

**$\psi(4230)$** 

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as  $Y(4230)$ ; was  $\psi(4260)$ 

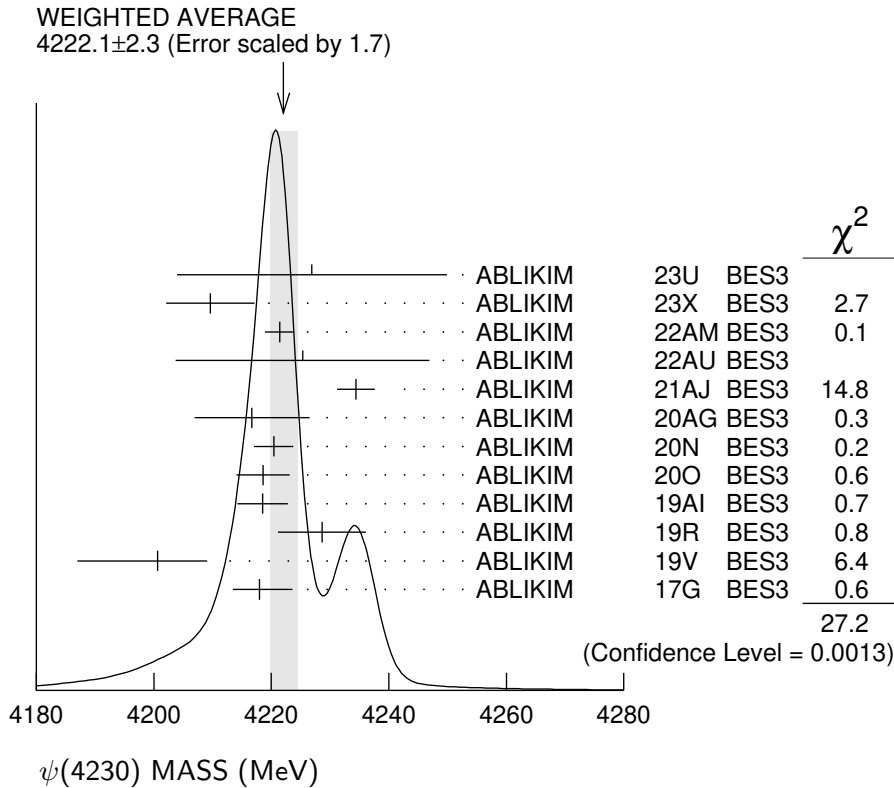
The original  $\psi(4260)$  (also known as  $Y(4260)$ ) was observed by AUBERT, B 05I as a peak in the energy dependence of the  $e^+e^- \rightarrow \pi^+\pi^- J/\psi$  cross section and was confirmed by HE 06B, YUAN 07, LEES 12AC, and LIU 13B in the same process. A higher-statistics analysis by ABLIKIM 17B revealed an asymmetry in the cross section and resulted in a shift of the peak position to a lower mass. The  $\psi(4260)$  was therefore renamed  $\psi(4230)$ . The energy-dependent cross sections for  $e^+e^-$  to other channels also exhibit peaks in the same mass region. The parameters corresponding to those peaks are also listed here, but the number of states in this region remains to be determined.

For details see the review on "Spectroscopy of mesons containing two heavy quarks."

 **$\psi(4230)$  MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>4222.1 ± 2.3</b>	<b>OUR AVERAGE</b>	Error includes scale factor of 1.7. See the ideogram below.		
4226.9 ± 6.6 ± 22.0	1	ABLIKIM	23U BES3	$e^+e^- \rightarrow K_S^+ K_S^- J/\psi$
4209.6 ± 4.7 ± 5.9	2	ABLIKIM	23X BES3	$e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$
4221.4 ± 1.5 ± 2.0	3	ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4225.3 ± 2.3 ± 21.5	4	ABLIKIM	22AU BES3	$e^+e^- \rightarrow K^+ K^- J/\psi$
4234.4 ± 3.2 ± 0.2	5	ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4216.7 ± 8.9 ± 4.1	6	ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+ \mu^-$
4220.4 ± 2.4 ± 2.3	7	ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$
4218.6 ± 3.8 ± 2.5	7	ABLIKIM	20O BES3	$e^+e^- \rightarrow \eta J/\psi$
4218.5 ± 1.6 ± 4.0	8	ABLIKIM	19AI BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
4228.6 ± 4.1 ± 6.3		ABLIKIM	19R BES3	$e^+e^- \rightarrow \pi^+ D^0 D^{*-} + c.c.$
4200.6 <sup>+7.9</sup> <sub>-13.3</sub> ± 3.0	9	ABLIKIM	19V BES3	$e^+e^- \rightarrow \gamma \chi_{c1}(3872)$
4218 <sup>+5.5</sup> <sub>-4.5</sub> ± 0.9		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4231.9 ± 5.3 ± 4.9		ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0 T_{c\bar{c}1}(3900)^0$ , $T_{c\bar{c}1}^0 \rightarrow \pi^0 J/\psi$
4222.0 ± 3.1 ± 1.4	10	ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4209.5 ± 7.4 ± 1.4	11	ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4209.1 ± 6.8 ± 7.0	12	ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4223.3 ± 1.6 ± 2.5	13	ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
4230 ± 8 ± 6180	14	ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
4258.6 ± 8.3 ± 12.1	15	LIU	13B BELL	$e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4245 ± 5 ± 4	16	LEES	12AC BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4247 ± 12 <sup>+17</sup> <sub>-32</sub>	15,17	YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4284 <sup>+17</sup> <sub>-16</sub> ± 413.6		HE	06B CLEO	9.4–10.6 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

4259 ± 8  $\pm \frac{2}{6}$  125 <sup>18</sup> AUBERT,B 051 BABR 10.58 e<sup>+</sup>e<sup>-</sup> → γπ<sup>+</sup>π<sup>-</sup>J/ψ



<sup>1</sup> From a three-resonance fit to the dressed cross section in the range  $\sqrt{s} = 4.128\text{--}4.950$  GeV.

<sup>2</sup> From a cross-section measurement of  $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$  between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths)  $4675.3 \pm 29.7$  ( $218.3 \pm 73.5$ ) MeV and  $4469.1 \pm 26.4$  ( $246.3 \pm 37.9$ ) MeV.

<sup>3</sup> From a three-resonance fit to the Born cross section in the range  $\sqrt{s} = 3.7730\text{--}4.7008$  GeV.

<sup>4</sup> From a two-resonance fit to the dressed cross section in the range  $\sqrt{s} = 4.127\text{--}4.600$  GeV. The second resonance has a mass of  $4484.7 \pm 13.3 \pm 24.1$  MeV and a total width of  $111.1 \pm 30.1 \pm 15.2$  MeV.

<sup>5</sup> From a three-resonance fit to the Born cross section in the range  $\sqrt{s} = 4.008\text{--}4.698$  GeV.

<sup>6</sup> Solution 1 of 8 with equal fit quality to the  $e^+e^- \rightarrow \mu^+\mu^-$  cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes. Other solutions range from  $4212.8 \pm 7.2 \pm 4.0$  to  $4219.4 \pm 11.2 \pm 4.1$  MeV.

<sup>7</sup> From a fit of the measured cross section in the range  $\sqrt{s} = 3.808\text{--}4.600$  GeV.

