(1S)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>30.0 ± 0.5 OUR FIT</b>		Error includes scale factor of 1.2.		
<b>30.2 ± 0.5 OUR AVERAGE</b>		Error includes scale factor of 1.2.		
28.82 ± 0.11 ± 0.82		<sup>1</sup> ABLIKIM	25R BES3	$\psi(2S) \rightarrow \gamma\eta_c \rightarrow \gamma 2(\pi^+\pi^-)\eta$
29.7 ± 0.5 ± 0.2	35k	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K\pi)$
33.8 ± 1.6 ± 4.1	1705	ABLIKIM	19AV BES3	$J/\psi \rightarrow \gamma\omega$
30.8 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 2.3 \\ 2.2 \end{smallmatrix} \pm 2.9$	2673	XU	18 BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
34.0 ± 1.9 ± 1.3	11k	AAIJ	17AD LHCb	$pp \rightarrow B^+X \rightarrow p\bar{p}K^+X$
31.4 ± 3.5 ± 2.0	6.4k	<sup>2</sup> AAIJ	17BB LHCb	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
27.2 ± 3.1 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 5.4 \\ 2.6 \end{smallmatrix}$		<sup>3</sup> ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma\eta_c$
25.2 ± 2.6 ± 2.4	4.5k	<sup>4,5</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$
34.8 ± 3.1 ± 4.0	900	<sup>4,5,6</sup> LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\eta$
32.0 ± 1.2 ± 1.0		<sup>7,8</sup> ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma\eta_c$
36.4 ± 3.2 ± 1.7	832	<sup>4</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma \text{ hadrons}$
37.8 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 5.8 \\ 5.3 \end{smallmatrix} \pm 3.1$	486	ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
36.2 ± 2.8 ± 3.0	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
35.1 ± 3.1 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.0 \\ 1.6 \end{smallmatrix}$	920	<sup>8</sup> VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm\pi^\mp)$
31.7 ± 1.2 ± 0.8	14k	<sup>9</sup> LEES	10 BABR	$10.6 e^+e^- \rightarrow e^+e^-K_S^0 K^\pm\pi^\mp$
36.3 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 3.7 \\ 3.6 \end{smallmatrix} \pm 4.4$	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S)K^*(*) \rightarrow K\bar{K}\pi K^*(*)$
28.1 ± 3.2 ± 2.2	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow \text{hadrons}$
48 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 8 \\ 7 \end{smallmatrix} \pm 5$	195	WU	06 BELL	$B^+ \rightarrow p\bar{p}K^+$
40 ± 19 ± 5	20	WU	06 BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
24.8 ± 3.4 ± 3.5	592	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm\pi^\mp$
20.4 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 7.7 \\ 6.7 \end{smallmatrix} \pm 2.0$	190	AMBROGIANI	03 E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
23.9 $\begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 12.6 \\ 7.1 \end{smallmatrix}$		ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
32.1 ± 1.1 ± 1.3	12k	<sup>10</sup> DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm\pi^\mp$
34.3 ± 2.3 ± 0.9	2.5k	<sup>11</sup> AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
17.0 ± 3.7 ± 7.4		<sup>12</sup> BAI	03 BES	$J/\psi \rightarrow \gamma\eta_c$
29 ± 8 ± 6	180	<sup>13</sup> FANG	03 BELL	$B \rightarrow \eta_c K$
11.0 ± 8.1 ± 4.1		<sup>14</sup> BAI	00F BES	$J/\psi \rightarrow \gamma\eta_c \text{ and } \psi(2S) \rightarrow \gamma\eta_c$
27.0 ± 5.8 ± 1.4		<sup>15</sup> BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0\pi^\mp$

7.0	$\begin{matrix} + 7.5 \\ - 7.0 \end{matrix}$	12	BAGLIN	87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma$
10.1	$\begin{matrix} +33.0 \\ - 8.2 \end{matrix}$	23	<sup>16</sup> BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \gamma\rho\bar{p}$
11.5	$\pm 4.5$		GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
< 40	90% CL	18	HIMEL	80B	MRK2	$e^+e^-$
< 20	90% CL		PARTRIDGE	80B	CBAL	$e^+e^-$

- <sup>1</sup> Average between constructive and destructive interference with background.
- <sup>2</sup> From a fit of the  $\phi\phi$  invariant mass with the mass and width of  $\eta_c(1S)$  as free parameters.
- <sup>3</sup> Taking into account an asymmetric photon lineshape.
- <sup>4</sup> With floating mass.
- <sup>5</sup> Ignoring possible interference with the non-resonant  $0^-$  amplitude.
- <sup>6</sup> Using both,  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^+\pi^-\pi^0$  decays.
- <sup>7</sup> From a simultaneous fit to six decay modes of the  $\eta_c$ .
- <sup>8</sup> Accounts for interference with non-resonant continuum.
- <sup>9</sup> Taking into account interference with the non-resonant  $J^P = 0^-$  amplitude.
- <sup>10</sup> Not independent from the measurements reported by LEES 10.
- <sup>11</sup> Superseded by LEES 10.
- <sup>12</sup> From a simultaneous fit of five decay modes of the  $\eta_c$ .
- <sup>13</sup> Superseded by VINOKUROVA 11.
- <sup>14</sup> From a fit to the 4-prong invariant mass in  $\psi(2S) \rightarrow \gamma\eta_c$  and  $J/\psi(1S) \rightarrow \gamma\eta_c$  decays.
- <sup>15</sup> Superseded by ASNER 04.
- <sup>16</sup> Positive and negative errors correspond to 90% confidence level.

### $\eta_c(1S)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level
<b>Decays involving hadronic resonances</b>		
$\Gamma_1$	$\eta'(958)\pi\pi$	( 1.59 ± 0.34 ) %      S=1.7
$\Gamma_2$	$\eta'(958)K\bar{K}$	( 1.37 ± 0.31 ) %
$\Gamma_3$	$\eta'(958)\eta\eta$	( 2.7 ± 0.5 ) × 10 <sup>-3</sup>
$\Gamma_4$	$\rho\rho$	( 1.41 ± 0.34 ) %
$\Gamma_5$	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	( 1.43 ± 0.35 ) %
$\Gamma_6$	$K^*(892)\bar{K}^*(892)$	( 5.5 ± 1.1 ) × 10 <sup>-3</sup> S=1.2
$\Gamma_7$	$K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	( 1.1 ± 0.4 ) %
$\Gamma_8$	$\phi K^+ K^-$	( 3.0 $\begin{matrix} +1.2 \\ -1.0 \end{matrix}$ ) × 10 <sup>-3</sup>
$\Gamma_9$	$\phi\phi$	( 1.4 ± 0.4 ) × 10 <sup>-3</sup> S=2.9
$\Gamma_{10}$	$\phi 2(\pi^+ \pi^-)$	< 3.3 × 10 <sup>-3</sup> CL=90%
$\Gamma_{11}$	$a_0(980)\pi$	seen
$\Gamma_{12}$	$a_2(1320)\pi$	seen
$\Gamma_{13}$	$K^*(892)\bar{K} + \text{c.c.}$	< 1.28 %      CL=90%
$\Gamma_{14}$	$f_2(1270)\eta$	seen
$\Gamma_{15}$	$f_2(1270)\eta'$	seen
$\Gamma_{16}$	$\omega\omega$	( 2.1 ± 0.8 ) × 10 <sup>-3</sup> S=2.4
$\Gamma_{17}$	$\omega\phi$	( 3.0 ± 0.8 ) × 10 <sup>-5</sup>
$\Gamma_{18}$	$f_2(1270)f_2(1270)$	( 8.4 ± 2.4 ) × 10 <sup>-3</sup> S=1.2

$\Gamma_{19}$	$f_2(1270) f_2'(1525)$	$( 7.7 \pm 2.5 ) \times 10^{-3}$
$\Gamma_{20}$	$f_0(500) \eta$	seen
$\Gamma_{21}$	$f_0(500) \eta'$	seen
$\Gamma_{22}$	$f_0(980) \eta$	seen
$\Gamma_{23}$	$f_0(980) \eta'$	seen
$\Gamma_{24}$	$f_0(1500) \eta$	seen
$\Gamma_{25}$	$f_0(1710) \eta'$	seen
$\Gamma_{26}$	$f_0(2100) \eta'$	seen
$\Gamma_{27}$	$f_0(2200) \eta$	seen
$\Gamma_{28}$	$a_0(1320) \pi$	seen
$\Gamma_{29}$	$a_0(1450) \pi$	seen
$\Gamma_{30}$	$a_2(1700) \pi$	seen
$\Gamma_{31}$	$a_0(1710) \pi$	seen
$\Gamma_{32}$	$a_0(1950) \pi$	seen
$\Gamma_{33}$	$K_0^*(1430) \bar{K} + \text{c.c.}$	seen
$\Gamma_{34}$	$K_2^*(1430) \bar{K} + \text{c.c.}$	seen
$\Gamma_{35}$	$K_0^*(1950) \bar{K} + \text{c.c.}$	seen
$\Gamma_{36}$	$K_0^*(2600) \bar{K} + \text{c.c.}$	seen