<sup>8</sup> From a fit of the measured cross section from  $\sqrt{s} = 4.178\text{--}4.278$  GeV. Supersedes ABLIKIM 15C.

<sup>9</sup> Simultaneous fit to  $\chi_{c1} \rightarrow \omega J/\psi$  and  $\chi_{c1} \rightarrow \pi^+\pi^- J/\psi$ .

<sup>10</sup> From a three-resonance fit. Superseded by ABLIKIM 22AM.

<sup>11</sup> From a fit to the cross section for  $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$  obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising  $5.1 \text{ fb}^{-1}$ . Superseded by ABLIKIM 21AJ.

<sup>12</sup> From a three-resonance fit.

<sup>13</sup> From a combined fit of BELLE, BABAR and BES3  $e^+e^- \rightarrow \pi^+\pi^- J/\psi$  and  $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$  data.

- <sup>14</sup> From a 3-parameter fit of measured cross sections from  $\sqrt{s} = 4.21\text{--}4.42$  GeV to a phase-space modified Breit-Wigner function, using the decays  $\chi_{c0} \rightarrow \pi^+ \pi^-$ ,  $\chi_{c0} \rightarrow K^+ K^-$ , and  $\omega \rightarrow \pi^+ \pi^- \pi^0$ .
- <sup>15</sup> From a two-resonance fit.
- <sup>16</sup> From a single-resonance fit. Supersedes AUBERT,B 05I.
- <sup>17</sup> Superseded by LIU 13B.
- <sup>18</sup> From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

## $\psi(4230)$ WIDTH

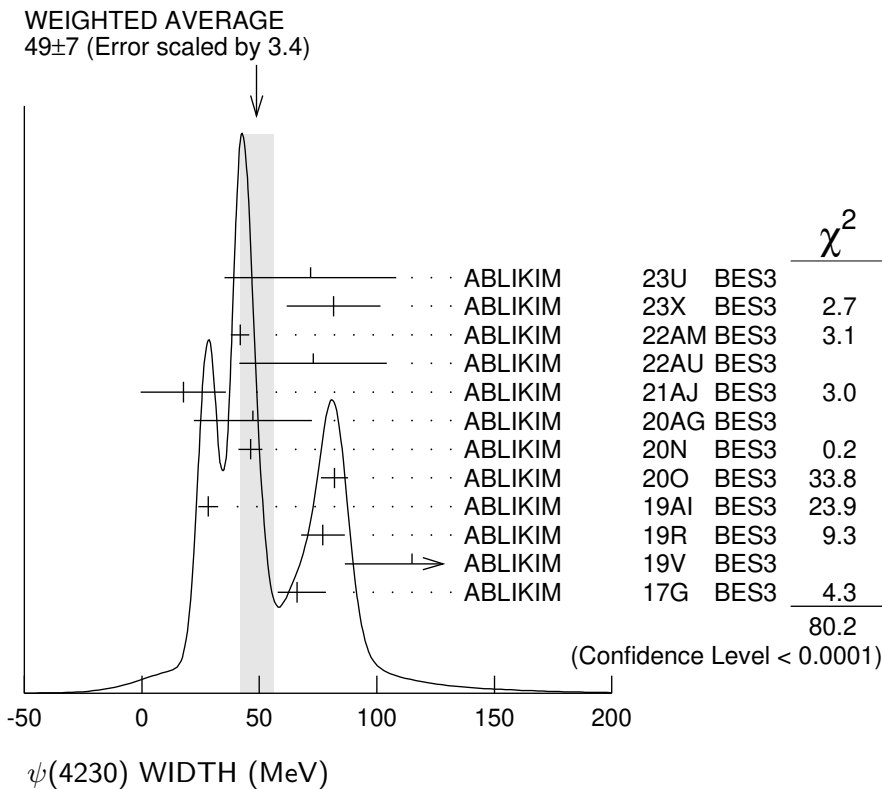
VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
<b>49 ± 7</b>		<b>OUR AVERAGE</b>		Error includes scale factor of 3.4. See the ideogram below.
71.7 ± 16.2 ± 32.8		<sup>1</sup> ABLIKIM	23U BES3	$e^+ e^- \rightarrow K_S^0 K_S^0 J/\psi$
81.6 ± 17.8 ± 9.0		<sup>2</sup> ABLIKIM	23X BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$
41.8 ± 2.9 ± 2.7		<sup>3</sup> ABLIKIM	22AM BES3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
72.9 ± 6.1 ± 30.8		<sup>4</sup> ABLIKIM	22AU BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$
17.6 ± 18.1 ± 0.9		<sup>5</sup> ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
47.2 ± 22.8 ± 10.5		<sup>6</sup> ABLIKIM	20AG BES3	$e^+ e^- \rightarrow \mu^+ \mu^-$
46.2 ± 4.7 ± 2.1		<sup>7</sup> ABLIKIM	20N BES3	$e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$
82.0 ± 5.7 ± 0.4		<sup>7</sup> ABLIKIM	20O BES3	$e^+ e^- \rightarrow \eta J/\psi$
28.2 ± 3.9 ± 1.6		<sup>8</sup> ABLIKIM	19AI BES3	$e^+ e^- \rightarrow \omega \chi_{c0}$
77.0 ± 6.8 ± 6.3		ABLIKIM	19R BES3	$e^+ e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$
115 $\begin{smallmatrix} +38 \\ -26 \end{smallmatrix}$ ± 12		<sup>9</sup> ABLIKIM	19V BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$
66.0 $\begin{smallmatrix} +12.3 \\ -8.3 \end{smallmatrix}$ ± 0.4		ABLIKIM	17G BES3	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
41.2 ± 16.0 ± 16.4		ABLIKIM	20N BES3	$e^+ e^- \rightarrow \pi^0 T_{c\bar{c}1}(3900)^0$ , $T_{c\bar{c}1}^0 \rightarrow \pi^0 J/\psi$
44.1 ± 4.3 ± 2.0		<sup>10</sup> ABLIKIM	17B BES3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
80.1 ± 24.6 ± 2.9		<sup>11</sup> ABLIKIM	17V BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
76.6 ± 14.2 ± 2.4		<sup>12</sup> ZHANG	17B RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
54.2 ± 2.6 ± 1.0		<sup>13</sup> ZHANG	17C RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$
38 ± 12 ± 2	180	<sup>14</sup> ABLIKIM	15C BES3	$e^+ e^- \rightarrow \omega \chi_{c0}$
134.1 ± 16.4 ± 5.5		<sup>15</sup> LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
114 $\begin{smallmatrix} +16 \\ -15 \end{smallmatrix}$ ± 7		<sup>16</sup> LEES	12AC BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
108 ± 19 ± 10		<sup>15,17</sup> YUAN	07 BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
73 $\begin{smallmatrix} +39 \\ -25 \end{smallmatrix}$ ± 5	13.6	HE	06B CLEO	9.4–10.6 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
88 ± 23 $\begin{smallmatrix} +6 \\ -4 \end{smallmatrix}$	125	<sup>18</sup> AUBERT,B	05I BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

<sup>1</sup> From a three-resonance fit to the dressed cross section in the range  $\sqrt{s} = 4.128\text{--}4.950$  GeV.

<sup>2</sup> From a cross-section measurement of  $e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$  between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths)  $4675.3 \pm 29.7$  ( $218.3 \pm 73.5$ ) MeV and  $4469.1 \pm 26.4$  ( $246.3 \pm 37.9$ ) MeV.

<sup>3</sup> From a three-resonance fit to the Born cross section in the range  $\sqrt{s} = 3.7730\text{--}4.7008$  GeV.

- 4 From a two-resonance fit to the dressed cross section in the range  $\sqrt{s} = 4.127\text{--}4.600$  GeV. The second resonance has a mass of  $4484.7 \pm 13.3 \pm 24.1$  MeV and a total width of  $111.1 \pm 30.1 \pm 15.2$  MeV.
- 5 From a three-resonance fit to the Born cross section in the range  $\sqrt{s} = 4.008\text{--}4.698$  GeV.
- 6 Solution 1 of 8 with equal fit quality to the  $e^+e^- \rightarrow \mu^+\mu^-$  cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes. Other solutions range from  $36.4 \pm 16.8 \pm 8.1$  to  $49.6 \pm 22.6 \pm 11.0$  MeV.
- 7 From a fit of the measured cross section in the range  $\sqrt{s} = 3.808\text{--}4.600$  GeV.
- 8 From a fit of the measured cross section from  $\sqrt{s} = 4.178\text{--}4.278$  GeV. Supersedes ABLIKIM 15C.
- 9 Simultaneous fit to  $\chi_{c1} \rightarrow \omega J/\psi$  and  $\chi_{c1} \rightarrow \pi^+\pi^- J/\psi$ .
- 10 From a three-resonance fit. Superseded by ABLIKIM 22AM.
- 11 From a fit to the cross section for  $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$  obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising  $5.1 \text{ fb}^{-1}$ . Superseded by ABLIKIM 21AJ.
- 12 From a three-resonance fit.
- 13 From a combined fit of BELLE, BABAR and BES3  $e^+e^- \rightarrow \pi^+\pi^- J/\psi$  and  $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$  data.
- 14 From a 3-parameter fit of measured cross sections from  $\sqrt{s} = 4.21\text{--}4.42$  GeV to a phase-space modified Breit-Wigner function, using the decays  $\chi_{c0} \rightarrow \pi^+\pi^-$ ,  $\chi_{c0} \rightarrow K^+K^-$ , and  $\omega \rightarrow \pi^+\pi^-\pi^0$ .
- 15 From a two-resonance fit.
- 16 From a single-resonance fit. Supersedes AUBERT,B 05I.
- 17 Superseded by LIU 13B.
- 18 From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.



**$\psi(4230)$  DECAY MODES**

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $e^+ e^-$	
$\Gamma_2$ $\mu^+ \mu^-$	$(3.1 \pm 2.8) \times 10^{-5}$
$\Gamma_3$ $\eta_c(1S) \pi^+ \pi^-$	not seen
$\Gamma_4$ $\eta_c(1S) \pi^+ \pi^- \pi^0$	seen
$\Gamma_5$ $J/\psi \pi^+ \pi^-$	seen
$\Gamma_6$ $J/\psi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-$	seen
$\Gamma_7$ $T_{c\bar{c}1}(3900)^\pm \pi^\mp, T_{c\bar{c}1}^\pm \rightarrow J/\psi \pi^\pm$	seen
$\Gamma_8$ $J/\psi \pi^0 \pi^0$	seen
$\Gamma_9$ $J/\psi K^+ K^-$	seen
$\Gamma_{10}$ $J/\psi K_S^0 K_S^0$	not seen
$\Gamma_{11}$ $J/\psi \eta$	seen
$\Gamma_{12}$ $J/\psi \pi^0$	not seen
$\Gamma_{13}$ $J/\psi \eta'$	seen
$\Gamma_{14}$ $J/\psi \pi^+ \pi^- \pi^0$	not seen
$\Gamma_{15}$ $J/\psi \eta \pi^0$	not seen
$\Gamma_{16}$ $J/\psi \eta \eta$	not seen
$\Gamma_{17}$ $\psi(2S) \pi^+ \pi^-$	seen
$\Gamma_{18}$ $\psi(2S) \eta$	not seen
$\Gamma_{19}$ $\chi_{c0} \omega$	seen
$\Gamma_{20}$ $\chi_{c1} \pi^+ \pi^- \pi^0$	not seen
$\Gamma_{21}$ $\chi_{c2} \pi^+ \pi^- \pi^0$	not seen
$\Gamma_{22}$ $h_c(1P) \pi^+ \pi^-$	seen
$\Gamma_{23}$ $\phi \pi^+ \pi^-$	not seen
$\Gamma_{24}$ $\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	not seen
$\Gamma_{25}$ $\phi K^+ K^-$	not seen
$\Gamma_{26}$ $\phi K_S^0 K_S^0$	not seen
$\Gamma_{27}$ $\phi \eta$	not seen
$\Gamma_{28}$ $\phi \eta'$	not seen
$\Gamma_{29}$ $D \bar{D}$	not seen
$\Gamma_{30}$ $D^0 \bar{D}^0$	not seen
$\Gamma_{31}$ $D^+ D^-$	not seen
$\Gamma_{32}$ $D^* \bar{D} + \text{c.c.}$	not seen
$\Gamma_{33}$ $D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	not seen
$\Gamma_{34}$ $D^*(2010)^+ D^- + \text{c.c.}$	not seen
$\Gamma_{35}$ $D^* \bar{D}^*$	not seen
$\Gamma_{36}$ $D^*(2007)^0 \bar{D}^*(2007)^0$	not seen
$\Gamma_{37}$ $D^*(2010)^+ D^*(2010)^-$	not seen
$\Gamma_{38}$ $D \bar{D} \pi + \text{c.c.}$	not seen

$\Gamma_{39}$	$D^0 D^- \pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0 \bar{D}^{*0} + \text{c.c.},$ $D^*(2010)^+ D^- + \text{c.c.}$ )	not seen
$\Gamma_{40}$	$D \bar{D}^* \pi + \text{c.c.}$ (excl. $D^* \bar{D}^*$ )	not seen
$\Gamma_{41}$	$D^0 D^*(2010)^- \pi^+ + \text{c.c.}$	seen
$\Gamma_{42}$	$D_1(2420) \bar{D} + \text{c.c.}$	not seen
$\Gamma_{43}$	$D^* \bar{D}^* \pi$	seen
$\Gamma_{44}$	$D^{*0} D^{*-} \pi^+$	seen
$\Gamma_{45}$	$D_s^+ D_s^-$	not seen
$\Gamma_{46}$	$D_s^{*+} D_s^- + \text{c.c.}$	not seen
$\Gamma_{47}$	$D_s^{*+} D_s^{*-}$	not seen
$\Gamma_{48}$	$p \bar{p}$	not seen
$\Gamma_{49}$	$p \bar{p} \pi^0$	not seen
$\Gamma_{50}$	$p \bar{p} \eta$	not seen
$\Gamma_{51}$	$\omega \pi^+ \pi^-$	seen
$\Gamma_{52}$	$p \bar{p} \omega$	not seen
$\Gamma_{53}$	$\Xi^- \bar{\Xi}^+$	not seen
$\Gamma_{54}$	$\pi^+ \pi^+ \pi^- \pi^-$	not seen
$\Gamma_{55}$	$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	not seen
$\Gamma_{56}$	$\omega \pi^0$	not seen
$\Gamma_{57}$	$\omega \eta$	not seen
$\Gamma_{58}$	$K_S^0 K^\pm \pi^\mp$	not seen
$\Gamma_{59}$	$K_S^0 K^\pm \pi^\mp \pi^0$	not seen
$\Gamma_{60}$	$K_S^0 K^\pm \pi^\mp \eta$	not seen
$\Gamma_{61}$	$K^+ K^- \pi^0$	not seen
$\Gamma_{62}$	$K^+ K^- \pi^+ \pi^-$	not seen
$\Gamma_{63}$	$K^+ K^- \pi^+ \pi^- \pi^0$	not seen
$\Gamma_{64}$	$K^+ K^+ K^- K^-$	not seen
$\Gamma_{65}$	$K^+ K^+ K^- K^- \pi^0$	not seen
$\Gamma_{66}$	$p \bar{p} \pi^+ \pi^-$	not seen
$\Gamma_{67}$	$p \bar{p} \pi^+ \pi^- \pi^0$	not seen
$\Gamma_{68}$	$p \bar{p} p \bar{p}$	not seen
$\Gamma_{69}$	$\Lambda \bar{\Lambda}$	not seen
$\Gamma_{70}$	$p K^- \bar{\Lambda} + \text{c.c.}$	