### Decays into stable hadrons

$\Gamma_{37}$	$K \bar{K} \pi$	$( 5.9 \pm 0.5 ) \%$	S=1.8
$\Gamma_{38}$	$K \bar{K} \eta$	$( 1.11 \pm 0.15 ) \%$	S=1.3
$\Gamma_{39}$	$\eta \pi^+ \pi^-$	$( 1.5 \pm 0.4 ) \%$	
$\Gamma_{40}$	$\eta 2(\pi^+ \pi^-)$	$( 4.0 \pm 1.2 ) \%$	
$\Gamma_{41}$	$K^+ K^- \pi^+ \pi^-$	$( 6.7 \pm 1.8 ) \times 10^{-3}$	S=2.4
$\Gamma_{42}$	$K^+ K^- \pi^+ \pi^- \pi^0$	$( 2.8 \pm 0.5 ) \%$	
$\Gamma_{43}$	$K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}$	$( 5.1 \pm 1.4 ) \%$	
$\Gamma_{44}$	$K^+ K^- 2(\pi^+ \pi^-)$	$( 6.9 \pm 2.0 ) \times 10^{-3}$	
$\Gamma_{45}$	$2(K^+ K^-)$	$( 1.2 \pm 0.4 ) \times 10^{-3}$	S=1.6
$\Gamma_{46}$	$\pi^+ \pi^- \pi^0$	$< 4 \times 10^{-4}$	CL=90%
$\Gamma_{47}$	$\pi^+ \pi^- \pi^0 \pi^0$	$( 4.3 \pm 1.0 ) \%$	
$\Gamma_{48}$	$2(\pi^+ \pi^-)$	$( 7.5 \pm 1.3 ) \times 10^{-3}$	S=1.6
$\Gamma_{49}$	$2\pi^+ 2\pi^- \eta$		
$\Gamma_{50}$	$2(\pi^+ \pi^- \pi^0)$	$( 15.5 \pm 2.0 ) \%$	
$\Gamma_{51}$	$3(\pi^+ \pi^-)$	$( 1.55 \pm 0.28 ) \%$	
$\Gamma_{52}$	$\rho \bar{\rho}$	$( 1.11 \pm 0.12 ) \times 10^{-3}$	S=1.4
$\Gamma_{53}$	$\rho \bar{\rho} \pi^0$	$( 3.2 \pm 1.2 ) \times 10^{-3}$	
$\Gamma_{54}$	$\rho \bar{\rho} \pi^+ \pi^-$	$( 3.4 \pm 0.5 ) \times 10^{-3}$	S=1.2
$\Gamma_{55}$	$\Lambda \bar{\Lambda}$	$( 9.4 \pm 1.8 ) \times 10^{-4}$	S=1.2
$\Gamma_{56}$	$K^+ \bar{p} \Lambda + \text{c.c.}$	$( 2.26 \pm 0.34 ) \times 10^{-3}$	
$\Gamma_{57}$	$\bar{\Lambda}(1520) \Lambda + \text{c.c.}$	$( 2.8 \pm 1.2 ) \times 10^{-3}$	
$\Gamma_{58}$	$\Sigma^+ \bar{\Sigma}^-$	$( 1.98 \pm 0.35 ) \times 10^{-3}$	
$\Gamma_{59}$	$\Xi^- \bar{\Xi}^+$	$( 8.3 \pm 1.8 ) \times 10^{-4}$	

**Radiative decays**

$\Gamma_{60}$	$\gamma\gamma$	$(2.13 \pm 0.15) \times 10^{-4}$	S=1.5
$\Gamma_{61}$	$\gamma\phi$	$(1.15^{+0.33}_{-0.40}) \times 10^{-5}$	

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

$\Gamma_{62}$	$\pi^+\pi^-$	$P, CP < 1.0$	$\times 10^{-4}$	CL=90%
$\Gamma_{63}$	$\pi^0\pi^0$	$P, CP < 3.3$	$\times 10^{-5}$	CL=90%
$\Gamma_{64}$	$K^+K^-$	$P, CP < 5$	$\times 10^{-4}$	CL=90%
$\Gamma_{65}$	$K_S^0 K_S^0$	$P, CP < 2.9$	$\times 10^{-4}$	CL=90%

**FIT INFORMATION**

A multiparticle fit to  $\eta_c(1S)$ ,  $J/\psi(1S)$ ,  $\psi(2S)$ ,  $h_c(1P)$ , and  $B^\pm$  with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 115 measurements to determine 19 parameters. The overall fit has a  $\chi^2 = 215.4$  for 96 degrees of freedom.

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

$x_6$	16									
$x_9$	13	14								
$x_{16}$	8	9	8							
$x_{18}$	10	12	12	7						
$x_{37}$	32	30	26	15	20					
$x_{38}$	19	18	15	9	12	59				
$x_{41}$	9	9	8	5	6	19	12			
$x_{45}$	7	6	6	3	4	17	10	5		
$x_{48}$	14	18	18	10	15	29	17	10	6	
$x_{52}$	22	23	21	12	17	45	27	13	12	25
$x_{54}$	10	10	10	5	7	28	17	7	13	11
$x_{55}$	9	11	13	7	10	22	13	7	7	16
$x_{60}$	-41	-37	-29	-17	-22	-76	-45	-20	-16	-33
$\Gamma$	-2	-1	-1	-1	-1	-3	-2	-1	-1	-1
	$x_1$	$x_6$	$x_9$	$x_{16}$	$x_{18}$	$x_{37}$	$x_{38}$	$x_{41}$	$x_{45}$	$x_{48}$

$\chi_{54}$	22			
$\chi_{55}$	20	16		
$\chi_{60}$	-51	-23	-20	
$\Gamma$	1	-1	-1	-15
	$\chi_{52}$	$\chi_{54}$	$\chi_{55}$	$\chi_{60}$

### $\eta_c(1S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$					$\Gamma_{60}$
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
<b><math>6.4 \pm 0.5</math> OUR FIT</b>	Error includes scale factor of 1.5.				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$5.8 \pm 1.1$	486	<sup>1</sup> ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	
$5.2 \pm 1.2$	$273 \pm 43$	<sup>2,3</sup> AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$	
$5.5 \pm 1.2 \pm 1.8$	$157 \pm 33$	<sup>4</sup> KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$	
$7.4 \pm 0.4 \pm 2.3$		<sup>5</sup> ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$	
$13.9 \pm 2.0 \pm 3.0$	41	<sup>6</sup> ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \eta_c$	
$3.8^+_{-1.0} \pm 1.1^+_{-1.0}$	190	<sup>7</sup> AMBROGIANI	03 E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$	
$7.6 \pm 0.8 \pm 2.3$		<sup>5,8</sup> BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$	
$6.9 \pm 1.7 \pm 2.1$	76	<sup>9</sup> ACCIARRI	99T L3	$e^+e^- \rightarrow e^+e^-\eta_c$	
$27 \pm 16 \pm 10$	5	<sup>5</sup> SHIRAI	98 AMY	58 $e^+e^-$	
$6.7^+_{-1.7} \pm 2.4 \pm 2.3$		<sup>4</sup> ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$	
$11.3 \pm 4.2$		<sup>10</sup> ALBRECHT	94H ARG	$e^+e^- \rightarrow e^+e^-\eta_c$	
$8.0 \pm 2.3 \pm 2.4$	17	<sup>11</sup> ADRIANI	93N L3	$e^+e^- \rightarrow e^+e^-\eta_c$	
$5.9^+_{-1.8} \pm 2.1 \pm 1.9$		<sup>7</sup> CHEN	90B CLEO	$e^+e^- \rightarrow e^+e^-\eta_c$	
$6.4^+_{-3.4} \pm 5.0 \pm 3.4$		<sup>12</sup> AIHARA	88D TPC	$e^+e^- \rightarrow e^+e^-X$	
$4.3^+_{-3.7} \pm 3.4 \pm 2.4$		<sup>4</sup> BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$	
$28 \pm 15$		<sup>5,13</sup> BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$	

<sup>1</sup> Assuming there is no interference with the non-resonant background.

<sup>2</sup> Calculated by us using  $\Gamma(\eta_c \rightarrow K\bar{K}\pi) \times \Gamma(\eta_c \rightarrow \gamma\gamma) / \Gamma = 0.44 \pm 0.05$  keV from PDG 06 and  $B(\eta_c \rightarrow K\bar{K}\pi) = (8.5 \pm 1.8)\%$  from AUBERT 06E.

<sup>3</sup> Systematic errors not evaluated.

<sup>4</sup> Normalized to  $B(\eta_c \rightarrow p\bar{p}) = (1.3 \pm 0.4) \times 10^{-3}$ .

<sup>5</sup> Normalized to  $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$ .

<sup>6</sup> Average of  $K_S^0 K^\pm \pi^\mp$ ,  $\pi^+ \pi^- K^+ K^-$ , and  $2(K^+ K^-)$  decay modes.

<sup>7</sup> Normalized to the sum of  $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$ ,  $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$ , and  $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$ .

<sup>8</sup> Superseded by ASNER 04.

<sup>9</sup> Normalized to the sum of 9 branching ratios.

<sup>10</sup> Normalized to the sum of  $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$ ,  $B(\eta_c \rightarrow \phi\phi)$ ,  $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$ , and  $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$ .

<sup>11</sup> Superseded by ACCIARRI 99T.

<sup>12</sup>Normalized to the sum of  $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$ ,  $B(\eta_c \rightarrow 2K^+ 2K^-)$ ,  $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$ , and  $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$ .

<sup>13</sup>Re-evaluated by AIHARA 88D.

### $\eta_c(1S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

#### $\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_1\Gamma_{60}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>102 ± 18 OUR FIT</b>				Error includes scale factor of 1.5.
<b>98.1 ± 3.9 ± 11.7</b>	2673	XU	18	BELL $e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$75.8^{+6.3}_{-6.2} \pm 8.4$	486	<sup>1</sup> ZHANG	12A	BELL $e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

<sup>1</sup>Superseded by XU 18.

#### $\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_4\Gamma_{60}/\Gamma$

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

#### $\Gamma(K^*(892)\bar{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_6\Gamma_{60}/\Gamma$

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

#### $\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_9\Gamma_{60}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>9.2 ± 2.2 OUR FIT</b>				Error includes scale factor of 2.7.
<b>7.75 ± 0.66 ± 0.62</b>	386 ± 31	<sup>1</sup> LIU	12B	BELL $\gamma\gamma \rightarrow 2(K^+K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$6.8 \pm 1.2 \pm 1.3$	132 ± 23	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(K^+K^-)$

<sup>1</sup>Supersedes UEHARA 08. Using  $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$ .

#### $\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{16}\Gamma_{60}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>13 ± 4 OUR FIT</b>				Error includes scale factor of 2.1.
<b>8.67 ± 2.86 ± 0.96</b>	85 ± 29	<sup>1</sup> LIU	12B	BELL $\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$

<sup>1</sup>Using  $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$ .

#### $\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{17}\Gamma_{60}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.49	90	<sup>1</sup> LIU	12B	BELL $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

<sup>1</sup>Using  $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$  and  $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$ .

$$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{18}\Gamma_{60}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>54±13 OUR FIT</b>				
<b>69±17±12</b>	3182 ± 766	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

$$\Gamma(f_2(1270)f'_2(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_{60}/\Gamma$$

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

$$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{37}\Gamma_{60}/\Gamma$$

VALUE (keV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.377±0.020 OUR FIT</b>	Error includes scale factor of 1.4.			
<b>0.396±0.016 OUR AVERAGE</b>				
0.386±0.008±0.021	12k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
0.374±0.009±0.031	14k	<sup>1</sup> LEES	10 BABR	$10.6 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
0.407±0.022±0.028		<sup>2,3</sup> ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c' \rightarrow K_S^0 K^\pm \pi^\mp$
0.60 ±0.12 ±0.09	41	<sup>3,4</sup> ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1.47 ±0.87 ±0.27		<sup>3</sup> SHIRAI	98 AMY	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
0.84 ±0.21		<sup>3</sup> ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^\pm K_S^0 \pi^\mp$
0.60 <sup>+0.23</sup> <sub>-0.20</sub>		<sup>3</sup> CHEN	90B CLEO	$\gamma\gamma \rightarrow \eta_c K^\pm K_S^0 \pi^\mp$
1.06 ±0.41 ±0.27	11	<sup>3</sup> BRAUNSCH...	89 TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$
1.5 <sup>+0.60</sup> <sub>-0.45</sub> ±0.3	7	<sup>3</sup> BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$

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

0.418±0.044±0.022		<sup>3,5</sup> BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
<0.63	95	<sup>3</sup> BEHREND	89 CELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
<4.4	95	ALTHOFF	85B TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

<sup>1</sup> From the corrected and unfolded mass spectrum.

<sup>2</sup> Calculated by us from the value reported in ASNER 04 that assumes  $B(\eta_c \rightarrow K\bar{K}\pi) = 5.5 \pm 1.7\%$

<sup>3</sup> We have multiplied  $K^\pm K_S^0 \pi^\mp$  measurement by 3 to obtain  $K\bar{K}\pi$ .

<sup>4</sup> Calculated by us from the value reported in ABDALLAH 03J, which uses  $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (1.5 \pm 0.4)\%$ .

<sup>5</sup> Superseded by ASNER 04.

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{41}\Gamma_{60}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>42 ± 10 OUR FIT</b>	Error includes scale factor of 2.2.			
<b>27 ± 6 OUR AVERAGE</b>				
25.7± 3.2± 4.9	2019 ± 248	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
280 ±100 ±60	42	<sup>1</sup> ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
170 ± 80 ±20	13.9 ± 6.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$

<sup>1</sup> Calculated by us from the value reported in ABDALLAH 03J, which uses  $B(\eta_c \rightarrow \pi^+\pi^-K^+K^-) = (2.0 \pm 0.7)\%$ .

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{42}\Gamma_{60}/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.190 ± 0.006 ± 0.028</b>	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

$\Gamma(2(K^+ K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{45}\Gamma_{60}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>7.5 ± 2.3 OUR FIT</b>	Error includes scale factor of 1.5.			
<b>5.8 ± 1.9 OUR AVERAGE</b>				

5.6 ± 1.1 ± 1.6	216 ± 42	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(K^+ K^-)$
350 ± 90 ± 60	46	<sup>1</sup> ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow 2(K^+ K^-)$
231 ± 90 ± 23	9.1 ± 3.3	<sup>2</sup> ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(K^+ K^-)$

<sup>1</sup> Calculated by us from the value reported in ABDALLAH 03J, which uses  $B(\eta_c \rightarrow )$

$$2(K^+ K^-) = (2.1 \pm 1.2)\%$$

<sup>2</sup> Includes all topological modes except  $\eta_c \rightarrow \phi\phi$ .

$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{48}\Gamma_{60}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>48 ± 7 OUR FIT</b>	Error includes scale factor of 1.4.			
<b>42 ± 6 OUR AVERAGE</b>				

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

$\Gamma(p\bar{p}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{52}\Gamma_{60}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>7.1 ± 0.6 OUR FIT</b>	Error includes scale factor of 1.2.			
<b>6.2 <sup>+1.1</sup>/<sub>-1.0</sub> OUR AVERAGE</b>	Error includes scale factor of 1.1.			

7.20 ± 1.53 <sup>+0.67</sup> / <sub>-0.75</sub>	157 ± 33	<sup>1</sup> KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$
4.6 <sup>+1.3</sup> / <sub>-1.1</sub> ± 0.4	190	AMBROGIANI	03 E835	$\bar{p}p \rightarrow \gamma\gamma$
8.1 <sup>+2.9</sup> / <sub>-2.0</sub>		ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$

<sup>1</sup> Not independent from the  $\Gamma_{\gamma\gamma}$  reported by the same experiment.

## $\eta_c(1S)$ BRANCHING RATIOS

### HADRONIC DECAYS

$\Gamma(\eta'(958) K\bar{K})/\Gamma(\eta'(958)\pi\pi)$   $\Gamma_2/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
<b>0.859 ± 0.052 ± 0.043</b>	<sup>1</sup> LEES	21A BABR	$\gamma\gamma \rightarrow \eta' K^+ K^-$ , $\eta' \pi^+ \pi^-$

<sup>1</sup> Based on Dalitz-plot analysis of the  $\eta_c \rightarrow \eta' K^+ K^-$ ,  $\eta' \pi^+ \pi^-$  final states where the fit fractions and relative phases are determined for numerous two-body intermediate states.

$\Gamma(\eta'(958)\eta\eta)/\Gamma_{\text{total}}$   $\Gamma_3/\Gamma$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.7 ± 0.4 ± 0.2</b>	<sup>1</sup> ABLIKIM	21C BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta'$

<sup>1</sup> ABLIKIM 21C reports  $[\Gamma(\eta_c(1S) \rightarrow \eta'(958)\eta\eta)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $= (4.86 \pm 0.62 \pm 0.45) \times 10^{-5}$  which we divide by our best (shown rounded) value  
 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's  
error and our second error is the systematic error from using our best (shown rounded)  
value.

### $\Gamma(\rho\rho)/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma$

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$0.9 \pm 0.4 \pm 0.1$		72	<sup>1</sup> ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
$1.8 \pm 0.4 \pm 0.1$		113	<sup>2,3</sup> BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^0 \rho^0$
$1.6 \pm 0.8 \pm 0.1$		32	<sup>4,5</sup> BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^+ \rho^-$
<14		90	<sup>6</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

<sup>1</sup> ABLIKIM 05L reports  $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.6 \pm 0.6 \pm 0.4) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>2</sup> BISELLO 91 reports  $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (3.30 \pm 0.30 \pm 0.60) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>3</sup> The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

<sup>4</sup> BISELLO 91 reports  $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (3.0 \pm 1.3 \pm 0.6) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>5</sup> The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

<sup>6</sup> Using  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$ .

### $\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ $\Gamma_5/\Gamma$

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1.43 \pm 0.33 \pm 0.12$		63	<sup>1</sup> BALTRUSAIT..86	MRK3 $J/\psi \rightarrow \eta_c \gamma$

<sup>1</sup> BALTRUSAITIS 86 reports  $[\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (2.6 \pm 0.6) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

### $\Gamma(K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ $\Gamma_7/\Gamma$

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$105 \pm 44 \pm 9$		45	<sup>1</sup> ABLIKIM	06A BES2 $J/\psi \rightarrow K^{*0} \bar{K}^{*0} \pi^+ \pi^- \gamma$

<sup>1</sup> ABLIKIM 06A reports  $[\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$   $\Gamma_8/\Gamma$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

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

$2.9^{+0.9}_{-0.8} \pm 1.1$	$14.1^{+4.4}_{-3.7}$	<sup>1,2</sup> HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$
-----------------------------	----------------------	----------------------	---------	--------------------------------------

<sup>1</sup> Using  $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$  from FANG 03 and  $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$ .

<sup>2</sup> Not used since the same experimental measurement has been used in another related quantity included elsewhere in the fit.