### Radiative decays

$\Gamma_{71}$	$\eta_c(1S) \gamma$	possibly seen
$\Gamma_{72}$	$\eta_c(1S) \pi^0 \gamma$	not seen
$\Gamma_{73}$	$\chi_{c1} \gamma$	not seen
$\Gamma_{74}$	$\chi_{c2} \gamma$	not seen
$\Gamma_{75}$	$\chi_{c1}(3872) \gamma$	seen

---

$\psi(4230)$  PARTIAL WIDTHS $\Gamma(\mu^+ \mu^-)$   $\Gamma_2$ 

VALUE (keV)		DOCUMENT ID	TECN	COMMENT
<b>1.53±1.26±0.54</b>		1,2 ABLIKIM	20AG BES3	$e^+ e^- \rightarrow \mu^+ \mu^-$

<sup>1</sup>From a fit to the  $e^+ e^- \rightarrow \mu^+ \mu^-$  cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming  $\Gamma(\mu^+ \mu^-) = \Gamma(e^+ e^-)$ .

<sup>2</sup>From solution 1 of 8 with equal fit quality. Other solutions range from  $1.09 \pm 0.84 \pm 0.39$  to  $1.53 \pm 1.26 \pm 0.54$  keV.

 $\psi(4230) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$  $\Gamma(J/\psi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$   $\Gamma_5 \Gamma_1 / \Gamma$ 

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>9.2±1.0 OUR AVERAGE</b>				

9.2±0.8±0.7		<sup>1</sup> LEES	12AC BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
8.9 <sup>+3.9</sup> <sub>-3.1</sub> ±1.8	8.1	HE	06B CLEO	9.4–10.6 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

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

6.4±0.8±0.6		<sup>2</sup> LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
20.5±1.4±2.0		<sup>3</sup> LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
6.0±1.2 <sup>+4.7</sup> <sub>-0.5</sub>		<sup>2,4</sup> YUAN	07 BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
20.6±2.3 <sup>+9.1</sup> <sub>-1.7</sub>		<sup>3,4</sup> YUAN	07 BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
5.5±1.0 <sup>+0.8</sup> <sub>-0.7</sub>	125	<sup>5</sup> AUBERT,B	05I BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

<sup>1</sup>From a single-resonance fit. Supersedes AUBERT,B 05I.

<sup>2</sup>Solution I of two equivalent solutions in a fit using two interfering resonances.

<sup>3</sup>Solution II of two equivalent solutions in a fit using two interfering resonances.

<sup>4</sup>Superseded by LIU 13B.

<sup>5</sup>From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

 $\Gamma(J/\psi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$   $\Gamma_9 \Gamma_1 / \Gamma$ 

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

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

0.42±0.04±0.15		<sup>1</sup> ABLIKIM	22AU BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$
0.29±0.02±0.10		<sup>2</sup> ABLIKIM	22AU BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$
<1.7	90	<sup>3</sup> SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$
<1.2	90	<sup>4</sup> YUAN	08 BELL	$e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$

<sup>1</sup>Solution I from a two-resonance fit to the dressed cross section in the range  $\sqrt{s} = 4.127\text{--}4.600$  GeV. The second resonance has a mass of  $4484.7 \pm 13.3 \pm 24.1$  MeV, a total width of  $111.1 \pm 30.1 \pm 15.2$  MeV, and  $\Gamma_{ee} \cdot B = 1.35 \pm 0.14 \pm 0.07$  eV. The phase difference is  $1.72 \pm 0.09 \pm 0.52$  rad.

<sup>2</sup>Solution II from a two-resonance fit to the dressed cross section in the range  $\sqrt{s} = 4.127\text{--}4.600$  GeV. The second resonance has a mass of  $4484.7 \pm 13.3 \pm 24.1$  MeV, a total width of  $111.1 \pm 30.1 \pm 15.2$  MeV, and  $\Gamma_{ee} \cdot B = 0.41 \pm 0.08 \pm 0.13$  eV. The phase difference is  $5.49 \pm 0.35 \pm 0.58$  rad.

<sup>3</sup> From a fit of the broad  $K^+ K^- J/\psi$  enhancement including a coherent  $\psi(4260)$  amplitude with mass and width from LIU 13B. Supersedes YUAN 08. The shape of the cross section observed by ABLIKIM 18N between 4.2 and 4.3 GeV is incompatible with that of  $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$  in ABLIKIM 13T and ABLIKIM 17B. They also observe a broad enhancement around 4.5 GeV.

<sup>4</sup> From a fit of the broad  $K^+ K^- J/\psi$  enhancement including a coherent  $\psi(4260)$  amplitude with mass and width from YUAN 07.

$\Gamma(J/\psi K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_{10} \Gamma_1 / \Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<b>&lt;0.85</b>	90	<sup>1</sup> SHEN	14	BELL	$9.4\text{--}10.9 e^+ e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$

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

$0.13 \pm 0.02 \pm 0.05$	<sup>2,3</sup> ABLIKIM	23U	BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$
$0.14 \pm 0.03 \pm 0.06$	<sup>2,4</sup> ABLIKIM	23U	BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$
$0.18 \pm 0.05 \pm 0.07$	<sup>2,5</sup> ABLIKIM	23U	BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$
$0.20 \pm 0.04 \pm 0.07$	<sup>2,6</sup> ABLIKIM	23U	BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$

<sup>1</sup> From a fit of the  $K_S^0 K_S^0 J/\psi$  mass range from 4.4 to 5.5 GeV including a coherent  $\psi(4260)$  amplitude with mass and width from LIU 13B.

<sup>2</sup> A three-resonance fit to the dressed cross section in the range  $\sqrt{s} = 4.128\text{--}4.950$  GeV.

<sup>3</sup> Solution I.

<sup>4</sup> Solution II.

<sup>5</sup> Solution III.

<sup>6</sup> Solution IV.