$\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$   $\Gamma_{10}/\Gamma$

VALUE (units $10^{-4}$ )	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<33	90	<sup>1</sup> ABLIKIM	06A BES2	$J/\psi \rightarrow \phi 2(\pi^+ \pi^-) \gamma$
-----	----	----------------------	----------	---

<sup>1</sup> ABLIKIM 06A reports  $[\Gamma(\eta_c(1S) \rightarrow \phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))]$  <  $0.603 \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.82 \times 10^{-2}$ .

$\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$   $\Gamma_{11}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

seen		AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
------	--	------	-----------	------------------------------------

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

seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$
------	--	------	----------	--

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

<0.02	90	<sup>1,2</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
-------	----	-------------------------------	------	------------------------------------

<sup>1</sup> The quoted branching ratio uses  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ .

<sup>2</sup> We are assuming  $B(a_0(980) \rightarrow \eta \pi) > 0.5$ .

$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$   $\Gamma_{12}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

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

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

<0.02	90	<sup>1</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
-------	----	-----------------------------	------	------------------------------------

<sup>1</sup> The quoted branching ratio uses  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ .

$\Gamma(K^*(892)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{13}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

<0.0128	90	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
---------	----	---------	--------	---

<0.0132	90	<sup>1</sup> BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
---------	----	----------------------	--------	---

<sup>1</sup> The quoted branching ratios use  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ .

$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$   $\Gamma_{14}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

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

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

<0.011	90	<sup>1</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
--------	----	-----------------------------	------	------------------------------------

<sup>1</sup> The quoted branching ratio uses  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ .

$\Gamma(f_2(1270)\eta')/\Gamma_{\text{total}}$  $\Gamma_{15}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	LEES	21A	BABR Dalitz anal. of $\eta_C \rightarrow \pi^+\pi^-\eta'$ ; $K^+K^-\eta'$

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$  $\Gamma_{17}/\Gamma$ 

VALUE (units $10^{-5}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>3.0 \pm 0.8 \pm 0.2</math></b>		118	<sup>1</sup> ABLIKIM	25AC	BES3 $J/\psi(1S) \rightarrow \gamma\eta_C$
< 25	90		<sup>2</sup> ABLIKIM	17P	BES3 $J/\psi \rightarrow \pi^+\pi^-\pi^0 K^+K^-\gamma$
< 170	90		<sup>3</sup> ABLIKIM	05L	BES2 $J/\psi \rightarrow \pi^+\pi^-\pi^0 K^+K^-\gamma$

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

<sup>1</sup> ABLIKIM 25AC reports  $(3.86 \pm 0.92 \pm 0.62) \times 10^{-5}$  from a measurement of  $[\Gamma(\eta_C(1S) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_C(1S))]$  assuming  $B(J/\psi(1S) \rightarrow \gamma\eta_C(1S)) = (1.41 \pm 0.14) \times 10^{-2}$ , which we rescale to our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_C(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>2</sup> Using  $B(J/\psi \rightarrow \gamma\eta_C) = 0.017 \pm 0.004$ .

<sup>3</sup> The quoted branching ratio uses  $B(J/\psi(1S) \rightarrow \gamma\eta_C(1S)) = 0.0127 \pm 0.0036$ .

 $\Gamma(f_0(500)\eta)/\Gamma_{\text{total}}$  $\Gamma_{20}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	LEES	21A	BABR Dalitz anal. of $\eta_C \rightarrow \pi^+\pi^-\eta$

 $\Gamma(f_0(500)\eta')/\Gamma_{\text{total}}$  $\Gamma_{21}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	LEES	21A	BABR Dalitz anal. of $\eta_C(1S) \rightarrow \pi^+\pi^-\eta'$

 $\Gamma(f_0(980)\eta)/\Gamma_{\text{total}}$  $\Gamma_{22}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A	BABR Dalitz anal. of $\eta_C \rightarrow \pi^+\pi^-\eta$
<b>seen</b>	LEES	14E	BABR Dalitz anal. of $\eta_C \rightarrow K^+K^-\eta$

 $\Gamma(f_0(980)\eta')/\Gamma_{\text{total}}$  $\Gamma_{23}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	LEES	21A	BABR Dalitz anal. of $\eta_C \rightarrow \pi^+\pi^-\eta'$ ; $K^+K^-\eta'$

 $\Gamma(f_0(1500)\eta)/\Gamma_{\text{total}}$  $\Gamma_{24}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A	BABR Dalitz anal. of $\eta_C \rightarrow \pi^+\pi^-\eta$
<b>seen</b>	LEES	14E	BABR Dalitz anal. of $\eta_C \rightarrow K^+K^-\eta$

 $\Gamma(f_0(1710)\eta')/\Gamma_{\text{total}}$  $\Gamma_{25}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	LEES	21A	BABR Dalitz anal. of $\eta_C \rightarrow K^+K^-\eta'$

$\Gamma(f_0(2100)\eta')/\Gamma_{\text{total}}$   $\Gamma_{26}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$

$\Gamma(f_0(2200)\eta)/\Gamma_{\text{total}}$   $\Gamma_{27}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$

$\Gamma(a_0(1320)\pi)/\Gamma_{\text{total}}$   $\Gamma_{28}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
<b>seen</b>	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

$\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}}$   $\Gamma_{29}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
<b>seen</b>	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$
<b>seen</b>	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

$\Gamma(a_2(1700)\pi)/\Gamma_{\text{total}}$   $\Gamma_{30}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$

$\Gamma(a_0(1710)\pi)/\Gamma_{\text{total}}$   $\Gamma_{31}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
<b>seen</b>	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta'$

$\Gamma(a_0(1950)\pi)/\Gamma_{\text{total}}$   $\Gamma_{32}/\Gamma$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>		LEES	21A BABR	Dalitz anal. of $\eta_c(1S) \rightarrow \pi^+ \pi^- \eta'$
<b>seen</b>	12k	<sup>1</sup> LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$

<sup>1</sup> From a model-independent partial wave analysis.

$\Gamma(K_0^*(1430)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{33}/\Gamma$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	12k	<sup>1</sup> LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
<b>seen</b>		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta/\pi^0$

<sup>1</sup> From a model-independent partial wave analysis.

$\Gamma(K_2^*(1430)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{34}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>seen</b>	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
<b>seen</b>	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta'$
<b>seen</b>	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

$\Gamma(K_0^*(1950)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{35}/\Gamma$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta'$
seen	12k	<sup>1</sup> LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta/\pi^0$

<sup>1</sup> From a Dalitz plot analysis using an isobar model.

 $\Gamma(K_0^*(2600)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{36}/\Gamma$ 

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

 $\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$   $\Gamma_{37}/\Gamma$ 

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>5.9 \pm 0.5</math> OUR FIT</b>	Error includes scale factor of 1.8.			
<b><math>7.4 \pm 0.6</math> OUR AVERAGE</b>				
$6.9 \pm 0.7 \pm 0.6$	146	<sup>1</sup> ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
$7.8 \pm 0.6 \pm 0.6$	267	<sup>2</sup> ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$5.7 \pm 1.1 \pm 0.6$	55	<sup>3,4,5</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^0$
$7.2 \pm 1.2 \pm 0.8$	107	<sup>5,6,7</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\pm$
$8.5 \pm 1.8$		<sup>5,8</sup> AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
$3.6 \pm 1.0 \pm 0.3$	0.6k	<sup>5,9,10</sup> BAI	04 BES	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
$4.8 \pm 1.4 \pm 0.4$	33	<sup>5,11,12</sup> BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
$3.8 \pm 0.9 \pm 0.3$	68	<sup>5,13,14</sup> BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
$4.8 \pm 1.7$	95	<sup>5,15,16</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
$4.3 \pm 1.6 \pm 0.3$	32	<sup>5,17,18</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
$3.1 \pm 0.8 \pm 0.3$	63	<sup>5,19,20</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
$12 \begin{smallmatrix} +7 \\ -5 \end{smallmatrix} \pm 2$		<sup>5,21</sup> HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$
< 10.7 CL	90%	<sup>16</sup> PARTRIDGE	80B CBAL	$J/\psi \rightarrow \eta_c \gamma$

<sup>1</sup> ABLIKIM 19AP quotes  $B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.15 \pm 0.12 \pm 0.10) \times 10^{-2}$  which we multiply by 6 to account for isospin symmetry.

<sup>2</sup> ABLIKIM 19AP quotes  $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (2.60 \pm 0.21 \pm 0.20) \times 10^{-2}$  which we multiply by 3 to account for isospin symmetry.

<sup>3</sup> ABLIKIM 12N quotes  $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$  which we multiply by 6 to account for isospin symmetry.

<sup>4</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

<sup>5</sup> Not used since the same experimental measurement has been used in another related quantity included elsewhere in the fit.

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

- <sup>7</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.
- <sup>8</sup> Determined from the ratio of  $B(B^\pm \rightarrow K^\pm \eta_c) B(\eta_c \rightarrow K\bar{K}\pi) = (7.4 \pm 0.5 \pm 0.7) \times 10^{-5}$  reported in AUBERT, B 04B and  $B(B^\pm \rightarrow K^\pm \eta_c) = (8.7 \pm 1.5) \times 10^{-3}$  reported in AUBERT 06E.
- <sup>9</sup> BAI 04 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.2 \pm 0.3 \pm 0.5) \times 10^{-4}$  which we multiply by 3 to account for isospin symmetry.
- <sup>10</sup> BAI 04 reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (6.6 \pm 0.9 \pm 1.5) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.
- <sup>11</sup> BISELLO 91 reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (8.76 \pm 1.80 \pm 1.68) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.
- <sup>12</sup> BISELLO 91 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.46 \pm 0.30 \pm 0.28) \times 10^{-4}$  which we multiply by 6 to account for isospin symmetry.
- <sup>13</sup> BISELLO 91 reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (6.9 \pm 1.2 \pm 1.2) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.
- <sup>14</sup> BISELLO 91 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.3 \pm 0.4 \pm 0.4) \times 10^{-4}$  which we multiply by 3 to account for isospin symmetry.
- <sup>15</sup> Average from  $K^+ K^- \pi^0$  and  $K^\pm K_S^0 \pi^\mp$  decay channels.
- <sup>16</sup> The quoted branching ratios use  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$ . Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.
- <sup>17</sup> BALTRUSAITIS 86 reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (7.8 \pm 3.0) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.
- <sup>18</sup> BALTRUSAITIS 86 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.3 \pm 0.5) \times 10^{-4}$  which we multiply by 6 to account for isospin symmetry.
- <sup>19</sup> BALTRUSAITIS 86 reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (5.7 \pm 1.5) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.
- <sup>20</sup> BALTRUSAITIS 86 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (1.9 \pm 0.5) \times 10^{-4}$  which we multiply by 3 to account for isospin symmetry.
- <sup>21</sup> HIMEL 80B reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\eta_c(1S))] = (4.5^{+2.4}_{-1.8}) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = (3.6 \pm 0.5) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

$\Gamma(\phi K^+ K^-)/\Gamma(K\bar{K}\pi)$   $\Gamma_8/\Gamma_{37}$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.052^{+0.016}_{-0.014} \pm 0.014$	7	<sup>1</sup> HUANG	03	BELL $B^\pm \rightarrow K^\pm \phi$

<sup>1</sup> Using  $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$  from FANG 03 and  $B(\eta_c \rightarrow K\bar{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$ .

 $\Gamma(K\bar{K}\eta)/\Gamma_{\text{total}}$   $\Gamma_{38}/\Gamma$ 

VALUE (units $10^{-2}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	------	-------------	------	---------

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

$0.9 \pm 0.4 \pm 0.1$	7	<sup>1,2,3</sup> ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$
<3.1	90	<sup>4</sup> BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \eta_c \gamma$

<sup>1</sup> Not used since the same experimental measurement has been used in another related quantity included elsewhere in the fit.

<sup>2</sup> ABLIKIM 12N quotes  $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$  which we multiply by 2 to account for isospin symmetry.

<sup>3</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

<sup>4</sup> The quoted branching ratios use  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ .

 $\Gamma(K\bar{K}\eta)/\Gamma(K\bar{K}\pi)$   $\Gamma_{38}/\Gamma_{37}$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

**0.188 ± 0.018 OUR FIT**

<b>0.190 ± 0.008 ± 0.017</b>	5.4k	<sup>1</sup> LEES	14E	BABR $\gamma\gamma \rightarrow K^+ K^- \eta/\pi^0$
------------------------------	------	-------------------	-----	--

<sup>1</sup> LEES 14E reports  $B(\eta_c(1S) \rightarrow K^+ K^- \eta)/B(\eta_c(1S) \rightarrow K^+ K^- \pi^0) = 0.571 \pm 0.025 \pm 0.051$ , which we divide by 3 to account for isospin symmetry. It uses both  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^+ \pi^- \pi^0$  decays.

 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{39}/\Gamma$ 

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

<b>1.5 ± 0.4 ± 0.2</b>	33	<sup>1</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$
------------------------	----	----------------------	-----	---

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

$5.4 \pm 2.0$	75	<sup>2,3</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
$3.7 \pm 1.3 \pm 2.0$	18	<sup>2,3</sup> PARTRIDGE	80B	CBAL $J/\psi \rightarrow \eta \pi^+ \pi^- \gamma$

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

<sup>2</sup> Not used since the same experimental measurement has been used in another related quantity.

<sup>3</sup> The quoted branching ratios use  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ . Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

$$\Gamma(\eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \quad \Gamma_{40}/\Gamma$$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>4.0±1.1±0.4</b>	39	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+ \pi^-)$

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi) \quad \Gamma_{42}/\Gamma_{37}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.477±0.017±0.070</b>	11k	<sup>1</sup> DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

<sup>1</sup> 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.

$$\Gamma(K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{43}/\Gamma$$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>5.1±1.3±0.5</b>	43	<sup>1,2</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\mp 2\pi^\pm$

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

<sup>2</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

$$\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \quad \Gamma_{44}/\Gamma$$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>6.9±2.0 OUR AVERAGE</b>				

8 ±4 ±1	10	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$
6.7±2.2±0.5	100	<sup>2</sup> ABLIKIM	06A BES2	$J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

<sup>2</sup> ABLIKIM 06A reports  $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;4 × 10<sup>-4</sup></b>	90	<sup>1</sup> ABLIKIM	17AJ BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$

<sup>1</sup> ABLIKIM 17AJ reports  $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\eta_c(1S))]$   
 $< 1.6 \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(\psi(2S) \rightarrow \gamma\eta_c(1S))$   
 $= 3.6 \times 10^{-3}$ .

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

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>4.3±0.8±0.5</b>	118	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma\pi^+\pi^-\pi^0$

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$   
 $\times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$  which we divide by our best  
(shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow$   
 $\gamma\eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second  
error is the systematic error from using our best (shown rounded) values.

### $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ $\Gamma_{50}/\Gamma$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>15.5±2.0 OUR AVERAGE</b>				

15.3±1.8±1.8	333	ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
15.8±2.6±1.7	175	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma 2(\pi^+\pi^-\pi^0)$

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$   
 $\times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$  which we divide by our best  
(shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow$   
 $\gamma\eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second  
error is the systematic error from using our best (shown rounded) values.

### $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ $\Gamma_{51}/\Gamma$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>15.5±2.8 OUR AVERAGE</b>				

19 ±5 ±2	51	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma 3(\pi^+\pi^-)$
14.2±3.1±1.2	479	<sup>2</sup> ABLIKIM	06A BES2	$J/\psi \rightarrow 3(\pi^+\pi^-)\gamma$

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$   
 $\times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$  which we divide by our best  
(shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow$   
 $\gamma\eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second  
error is the systematic error from using our best (shown rounded) values.

<sup>2</sup> ABLIKIM 06A reports  $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $= (2.59 \pm 0.32 \pm 0.47) \times 10^{-4}$  which we divide by our best (shown rounded) value  
 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's  
error and our second error is the systematic error from using our best (shown rounded)  
value.

### $\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ $\Gamma_{52}/\Gamma$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>11.1± 1.2 OUR FIT</b>	Error includes scale factor of 1.4.			

<b>12.0± 2.6±1.5</b>	34	ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
----------------------	----	---------	-----------	--------------------------------

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

14 ± 5 ±1	15	<sup>1,2</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma\rho\bar{\rho}$
-----------	----	------------------------	----------	--

11.8 <sup>+</sup> <sub>-</sub> 1.6 1.9±0.8	195	<sup>2,3</sup> WU	06 BELL	$B^+ \rightarrow \rho\bar{\rho}K^+$
---	-----	-------------------	---------	-------------------------------------

10.4 ± 2.3 ± 0.8	213	2, <sup>4</sup> BAI	04	BES	$J/\psi \rightarrow \gamma p \bar{p}$
7.1 ± 2.7 ± 0.6	18	2, <sup>5</sup> BISELLO	91	DM2	$J/\psi \rightarrow \gamma p \bar{p}$
8 ± 4 ± 1	23	2, <sup>6</sup> BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \eta_c \gamma$
22 $\begin{smallmatrix} +22 \\ -11 \end{smallmatrix}$ ± 3		2, <sup>7</sup> HIMEL	80B	MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

<sup>2</sup> Not used since the same experimental measurement has been used in another related quantity included elsewhere in the fit.

<sup>3</sup> WU 06 reports  $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (1.42 \pm 0.11 \begin{smallmatrix} +0.16 \\ -0.20 \end{smallmatrix}) \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(B^+ \rightarrow \eta_c K^+) = (1.20 \pm 0.08) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>4</sup> BAI 04 reports  $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.9 \pm 0.3 \pm 0.3) \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>5</sup> BISELLO 91 reports  $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (0.13 \pm 0.04 \pm 0.03) \times 10^{-4}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>6</sup> BALTRUSAITIS 86 reports  $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.4 \pm 0.7) \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>7</sup> HIMEL 80B reports  $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \eta_c(1S))] = (8 \begin{smallmatrix} +8 \\ -4 \end{smallmatrix}) \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = (3.6 \pm 0.5) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi\phi)/\Gamma_{\text{total}}$				$\Gamma_{52}/\Gamma \times \Gamma_9/\Gamma$
<u>VALUE (units 10<sup>-5</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<b>0.16 ± 0.06 OUR FIT</b>	Error includes scale factor of 2.8.			
<b>4.0 <math>\begin{smallmatrix} +3.5 \\ -3.2 \end{smallmatrix}</math></b>	BAGLIN	89	SPEC	$\bar{p}p \rightarrow K^+ K^- K^+ K^-$

$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$				$\Gamma_{53}/\Gamma$
<u>VALUE (units 10<sup>-2</sup>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>

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

0.32 ± 0.11 ± 0.03	14	<sup>1</sup> ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p} \pi^0$
--------------------	----	----------------------	-----	------	---

<sup>1</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow p \bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$  which we divide by our best (shown rounded) values  $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ ,  $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (64 \pm 5) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) values.