$\Gamma(J/\psi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_{11} \Gamma_1 / \Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
$8.0 \pm 1.7$		<sup>1</sup> ABLIKIM	200	BES3	$e^+ e^- \rightarrow \eta J/\psi$
$4.8 \pm 1.0$		<sup>2</sup> ABLIKIM	200	BES3	$e^+ e^- \rightarrow \eta J/\psi$
$7.0 \pm 1.5$		<sup>3</sup> ABLIKIM	200	BES3	$e^+ e^- \rightarrow \eta J/\psi$
<b>&lt;14.2</b>	90	WANG	13B	BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

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

$8.0 \pm 1.7$		<sup>1</sup> ABLIKIM	200	BES3	$e^+ e^- \rightarrow \eta J/\psi$
$4.8 \pm 1.0$		<sup>2</sup> ABLIKIM	200	BES3	$e^+ e^- \rightarrow \eta J/\psi$
$7.0 \pm 1.5$		<sup>3</sup> ABLIKIM	200	BES3	$e^+ e^- \rightarrow \eta J/\psi$
<b>&lt;14.2</b>	90	WANG	13B	BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

<sup>1</sup> Solution 1 of three equivalent fit solutions using three resonant structures.

<sup>2</sup> Solution 2 of three equivalent fit solutions using three resonant structures.

<sup>3</sup> Solution 3 of three equivalent fit solutions using three resonant structures.

$\Gamma(J/\psi \eta') \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$					$\Gamma_{13} \Gamma_1 / \Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.06 \pm 0.03$	46	<sup>1,2</sup> ABLIKIM	20A	BES3	$e^+ e^- \rightarrow \eta' J/\psi$
$1.38 \pm 0.11$	46	<sup>1,3</sup> ABLIKIM	20A	BES3	$e^+ e^- \rightarrow \eta' J/\psi$

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

$0.06 \pm 0.03$	46	<sup>1,2</sup> ABLIKIM	20A	BES3	$e^+ e^- \rightarrow \eta' J/\psi$
$1.38 \pm 0.11$	46	<sup>1,3</sup> ABLIKIM	20A	BES3	$e^+ e^- \rightarrow \eta' J/\psi$

<sup>1</sup> Based on a fit to  $\sigma(e^+ e^- \rightarrow \eta' J/\psi)$  from  $\sqrt{s} = 4.18$  to 4.60 GeV assuming interfering  $\psi(4160)$  and  $\psi(4260)$  contributions. At  $\sqrt{s} = 4.23$  GeV,  $\sigma(e^+ e^- \rightarrow \eta' J/\psi) = 3.6 \pm 0.6 \pm 0.3$  pb.

<sup>2</sup> Solution I of the fit, corresponding to a phase of  $-0.03 \pm 0.44$  rad.

<sup>3</sup> Solution II of the fit, corresponding to a phase of  $2.54 \pm 0.04$  rad.



$$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{17}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

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

1.59±0.75		<sup>1</sup> ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.63±0.78		<sup>2</sup> ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
0.02±0.01		<sup>3</sup> ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.6 ±1.3		<sup>4</sup> ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.8 ±1.4		<sup>5</sup> ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
<4.3	90	<sup>6</sup> LIU	08H RVUE	10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
7.4 $\begin{smallmatrix} +2.1 \\ -1.7 \end{smallmatrix}$		<sup>7</sup> LIU	08H RVUE	10.58 $e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$

<sup>1</sup> Solution I of four equivalent solutions in a fit using three interfering resonances.

<sup>2</sup> Solution II of four equivalent solutions in a fit using three interfering resonances

<sup>3</sup> Solutions III and IV of four equivalent solutions in a fit using three interfering resonances.

<sup>4</sup> Solution I of two equivalent solutions in a fit using two interfering resonances.

<sup>5</sup> Solution II of two equivalent solutions in a fit using two interfering resonances.

<sup>6</sup> For constructive interference with the  $\psi(4360)$  in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

<sup>7</sup> For destructive interference with the  $\psi(4360)$  in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

$$\Gamma(\chi_{c0}\omega) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{19}\Gamma_1/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
------------	------	-------------	------	---------

<b>2.5±0.2±0.3</b>		<sup>1</sup> ABLIKIM	19AI BES3	$e^+e^- \rightarrow \omega\chi_{c0}$
--------------------	--	----------------------	-----------	--------------------------------------

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

2.7±0.5±0.4	180	<sup>2</sup> ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$
-------------	-----	----------------------	----------	--------------------------------------

<sup>1</sup> From a fit of the measured cross section from  $\sqrt{s} = 4.178\text{--}4.278$  GeV. Supersedes ABLIKIM 15C.

<sup>2</sup> From a 3-parameter fit of measured cross sections from  $\sqrt{s} = 4.21\text{--}4.42$  GeV to a phase-space modified Breit-Wigner function, using the decays  $\chi_{c0} \rightarrow \pi^+\pi^-$ ,  $\chi_{c0} \rightarrow K^+K^-$ , and  $\omega \rightarrow \pi^+\pi^-\pi^0$ .

$$\Gamma(h_c(1P)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{22}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
------------	-------------	------	---------

<b>4.6<math>\begin{smallmatrix} +2.9 \\ -1.4 \end{smallmatrix}</math>±0.8</b>	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$
---	---------	----------	------------------------------------

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{23}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

<b>&lt;0.4</b>	90	AUBERT, BE	06D BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
----------------	----	------------	----------	--

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{24}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

<b>&lt;0.28</b>	90	<sup>1</sup> AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
-----------------	----	---------------------	-----------	--

<sup>1</sup> AUBERT 07AK reports  $[\Gamma(\psi(4230) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(4230) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] < 0.14$  eV which we divide by our best value  $B(\phi(1020) \rightarrow K^+K^-) = 49.1 \times 10^{-2}$ .

$\Gamma(\phi K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{25}\Gamma_1/\Gamma$ 

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.75	90	ABLIKIM	23AE BES3	$e^+ e^- \rightarrow \phi K^+ K^-$

 $\Gamma(\phi K_S^0 K_S^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{26}\Gamma_1/\Gamma$ 

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.47	90	ABLIKIM	23AE BES3	$e^+ e^- \rightarrow \phi K_S^0 K_S^0$

 $\Gamma(\phi\eta') \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{28}\Gamma_1/\Gamma$ 

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.53	90	ABLIKIM	23R BES3	$e^+ e^- \rightarrow \phi\eta'$

 $\Gamma(D^{*0} D^{*-} \pi^+) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{44}\Gamma_1/\Gamma$ 

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
------------	-------------	------	---------

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

5 to 22	<sup>1</sup> ABLIKIM	23X BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$
---------	----------------------	----------	---

<sup>1</sup> From a cross-section measurement of  $e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$  between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. Depending on solutions I – VIII with the same fit qualities.

 $\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{51}\Gamma_1/\Gamma$ 

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
------------	-------------	------	---------

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

0.487 ± 0.008 ± 0.030	<sup>1,2</sup> ABLIKIM	23AQ BES3	fit to cross sections
-----------------------	------------------------	-----------	-----------------------

0.0005 ± 0.0003 ± 0.0001	<sup>2,3</sup> ABLIKIM	23AQ BES3	fit to cross sections
--------------------------	------------------------	-----------	-----------------------

<sup>1</sup> Solution I of the fit.