$\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{56}/\Gamma$ 

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
$2.26^{+0.31}_{-0.29} \pm 0.16$	157	<sup>1</sup> LU	19	BELL $B^+ \rightarrow \bar{p}\Lambda K^+ K^+$

<sup>1</sup> LU 19 reports  $(2.83^{+0.36}_{-0.34} \pm 0.35) \times 10^{-3}$  from a measurement of  $[\Gamma(\eta_c(1S) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)]$  assuming  $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$ , which we rescale to our best (shown rounded) value  $B(B^+ \rightarrow \eta_c K^+) = (1.20 \pm 0.08) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

 $\Gamma(\bar{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}$   $\Gamma_{57}/\Gamma$ 

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 1.2 \pm 0.2$	43	<sup>1</sup> LU	19	BELL $B^+ \rightarrow \bar{p}\Lambda K^+ K^+$

<sup>1</sup> LU 19 reports  $(3.48 \pm 1.48 \pm 0.46) \times 10^{-3}$  from a measurement of  $[\Gamma(\eta_c(1S) \rightarrow \bar{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)]$  assuming  $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$ , which we rescale to our best (shown rounded) value  $B(B^+ \rightarrow \eta_c K^+) = (1.20 \pm 0.08) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$   $\Gamma_{58}/\Gamma$ 

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

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

$1.98 \pm 0.31 \pm 0.16$	112	<sup>1</sup> ABLIKIM	13C	BES3 $J/\psi \rightarrow \gamma p \bar{p} \pi^0 \pi^0$
--------------------------	-----	----------------------	-----	--

<sup>1</sup> ABLIKIM 13C reports  $[\Gamma(\eta_c(1S) \rightarrow \Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))]$  =  $(3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

 $\Gamma(\Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}$   $\Gamma_{59}/\Gamma$ 

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

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

$0.83 \pm 0.17 \pm 0.07$	78	<sup>1</sup> ABLIKIM	13C	BES3 $J/\psi \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$
--------------------------	----	----------------------	-----	--

<sup>1</sup> ABLIKIM 13C reports  $[\Gamma(\eta_c(1S) \rightarrow \Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))]$  =  $(1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

————— RADIATIVE DECAYS —————

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{60}/\Gamma$ 

VALUE (units $10^{-4}$ )	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	------	-------------	------	---------

**2.13 ± 0.15 OUR FIT** Error includes scale factor of 1.5.

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

$2.5 \pm 0.7 \pm 0.2$	73	<sup>1,2</sup> ABLIKIM	13i	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
-----------------------	----	------------------------	-----	--

0.7	$\begin{smallmatrix} +1.5 \\ -0.6 \end{smallmatrix} \pm 0.1$	$1.2 \begin{smallmatrix} +2.8 \\ -1.1 \end{smallmatrix}$	1, <sup>3</sup> ADAMS	08	CLEO	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
1.8	$\begin{smallmatrix} +0.8 \\ -0.6 \end{smallmatrix} \pm 0.1$	13	1, <sup>4</sup> WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
1.87	$\pm 0.32 \begin{smallmatrix} +0.95 \\ -0.50 \end{smallmatrix}$		<sup>1</sup> AMBROGIANI	03	E835	$\bar{p} p \rightarrow \gamma \gamma$
2.80	$\begin{smallmatrix} +0.67 \\ -0.58 \end{smallmatrix} \pm 1.0$		<sup>1</sup> ARMSTRONG	95F	E760	$\bar{p} p \rightarrow \gamma \gamma$
< 9	90		1, <sup>5</sup> BISELLO	91	DM2	$J/\psi \rightarrow \gamma \gamma \gamma$
6	$\begin{smallmatrix} +4 \\ -3 \end{smallmatrix} \pm 4$		<sup>1</sup> BAGLIN	87B	SPEC	$\bar{p} p \rightarrow \gamma \gamma$
< 18	90		<sup>6</sup> BLOOM	83	CBAL	$J/\psi \rightarrow \eta_c \gamma$

<sup>1</sup> Not used since the same experimental measurement has been used in another related quantity included elsewhere in the fit.

<sup>2</sup> ABLIKIM 13I reports  $[\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (4.5 \pm 1.2 \pm 0.6) \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>3</sup> ADAMS 08 reports  $[\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.2 \begin{smallmatrix} +2.7 \\ -1.1 \end{smallmatrix} \pm 0.3) \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>4</sup> WICHT 08 reports  $[\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (2.2 \begin{smallmatrix} +0.9+0.4 \\ -0.7-0.2 \end{smallmatrix}) \times 10^{-7}$  which we divide by our best (shown rounded) value  $B(B^+ \rightarrow \eta_c K^+) = (1.20 \pm 0.08) \times 10^{-3}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

<sup>5</sup> The quoted branching ratios use  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ .

<sup>6</sup> Using  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$ .

**$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_{52}/\Gamma \times \Gamma_{60}/\Gamma$**

VALUE (units $10^{-6}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.237 ± 0.020 OUR FIT</b>				Error includes scale factor of 1.2.
<b>0.26 ± 0.05 OUR AVERAGE</b>				Error includes scale factor of 1.4.
0.224 $\begin{smallmatrix} +0.038 \\ -0.037 \end{smallmatrix} \pm 0.020$	190	AMBROGIANI 03	E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma \gamma$
0.336 $\begin{smallmatrix} +0.080 \\ -0.070 \end{smallmatrix}$		ARMSTRONG 95F	E760	$\bar{p} p \rightarrow \gamma \gamma$
0.68 $\begin{smallmatrix} +0.42 \\ -0.31 \end{smallmatrix}$	12	BAGLIN 87B	SPEC	$\bar{p} p \rightarrow \gamma \gamma$

**$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$   $\Gamma_{61}/\Gamma$**

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>11.5 <math>\begin{smallmatrix} +3.2 \\ -4.2 \end{smallmatrix} \pm 0.9</math></b>	<sup>1</sup> ABLIKIM	25P	BES3 $J/\psi \rightarrow \phi \gamma \gamma$

<sup>1</sup> ABLIKIM 25P reports  $[\Gamma(\eta_c(1S) \rightarrow \gamma \phi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (2.1 \pm 0.3 \begin{smallmatrix} +0.5 \\ -0.7 \end{smallmatrix}) \times 10^{-7}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.82 \pm 0.15) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

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

**$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$**   **$\Gamma_{62}/\Gamma$**

<i>VALUE</i> (units $10^{-5}$ )	<i>CL%</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
---------------------------------	------------	--------------------	-------------	----------------

<b>&lt;10</b>	90	<sup>1</sup> ABLIKIM	11G BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
---------------	----	----------------------	----------	---------------------------------------

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

<b>&lt;60</b>	90	<sup>2</sup> ABLIKIM	06B BES2	$J/\psi \rightarrow \pi^+\pi^-\gamma$
---------------	----	----------------------	----------	---------------------------------------

<sup>1</sup> ABLIKIM 11G reports  $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $< 1.82 \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.82 \times 10^{-2}$ .

<sup>2</sup> ABLIKIM 06B reports  $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $< 1.1 \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.82 \times 10^{-2}$ .

**$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{63}/\Gamma$**

<i>VALUE</i> (units $10^{-5}$ )	<i>CL%</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
---------------------------------	------------	--------------------	-------------	----------------

<b>&lt; 3.3</b>	90	<sup>1</sup> ABLIKIM	11G BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$
-----------------	----	----------------------	----------	---------------------------------------

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

<b>&lt;40</b>	90	<sup>2</sup> ABLIKIM	06B BES2	$J/\psi \rightarrow \pi^0\pi^0\gamma$
---------------	----	----------------------	----------	---------------------------------------

<sup>1</sup> ABLIKIM 11G reports  $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $< 6.0 \times 10^{-7}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.82 \times 10^{-2}$ .

<sup>2</sup> ABLIKIM 06B reports  $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $< 0.71 \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.82 \times 10^{-2}$ .

**$\Gamma(K^+K^-)/\Gamma_{\text{total}}$**   **$\Gamma_{64}/\Gamma$**

<i>VALUE</i> (units $10^{-5}$ )	<i>CL%</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
---------------------------------	------------	--------------------	-------------	----------------

<b>&lt;50</b>	90	<sup>1</sup> ABLIKIM	06B BES2	$J/\psi \rightarrow K^+K^-\gamma$
---------------	----	----------------------	----------	-----------------------------------

<sup>1</sup> ABLIKIM 06B reports  $[\Gamma(\eta_c(1S) \rightarrow K^+K^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $< 0.96 \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.82 \times 10^{-2}$ .

**$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$**   **$\Gamma_{65}/\Gamma$**

<i>VALUE</i> (units $10^{-5}$ )	<i>CL%</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
---------------------------------	------------	--------------------	-------------	----------------

<b>&lt;29</b>	90	<sup>1</sup> ABLIKIM	06B BES2	$J/\psi \rightarrow K_S^0 K_S^0 \gamma$
---------------	----	----------------------	----------	---

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

<b>&lt;32</b>	90	<sup>2,3</sup> UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
---------------	----	-----------------------	---------	--

<b>&lt; 5.6</b>	90	<sup>4,5</sup> UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
-----------------	----	-----------------------	---------	--

<sup>1</sup> ABLIKIM 06B reports  $[\Gamma(\eta_c(1S) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$   
 $< 0.53 \times 10^{-5}$  which we divide by our best (shown rounded) value  $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.82 \times 10^{-2}$ .