<sup>2</sup> From a fit to  $e^+ e^- \rightarrow \omega\pi^+\pi^-$  cross sections between 4 and 4.6 GeV. Recalculated from 12  $\pi\Gamma(e^+ e^-) B(\psi(4230) \rightarrow \omega\pi^+\pi^-)$ . First uncertainty is from statistical and uncommon systematic uncertainties, and the second is a 6.2% common systematic uncertainty quoted in the paper.

<sup>3</sup> Solution II of the fit.

 $\Gamma(\Xi^- \Xi^+) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{53}\Gamma_1/\Gamma$ 

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

<0.0251	90	<sup>1</sup> ABLIKIM	23BK BES3	$e^+ e^- \rightarrow \psi(4230)$
---------	----	----------------------	-----------	----------------------------------

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

<2.7 × 10 <sup>-4</sup>	90	<sup>2</sup> ABLIKIM	20C BES3	$e^+ e^- \rightarrow \Xi^- \Xi^+$
-------------------------	----	----------------------	----------	-----------------------------------

<sup>1</sup> From a fit to  $e^+ e^- \rightarrow \Xi^- \Xi^+$  cross sections.

<sup>2</sup> Superseded by ABLIKIM 23BK.

 $\Gamma(\pi^+\pi^+\pi^-\pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{54}\Gamma_1/\Gamma$ 

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

<32	90	ABLIKIM	21AW BES3	$e^+ e^- \rightarrow 2\pi^+ 2\pi^-$
-----	----	---------	-----------	-------------------------------------

 $\Gamma(\pi^+\pi^+\pi^-\pi^-\pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$   $\Gamma_{55}\Gamma_1/\Gamma$ 

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

<16	90	ABLIKIM	21AW BES3	$e^+ e^- \rightarrow 2\pi^+ 2\pi^- \pi^0$
-----	----	---------	-----------	---

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{58} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

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

2.04 ± 0.19 ± 0.09		<sup>1</sup> ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
0.0027 ± 0.0023 ± 0.0001		<sup>2</sup> ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
< 0.5 at 90% CL		AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

<sup>1</sup> Solution I of the fit including the  $\psi(4160)$  with mass  $4191 \pm 5$  MeV and width  $70 \pm 10$  MeV from PDG 16 and the  $\psi(4230)$  with mass  $4219.6 \pm 3.3 \pm 5.1$  MeV and width  $56.0 \pm 3.6 \pm 6.9$  MeV from GAO 17.

<sup>2</sup> Solution II of the fit including the  $\psi(4160)$  with mass  $4191 \pm 5$  MeV and width  $70 \pm 10$  MeV from PDG 16 and the  $\psi(4230)$  with mass  $4219.6 \pm 3.3 \pm 5.1$  MeV and width  $56.0 \pm 3.6 \pm 6.9$  MeV from GAO 17.

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{59} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

< 0.05	90	ABLIKIM	19 BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0$
--------	----	---------	---------	---

$$\Gamma(K_S^0 K^\pm \pi^\mp \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{60} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

< 0.19	90	ABLIKIM	19 BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \eta$
--------	----	---------	---------	--

$$\Gamma(K^+ K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{61} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

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

< 0.6	90	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$
-------	----	--------	----------	---

$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{62} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

< 20	90	ABLIKIM	21AW BES3	$e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^-$
------	----	---------	-----------	---

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{63} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

< 43	90	ABLIKIM	21AW BES3	$e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
------	----	---------	-----------	---

$$\Gamma(K^+ K^+ K^- K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{64} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

< 3.8	90	ABLIKIM	21AW BES3	$e^+ e^- \rightarrow 2K^+ 2K^-$
-------	----	---------	-----------	---------------------------------

$$\Gamma(K^+ K^+ K^- K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{65} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

< 2.1	90	ABLIKIM	21AW BES3	$e^+ e^- \rightarrow 2K^+ 2K^- \pi^0$
-------	----	---------	-----------	---------------------------------------

$$\Gamma(p \bar{p} \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{66} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

< 7.2	90	ABLIKIM	21AW BES3	$e^+ e^- \rightarrow p \bar{p} \pi^+ \pi^-$
-------	----	---------	-----------	---

$\Gamma(p\bar{p}\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{67}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<15	90	ABLIKIM	21AW BES3	$e^+e^- \rightarrow p\bar{p}\pi^+\pi^-\pi^0$	

$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{69}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.8 × 10 <sup>-3</sup>	90	<sup>1</sup> ABLIKIM	21AS BES3	$e^+e^- \rightarrow \psi(4260)$	

<sup>1</sup> From a measurement of the  $e^+e^- \rightarrow \Lambda\bar{\Lambda}$  cross section between 3.5 and 4.6 GeV.

$\Gamma(pK^-\bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{70}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.3 × 10 <sup>-3</sup>	90	<sup>1</sup> ABLIKIM	23BL BES3	$e^+e^- \rightarrow \psi(4230)$	

<sup>1</sup> From a fit to  $e^+e^- \rightarrow pK^-\bar{\Lambda} + \text{c.c.}$  cross sections.

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{73}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.4	90	<sup>1</sup> HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$	

<sup>1</sup> Using  $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$ .

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{74}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<4.0	90	<sup>1</sup> HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$	

<sup>1</sup> Using  $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$ .

### $\psi(4230) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$

$\Gamma(D^0 D^{*(2010)-} \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{41}/\Gamma \times \Gamma_1/\Gamma$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.42 × 10 <sup>-6</sup>	90	<sup>1</sup> PAKHLOVA	09 BELL	$e^+e^- \rightarrow D^0 D^{*-} \pi^+$	

<sup>1</sup> Using  $4263_{-9}^{+8}$  MeV for the mass of  $\psi(4260)$ .

### $\psi(4230)$ BRANCHING RATIOS

$\Gamma(\eta_c(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$					$\Gamma_3/\Gamma$
VALUE		DOCUMENT ID	TECN	COMMENT	
not seen		<sup>1</sup> ABLIKIM	21B BES3	$e^+e^- \rightarrow \pi^+\pi^-\eta_c$	

<sup>1</sup> Not seen in  $e^+e^- \rightarrow \pi^+\pi^-\eta_c$  at  $\sqrt{s} = 4.226$  GeV with a 90% C.L. upper limit on the cross section of 16.8 pb.

$\Gamma(\eta_c(1S)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					$\Gamma_4/\Gamma$
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		<sup>1</sup> ABLIKIM	21B BES3	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c$	

<sup>1</sup> Seen as a peak in the  $e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c$  cross section with a peak value of  $46.1_{-9.4}^{+9.5} \pm 6.6$  pb at  $\sqrt{s} = 4.226$  GeV.

$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_5/\Gamma$ 

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

<b>seen</b>	<sup>1</sup> ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
-------------	----------------------	----------	--

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

seen	<sup>2</sup> ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
------	----------------------	----------	--

<sup>1</sup> From a three-resonance fit to the Born cross section in the range  $\sqrt{s} = 3.7730\text{--}4.7008$  GeV.

<sup>2</sup> From a three-resonance fit. Superseded by ABLIKIM 22AM.

 $\Gamma(J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_6/\Gamma_5$ 

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

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

$0.17 \pm 0.13$	<sup>1</sup> LEES	12AC BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
-----------------	-------------------	-----------	--

<sup>1</sup> Systematic uncertainties not estimated.

 $\Gamma(T_{c\bar{c}1}(3900)^\pm\pi^\mp, T_{c\bar{c}1}^\pm \rightarrow J/\psi\pi^\pm)/\Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_7/\Gamma_5$ 

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

<b><math>0.215 \pm 0.033 \pm 0.075</math></b>	<sup>1</sup> ABLIKIM	13T BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
---	----------------------	----------	--

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

$0.29 \pm 0.08$	<sup>2</sup> LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
-----------------	------------------	----------	--

<sup>1</sup> Assuming that the cross section of  $e^+e^- \rightarrow \pi^+\pi^- J/\psi$  is fully due to the  $\psi(4260)$ .

<sup>2</sup> Systematic error not evaluated.

 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$   $\Gamma_8/\Gamma$ 

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

<b>seen</b>	<sup>1</sup> ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
-------------	----------------------	----------	--

<sup>1</sup> From a fit to the cross section  $e^+e^- \rightarrow \pi^0\pi^0 J/\psi$  at center-of-mass energies between 3.808 and 4.600 GeV.

 $\Gamma(J/\psi K_S^0 K_S^0)/\Gamma_{\text{total}}$   $\Gamma_{10}/\Gamma$ 

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

<b>not seen</b>	SHEN	14 BELL	$9.4\text{--}10.9 e^+e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$
-----------------	------	---------	---

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$   $\Gamma_{11}/\Gamma$ 

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

<b>seen</b>	ABLIKIM	20O BES3	$e^+e^- \rightarrow \eta J/\psi$
-------------	---------	----------	----------------------------------

 $\Gamma(J/\psi\eta\pi^0)/\Gamma_{\text{total}}$   $\Gamma_{15}/\Gamma$ 

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

<b>not seen</b>	ABLIKIM	15Q BES3	$4.0\text{--}4.6 e^+e^- \rightarrow J/\psi\eta\pi^0$
-----------------	---------	----------	--

 $\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{17}/\Gamma$ 

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

<b>seen</b>	<sup>1</sup> ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
-------------	----------------------	----------	--

<sup>1</sup> From a fit to the cross section for  $e^+e^- \rightarrow \pi^+\pi^- \psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$  obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising  $5.1 \text{ fb}^{-1}$ .

$\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{17}/\Gamma_5$ 

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

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

$(0.11 \pm 0.03 \pm 0.03)$ to $(0.55 \pm 0.18 \pm 0.19)$	<sup>1</sup> ZHANG	17C	RVUE $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
--	--------------------	-----	---

<sup>1</sup>From a combined fit of BELLE, BABAR and BES3  $e^+e^- \rightarrow \pi^+\pi^- J/\psi$  and  $e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$  data.

 $\Gamma(\chi_{c0}\omega)/\Gamma_{\text{total}}$   $\Gamma_{19}/\Gamma$ 

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

seen	180	<sup>1</sup> ABLIKIM	15C	BES3 $e^+e^- \rightarrow \omega\chi_{c0}$
------	-----	----------------------	-----	---

<sup>1</sup>From a 3-parameter fit of measured cross sections from  $\sqrt{s} = 4.21\text{--}4.42$  GeV to a phase-space modified Breit-Wigner function, using the decays  $\chi_{c0} \rightarrow \pi^+\pi^-$ ,  $\chi_{c0} \rightarrow K^+K^-$ , and  $\omega \rightarrow \pi^+\pi^-\pi^0$ .

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$   $\Gamma_{22}/\Gamma$ 

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

seen	ABLIKIM	17G	BES3 $e^+e^- \rightarrow \pi^+\pi^- h_c$
------	---------	-----	--

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{22}/\Gamma_5$ 

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

$<1.0$	90	<sup>1</sup> PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$
--------	----	---------------------	----	---

<sup>1</sup>At  $\sqrt{s} = 4260$  MeV, PEDLAR 11 measures  $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 32 \pm 17 \pm 6 \pm 6$  pb, where the errors are statistical, systematic, and due to uncertainty in  $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$ , respectively.

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

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

not seen	ABLIKIM	23BT	BES3 $e^+e^- \rightarrow \phi\eta$
----------	---------	------	------------------------------------

 $\Gamma(D\bar{D})/\Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{29}/\Gamma_5$ 

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

$<1.0$	90	<sup>1</sup> AUBERT	07BE	BABR $e^+e^- \rightarrow D\bar{D}\gamma$
--------	----	---------------------	------	--

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

$<4.0$	90	CRONIN-HEN..09	CLEO	$e^+e^-$
--------	----	----------------	------	----------

<sup>1</sup>Using  $4259 \pm 10$  MeV for the mass and  $88 \pm 24$  MeV for the width of  $\psi(4260)$ .

 $\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$   $\Gamma_{30}/\Gamma$ 

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

not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^0\bar{D}^0$
----------	----------------	------	-----------------------------------

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

not seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^0\bar{D}^0\gamma$
----------	--------	-----	--

not seen	PAKHLOVA	08	BELL $e^+e^- \rightarrow D^0\bar{D}^0\gamma$
----------	----------	----	--

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$   $\Gamma_{31}/\Gamma$ 

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

not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^+D^-$
----------	----------------	------	-----------------------------

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

not seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^+D^-\gamma$
----------	--------	-----	--

not seen	PAKHLOVA	08	BELL $e^+e^- \rightarrow D^+D^-\gamma$
----------	----------	----	--

$\Gamma(D^*\bar{D}+c.c.)/\Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{32}/\Gamma_5$ 

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<34	90	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^*\bar{D}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<45	90	CRONIN-HEN..09	CLEO	$e^+e^-$

 $\Gamma(D^*(2007)^0\bar{D}^0+c.c.)/\Gamma_{total}$   $\Gamma_{33}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$

 $\Gamma(D^*(2010)^+D^-+c.c.)/\Gamma_{total}$   $\Gamma_{34}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^-$
not seen	PAKHLOVA 07	BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^-\gamma$

 $\Gamma(D^*\bar{D}^*)/\Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{35}/\Gamma_5$ 

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<11	90	CRONIN-HEN..09	CLEO	$e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<40	90	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^*\bar{D}^*$

 $\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{total}$   $\Gamma_{36}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$

 $\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{total}$   $\Gamma_{37}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^{*-}$
not seen	PAKHLOVA 07	BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

 $\Gamma(D^0D^-\pi^++c.c. (excl. D^*(2007)^0\bar{D}^{*0}+c.c., D^*(2010)^+D^-+c.c.))/\Gamma_{total}$   $\Gamma_{39}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
not seen	PAKHLOVA 08A	BELL	$10.6 e^+e^- \rightarrow D^0D^-\pi^+\gamma$

 $\Gamma(D\bar{D}^*\pi+c.c. (excl. D^*\bar{D}^*))/\Gamma_{total}$   $\Gamma_{40}/\Gamma$ 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^*\bar{D}\pi$

$\Gamma(D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*)) / \Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{40}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	$e^+e^-$

 $\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}}$   $\Gamma_{41}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	ABLIKIM 19R BES3		$e^+e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$

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

not seen PAKHLOVA 09 BELL  $e^+e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

 $\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.}) / \Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{41}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+e^- \rightarrow D^0 D^{*-} \pi^+$

 $\Gamma(D_1(2420)\bar{D} + \text{c.c.}) / \Gamma_{\text{total}}$   $\Gamma_{42}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>not seen</b>	<sup>1</sup> ABLIKIM 19AR BES3		$e^+e^- \rightarrow \pi^+ \pi^- D\bar{D}$

<sup>1</sup> Results from a measurement of  $\sigma(e^+e^- \rightarrow D_1(2420)\bar{D} + \text{c.c.})$  between  $\sqrt{s} = 4.3$  and 4.6 GeV.