<sup>2</sup> Using  $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$  keV. UEHARA 13 reports  $\Gamma(\gamma\gamma) \times B(K_S^0 K_S^0) < 1.6$  eV.

<sup>3</sup> Taking into account interference with the non-resonant continuum.

<sup>4</sup> Using  $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$  keV. UEHARA 13 reports  $\Gamma(\gamma\gamma) \times B(K_S^0 K_S^0) < 0.29$  eV.

<sup>5</sup> Neglecting interference with the non-resonant continuum.

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

$$\Gamma(\eta_c(1S) \rightarrow \eta'(958)\pi\pi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2.9 ± 0.6 OUR FIT</b>		Error includes scale factor of 1.5.		
<b>5.25 ± 1.65</b>	14	<sup>1</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

<sup>1</sup> The value reported by BALTRUSAITIS 86 has been multiplied by 3/2 to account for isospin symmetry.

$$\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_4/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

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

<sup>1</sup> The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

<sup>2</sup> The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

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

$$\Gamma_5/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

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

$$\Gamma(\eta_c(1S) \rightarrow K^*(892)\bar{K}^*(892))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.00 ± 0.18 OUR FIT</b>				
<b>1.17 ± 0.29 OUR AVERAGE</b>				

1.4 ± 0.3 ± 0.5	60	ABLIKIM 05L	BES2	$J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
1.04 ± 0.36 ± 0.18	14	<sup>1</sup> BISELLO 91	DM2	$e^+ e^- \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
1.2 ± 0.6	9	<sup>1</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

<sup>1</sup> The reported value has been multiplied by 2 to account for isospin symmetry.

$$\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

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

$$\Gamma(\eta_c(1S) \rightarrow \phi K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+) / \Gamma_{\text{total}} \quad \Gamma_8 / \Gamma \times \Gamma_{274}^{B^\pm} / \Gamma^{B^\pm}$$

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

$$\Gamma(\eta_c(1S) \rightarrow \phi\phi) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma \times \Gamma_{248}^{J/\psi(1S)} / \Gamma^{J/\psi(1S)}$$

VALUE (units $10^{-5}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

**2.6 ± 0.6 OUR FIT** Error includes scale factor of 2.3.

**4.1 ± 0.6 OUR AVERAGE** Error includes scale factor of 1.2.

$4.3 \pm 0.5^{+0.5}_{-1.2}$	1.2k	ABLIKIM	17P BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$3.3 \pm 0.6 \pm 0.6$	72	ABLIKIM	05L BES2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$3.9 \pm 0.9 \pm 0.7$	19	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$3.8^{+2.3}_{-1.5} \pm 0.7$	5	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$9.3 \pm 2.0 \pm 1.6$	80	BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$8.5 \pm 2.7 \pm 1.8$		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

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

$3.3 \pm 0.6 \pm 0.6$	357	<sup>1</sup> BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
-----------------------	-----	------------------	--------	---

<sup>1</sup>Superseded by ABLIKIM 05L.

$$\Gamma(\eta_c(1S) \rightarrow \phi\phi) / \Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma \times \Gamma_{274}^{B^\pm} / \Gamma^{B^\pm}$$

VALUE (units $10^{-6}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

**1.7 ± 0.4 OUR FIT** Error includes scale factor of 2.5.

**3.3<sup>+1.2</sup><sub>-1.0</sub> OUR AVERAGE** Error includes scale factor of 1.5.

$4.7 \pm 1.2 \pm 0.5$		AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm \eta_c$
$2.2^{+1.0}_{-0.7} \pm 0.5$	7	HUANG	03 BELL	$B^\pm \rightarrow K^\pm \phi\phi$

$$\Gamma(\eta_c(1S) \rightarrow \omega\omega) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) / \Gamma_{\text{total}} \quad \Gamma_{16} / \Gamma \times \Gamma_{248}^{J/\psi(1S)} / \Gamma^{J/\psi(1S)}$$

VALUE (units $10^{-5}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

**3.8 ± 1.2 OUR FIT** Error includes scale factor of 2.1.

**4.90 ± 0.17 ± 0.77** 1705 ABLIKIM 19AV BES3  $J/\psi \rightarrow \gamma\omega\omega$

$$\Gamma(\eta_c(1S) \rightarrow f_2(1270) f_2(1270)) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) / \Gamma_{\text{total}} \quad \Gamma_{18} / \Gamma \times \Gamma_{248}^{J/\psi(1S)} / \Gamma^{J/\psi(1S)}$$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

**1.5 ± 0.4 OUR FIT**

**1.3 ± 0.3<sup>+0.3</sup><sub>-0.4</sub>** 91.2 ± 19.8 ABLIKIM 04M BES  $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>10.7 ± 1.0 OUR FIT</b>	Error includes scale factor of 1.7.			
<b>6.7 ± 0.8 OUR AVERAGE</b>				
6.6 ± 0.9 ± 1.5	0.6k	<sup>1</sup> BAI	04	BES $J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
8.76 ± 1.80 ± 1.68	33	<sup>2</sup> BISELLO	91	DM2 $J/\psi \rightarrow \gamma K^+ K^- \pi^0$
6.9 ± 1.2 ± 1.2	68	<sup>3</sup> BISELLO	91	DM2 $J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
7.8 ± 3.0	32	<sup>4</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
5.7 ± 1.5	63	<sup>5</sup> BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$

<sup>1</sup> BAI 04 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.2 \pm 0.3 \pm 0.5) \times 10^{-4}$  which we multiply by 3 to account for isospin symmetry.

<sup>2</sup> BISELLO 91 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.46 \pm 0.30 \pm 0.28) \times 10^{-4}$  which we multiply by 6 to account for isospin symmetry.

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

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

<sup>5</sup> BALTRUSAITIS 86 reports  $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (1.9 \pm 0.5) \times 10^{-4}$  which we multiply by 3 to account for isospin symmetry.

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{274}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>7.1 ± 0.6 OUR FIT</b>	Error includes scale factor of 1.3.		
<b>7.5 ± 0.8 OUR AVERAGE</b>			

8.01 ± 0.42  $^{+1.71}_{-1.65}$  <sup>1</sup> VINOKUROVA 11 BELL  $e^+ e^- \rightarrow \Upsilon(4S)$

7.4 ± 0.5 ± 0.7 AUBERT,B 04B BABR  $B^\pm \rightarrow K^\pm \eta_c$

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

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{199}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units $10^{-4}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.1 ± 0.4 OUR FIT</b>	Error includes scale factor of 1.6.		
<b>4.5 <math>^{+2.4}_{-1.8}</math></b>	HIMEL	80B	MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>3.8 ± 0.4 OUR FIT</b>	Error includes scale factor of 1.3.			
<b>4.1 ± 0.6 OUR AVERAGE</b>				
3.7 ± 0.7 ± 0.3	55	<sup>1,2</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^0$
4.6 ± 0.8 ± 0.3	107	<sup>3,4</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\pm$

- <sup>1</sup> ABLIKIM 12N quotes  $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$  which we multiply by 6 to account for isospin symmetry.
- <sup>2</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.
- <sup>3</sup> ABLIKIM 12N quotes  $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$  which we multiply by 3 to account for isospin symmetry.
- <sup>4</sup> ABLIKIM 12N reports  $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$  which we divide by our best (shown rounded) value  $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.

$$\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \quad \Gamma_{38} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>7.1±1.0 OUR FIT</b>		Error includes scale factor of 1.2.		
<b>5.7±2.9±0.4</b>	7	<sup>1,2</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$
<sup>1</sup> ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.				
<sup>2</sup> ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best (shown rounded) value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.				

$$\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \quad \Gamma_{39} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>9.7±2.5±0.7</b>	33	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$
<sup>1</sup> ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best (shown rounded) value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.				

$$\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \quad \Gamma_{39} / \Gamma \times \Gamma_{248}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

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

$$\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{40} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2.6±0.7±0.2</b>	39	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+ \pi^-)$
<sup>1</sup> ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best (shown rounded) value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.				

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{41} / \Gamma \times \Gamma_{248}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.21±0.29 OUR FIT</b>	Error includes scale factor of 2.2.			
<b>1.9 ±0.6 OUR AVERAGE</b>	Error includes scale factor of 2.4.			
1.5 ±0.2 ±0.2	0.4k	BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
2.7 ±0.4	110	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{41} / \Gamma \times \Gamma_{199}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.4±0.8 OUR FIT</b>	Error includes scale factor of 2.1.		
<b>4.0<sup>+6.0</sup><sub>-2.5</sub></b>	HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

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

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>4.2±1.1 OUR FIT</b>	Error includes scale factor of 2.0.			
<b>5.6±1.3±0.4</b>	38	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^+ \pi^-$
<sup>1</sup> ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best (shown rounded) value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.				

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

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
<b>3.2±0.8±0.2</b>	<sup>1,2</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\mp 2\pi^\pm$
<sup>1</sup> ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^- \pi^- 2\pi^+)$ = $(12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to take c.c. into account.			
<sup>2</sup> ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best (shown rounded) value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$ . Our first error is their experiment's error and our second error is the systematic error from using our best (shown rounded) value.			

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

$$\Gamma_{44}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

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

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

$$\Gamma_{44}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>4.8 ± 2.5 ± 0.3</b>	10	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$

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

$$\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-))/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}}$$

$$\Gamma_{45}/\Gamma \times \Gamma_{274}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units $10^{-6}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.4 ± 0.4 OUR FIT</b>				Error includes scale factor of 1.5.
<b>1.8<sup>+0.6</sup><sub>-0.5</sub></b>	14.5 <sup>+4.6</sup> <sub>-3.0</sub>	HUANG	03 BELL	$B^+ \rightarrow 2(K^+ K^-) K^+$

$$\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{45}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.75 ± 0.24 OUR FIT</b>				Error includes scale factor of 1.5.