 $\Gamma(D^* \bar{D}^* \pi) / \Gamma_{\text{total}}$   $\Gamma_{43}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>seen</b>	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^* \bar{D}^* \pi$

 $\Gamma(D^* \bar{D}^* \pi) / \Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{43}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	$e^+e^-$

 $\Gamma(D_s^+ D_s^-) / \Gamma_{\text{total}}$   $\Gamma_{45}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>not seen</b>	DEL-AMO-SA..10N BABR		$e^+e^- \rightarrow D_s^+ D_s^- \gamma$

**not seen** CRONIN-HEN..09 CLEO  $e^+e^- \rightarrow D_s^+ D_s^-$

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

not seen PAKHLOVA 11 BELL  $e^+e^- \rightarrow D_s^+ D_s^- \gamma$

 $\Gamma(D_s^+ D_s^-) / \Gamma(J/\psi\pi^+\pi^-)$   $\Gamma_{45}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	95	DEL-AMO-SA..10N BABR		10.6 $e^+e^-$

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

<1.3 90 CRONIN-HEN..09 CLEO  $e^+e^-$

 $\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma_{\text{total}}$   $\Gamma_{46}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>not seen</b>	DEL-AMO-SA..10N BABR		$e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$

**not seen** CRONIN-HEN..09 CLEO  $e^+e^- \rightarrow D_s^{*+} D_s^-$

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

not seen PAKHLOVA 11 BELL  $e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$



$\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma(J/\psi \pi^+ \pi^-)$   $\Gamma_{46}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.8	90	CRONIN-HEN..09	CLEO	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 44	95	DEL-AMO-SA..10N	BABR	10.6 $e^+ e^-$

 $\Gamma(D_s^{*+} D_s^{*-}) / \Gamma_{\text{total}}$   $\Gamma_{47}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

 $\Gamma(D_s^{*+} D_s^{*-}) / \Gamma(J/\psi \pi^+ \pi^-)$   $\Gamma_{47}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 9.5	90	CRONIN-HEN..09	CLEO	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 30	95	DEL-AMO-SA..10N	BABR	10.6 $e^+ e^-$

 $\Gamma(p\bar{p}) / \Gamma(J/\psi \pi^+ \pi^-)$   $\Gamma_{48}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.13	90	<sup>1</sup> AUBERT 06B	BABR	$e^+ e^- \rightarrow p\bar{p} \gamma$

<sup>1</sup> Using  $4259 \pm 10$  MeV for the mass and  $88 \pm 24$  MeV for the width of  $\psi(4260)$ .

 $\Gamma(p\bar{p}\pi^0) / \Gamma(J/\psi \pi^+ \pi^-)$   $\Gamma_{49}/\Gamma_5$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< $2 \times 10^{-4}$	90	ABLIKIM 17F	BES3	$e^+ e^- \rightarrow \psi(4260) \rightarrow$ hadrons

 $\Gamma(p\bar{p}\eta) / \Gamma_{\text{total}}$   $\Gamma_{50}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 21AN	BES3	$e^+ e^- \rightarrow p\bar{p}\eta$

 $\Gamma(p\bar{p}\omega) / \Gamma_{\text{total}}$   $\Gamma_{52}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 21AN	BES3	$e^+ e^- \rightarrow p\bar{p}\omega$

 $\Gamma(\omega\pi^0) / \Gamma_{\text{total}}$   $\Gamma_{56}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 22K	BES3	$e^+ e^- \rightarrow \omega\pi^0$

 $\Gamma(\omega\eta) / \Gamma_{\text{total}}$   $\Gamma_{57}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 22K	BES3	$e^+ e^- \rightarrow \omega\eta$

 $\Gamma(p\bar{p}p\bar{p}) / \Gamma_{\text{total}}$   $\Gamma_{68}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 21D	BES3	4.0–4.6 $e^+ e^- \rightarrow p\bar{p}p\bar{p}$

## Radiative decays

 $\Gamma(\eta_c(1S)\gamma)/\Gamma_{\text{total}}$   $\Gamma_{71}/\Gamma$ 

VALUE	DOCUMENT ID	COMMENT
<b>possibly seen</b>	<sup>1</sup> ABLIKIM 17W	$e^+e^- \rightarrow \gamma\eta_c(1S)$

<sup>1</sup>Significance ranges from 4.2  $\sigma$  to as low as 1.5  $\sigma$  for a flat component plus  $\psi(4260)$  spectrum. Needs confirmation.

 $\Gamma(\eta_c(1S)\pi^0\gamma)/\Gamma_{\text{total}}$   $\Gamma_{72}/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
<b>not seen</b>	<sup>1</sup> ABLIKIM 21B	BES3	$e^+e^- \rightarrow \gamma\pi^0\eta_c$

<sup>1</sup>Not seen in  $e^+e^- \rightarrow \gamma\pi^0\eta_c$  at  $\sqrt{s} = 4.226$  GeV with a 90% C.L. upper limit on the cross section of 11.2 pb.

 $\Gamma(\chi_{c1}(3872)\gamma)/\Gamma_{\text{total}}$   $\Gamma_{75}/\Gamma$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		ABLIKIM 19V	BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$
<b>seen</b>	$20 \pm 5$	ABLIKIM 14	BES3	$e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$

 $\psi(4230)$  REFERENCES

ABLIKIM 23AE	PR D108 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 23AQ	JHEP 2308 159	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 23BT	PR D108 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 23R	PR D107 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 23U	PR D107 092005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 23X	PRL 130 121901	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 22AM	PR D106 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 22AU	CP C46 111002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 21AJ	PR D104 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 21AN	PR D104 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 21AW	PR D104 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 21B	PR D103 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 21D	PR D103 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 20A	PR D101 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 20C	PRL 124 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 20N	PR D102 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 20O	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19	PR D99 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19AE	PR D99 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19AI	PR D99 091103	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19K	PR D99 019903 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19R	PRL 122 102002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 18N	PR D97 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17F	PL B771 45	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17G	PRL 118 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also	PR D99 019903 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17W	PR D96 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
GAO 17	PR D95 092007	X.Y. Gao, C.P. Shen, C.Z. Yuan	
ZHANG 17B	PR D96 054008	J. Zhang, J. Zhang	
ZHANG 17C	EPJ C77 727	J. Zhang, L. Yuan	
PDG 16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)

ABLIKIM	15C	PRL 114 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15Q	PR D92 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
SHEN	14	PR D89 072015	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
LEES	12AC	PR D86 051102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
YUAN	08	PR D77 011105	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)
YUAN	07	PRL 99 182004	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)
HE	06B	PR D74 091104	Q. He <i>et al.</i>	(CLEO Collab.)
AUBERT,B	05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)

---