<b>1.3 ± 0.5 ± 0.1</b>	7	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma 2(K^+ K^-)$
------------------------	---	----------------------	----------	--

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

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

$$\Gamma_{47}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2.7 ± 0.5 ± 0.2</b>	118	<sup>1</sup> ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \pi^+ \pi^- 2\pi^0$

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

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \\ \Gamma_{48}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.37±0.19 OUR FIT</b>				Error includes scale factor of 1.3.
<b>1.36±0.23 OUR AVERAGE</b>				
1.3 ±0.2 ±0.4	0.5k	BAI	04	BES $J/\psi \rightarrow \gamma 2(\pi^+\pi^-)$
1.33±0.22±0.20	137	BISELLO	91	DM2 $J/\psi \rightarrow \gamma 2(\pi^+\pi^-)$
1.6 ±0.6	25	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma\eta_c$

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \\ \Gamma_{48}/\Gamma \times \Gamma_{199}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.7±0.6 OUR FIT</b>			Error includes scale factor of 1.6.
<b>5.7<sup>+3.9</sup><sub>-2.4</sub></b>	HIMEL	80B	MRK2 $\psi(2S) \rightarrow \eta_c\gamma$

$$\Gamma(\eta_c(1S) \rightarrow 2\pi^+2\pi^-\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \\ \Gamma_{49}/\Gamma \times \Gamma_{199}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.01±0.17±0.64	<sup>1</sup> ABLIKIM	25R	BES3 $e^+e^- \rightarrow \psi(2S)$

<sup>1</sup> Destructive interference with background. The constructive interference solution is  $(0.95 \pm 0.17 \pm 0.44) \times 10^{-5}$ .

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

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.48±0.09 OUR FIT</b>				Error includes scale factor of 1.4.
<b>1.01±0.19±0.07</b>	100	<sup>1</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma 2(\pi^+\pi^-)$

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

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \\ \Gamma_{50}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>10.1±1.7±0.7</b>	175	<sup>1</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma 2(\pi^+\pi^-\pi^0)$

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

$$\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{51}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

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

$$\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{51}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.19±0.30±0.08</b>	51	<sup>1</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma 3(\pi^+\pi^-)$

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

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{52}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-5}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2.02±0.19 OUR FIT</b>	Error includes scale factor of 1.2.			
<b>1.61±0.29 OUR AVERAGE</b>				
1.9 ±0.3 ±0.3	213	BAI	04	BES $J/\psi \rightarrow \gamma p\bar{p}$
1.3 ±0.4 ±0.3	18	BISELLO	91	DM2 $J/\psi \rightarrow \gamma p\bar{p}$
1.4 ±0.7	23	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{52}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>7.1±0.8 OUR FIT</b>	Error includes scale factor of 1.2.			
<b>8.7±2.9±0.6</b>	15	<sup>1</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma p\bar{p}$

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

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{52}/\Gamma \times \Gamma_{199}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>4.0±0.7 OUR FIT</b>	Error includes scale factor of 1.4.		
<b>8 <sup>+8</sup>/<sub>-4</sub></b>	HIMEL	80B	MRK2 $\psi(2S) \rightarrow \eta_c\gamma$

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \times \Gamma_{52}/\Gamma \times \Gamma_{274}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units $10^{-6}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.34±0.13 OUR FIT</b>	Error includes scale factor of 1.2.			
<b>1.54±0.19 OUR AVERAGE</b>	Error includes scale factor of 1.1.			
1.42±0.11 <sup>+0.16</sup> / <sub>-0.20</sub>	195	WU	06	BELL $B^+ \rightarrow p\bar{p}K^+$

$$1.8^{+0.3}_{-0.2} \pm 0.2$$

AUBERT,B 05L BABR  $e^+e^- \rightarrow \Upsilon(4S)$ 

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{53}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-3}$ )	DOCUMENT ID	TECN	COMMENT
<b>2.1±0.7±0.1</b>	<sup>1</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma p\bar{p}\pi^0$

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

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{54}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>2.15±0.31 OUR FIT</b>	Error includes scale factor of 1.1.			
<b>3.1 ± 1.0 ± 0.2</b>	19	<sup>1</sup> ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma p\bar{p}\pi^+\pi^-$

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

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \times \Gamma_{54}/\Gamma \times \Gamma_{274}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units $10^{-6}$ )	DOCUMENT ID	TECN	COMMENT
<b>4.0 ± 0.4 OUR FIT</b>			
<b>3.94<sup>+0.41+0.22</sup><sub>-0.39-0.18</sub></b>	CHILIKIN	19	BELL $e^+e^- \rightarrow \Upsilon(4S)$

$$\Gamma(\eta_c(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{55}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-5}$ )	DOCUMENT ID	TECN	COMMENT
<b>1.72±0.28 OUR FIT</b>			
<b>1.98±0.21±0.32</b>	ABLIKIM	12B	BES3 $J/\psi \rightarrow \Lambda\bar{\Lambda}\gamma$

$$\Gamma(\eta_c(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \times \Gamma_{55}/\Gamma \times \Gamma_{274}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units $10^{-6}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>1.13±0.19 OUR FIT</b>	Error includes scale factor of 1.1.			
<b>0.95<sup>+0.25+0.08</sup><sub>-0.22-0.11</sub></b>	20	WU	06	BELL $B^+ \rightarrow \Lambda\bar{\Lambda}K^+$

$$\Gamma(\eta_c(1S) \rightarrow \Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma_{58}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

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

$$\Gamma(\eta_c(1S) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{59}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

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

$$\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{60}/\Gamma \times \Gamma_{248}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units $10^{-6}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>3.9 ± 0.4 OUR FIT</b>	Error includes scale factor of 1.5.			
<b>5.1 ± 0.4 OUR AVERAGE</b>				
5.23 ± 0.26 ± 0.30	678	ABLIKIM	25D	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
4.5 ± 1.2 ± 0.6	73	ABLIKIM	13I	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
1.2 $^{+2.7}_{-1.1}$ ± 0.3	1.2 $^{+2.8}_{-1.1}$	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

$$\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{60}/\Gamma \times \Gamma_{274}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units $10^{-6}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b>0.256 ± 0.028 OUR FIT</b>	Error includes scale factor of 1.4.			
<b>0.22 <math>^{+0.09}_{-0.07}</math> <math>^{+0.04}_{-0.02}</math></b>	13	WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma \gamma$

## $\eta_c(1S)$ REFERENCES

ABLIKIM	25AC	PR D112 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	25D	PRL 134 181901	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	25P	PR D111 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	25R	PR D111 052013	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	21C	PR D103 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	20H	EPJ C80 191	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	19AP	PR D100 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AV	PR D100 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
CHILIKIN	19	PR D100 012001	K. Chilikin <i>et al.</i>	(BELLE Collab.)
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)
XU	18	PR D98 072001	Q.N. Xu <i>et al.</i>	(BELLE Collab.)
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17P	PR D95 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	16A	PR D93 012005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	15BI	EPJ C75 311	R. Aaij <i>et al.</i>	(LHCb Collab.)
ANASHIN	14	PL B738 391	V.V. Anashin <i>et al.</i>	(KEDR Collab.)
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	13C	PR D87 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM	12B	PR D86 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12F	PRL 108 222002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12N	PR D86 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BESIII 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.)
LEES	10	PR D81 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)
ADAMS	08	PRL 101 101801	G.S. Adams <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.)
ABLIKIM	06A	PL B633 19	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	06B	EPJ C45 337	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)
ABLIKIM	05L	PR D72 072005	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT,B	05L	PR D72 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)
KUO	05	PL B621 41	C.C. Kuo <i>et al.</i>	(BELLE Collab.)
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES 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.)
AUBERT,B	04B	PR D70 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)
ABDALLAH	03J	EPJ C31 481	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
AMBROGIANI	03	PL B566 45	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
BAI	03	PL B555 174	J.Z. Bai <i>et al.</i>	(BES Collab.)
FANG	03	PRL 90 071801	F. Fang <i>et al.</i>	(BELLE Collab.)
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
BAI	00F	PR D62 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BRANDENB...	00B	PRL 85 3095	G. Brandenburg <i>et al.</i>	(CLEO Collab.)
ACCIARRI	99T	PL B461 155	M. Acciarri <i>et al.</i>	(L3 Collab.)
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)
SHIRAI	98	PL B424 405	M. Shirai <i>et al.</i>	(AMY Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ALBRECHT	94H	PL B338 390	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ADRIANI	93N	PL B318 575	O. Adriani <i>et al.</i>	(L3 Collab.)
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)
CHEN	90B	PL B243 169	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
BAGLIN	89	PL B231 557	C. Baglin, S. Baird, G. Bassompierre	(R704 Collab.)
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
BRAUNSCH...	89	ZPHY C41 533	W. Braunschweig <i>et al.</i>	(TASSO Collab.)
AIHARA	88D	PRL 60 2355	H. Aihara <i>et al.</i>	(TPC Collab.)
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
BERGER	86	PL 167B 120	C. Berger <i>et al.</i>	(PLUTO Collab.)
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+) JP
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)
HIMEL	80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)
PARTRIDGE	80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)