

$\psi(4160)$

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

$\psi(4160)$ MASS

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|----------------------|-----------|--------------------------------------|
| 4191 ± 5 OUR AVERAGE | | | |
| 4191 $\begin{smallmatrix} +9 \\ -8 \end{smallmatrix}$ | AAIJ | 13BC LHCb | $B^+ \rightarrow K^+ \mu^+ \mu^-$ |
| 4191.7 ± 6.5 | ¹ ABLIKIM | 08D BES2 | $e^+ e^- \rightarrow \text{hadrons}$ |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 4193 ± 7 | ² MO | 10 RVUE | $e^+ e^- \rightarrow \text{hadrons}$ |
| 4151 ± 4 | ³ SETH | 05A RVUE | $e^+ e^- \rightarrow \text{hadrons}$ |
| 4155 ± 5 | ⁴ SETH | 05A RVUE | $e^+ e^- \rightarrow \text{hadrons}$ |
| 4159 ± 20 | BRANDELIK | 78C DASP | $e^+ e^-$ |

¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

$\psi(4160)$ WIDTH

| VALUE (MeV) | DOCUMENT ID | TECN | COMMENT |
|---|----------------------|-----------|--------------------------------------|
| 70 ± 10 OUR AVERAGE | | | |
| 65 $\begin{smallmatrix} +22 \\ -16 \end{smallmatrix}$ | AAIJ | 13BC LHCb | $B^+ \rightarrow K^+ \mu^+ \mu^-$ |
| 71.8 ± 12.3 | ¹ ABLIKIM | 08D BES2 | $e^+ e^- \rightarrow \text{hadrons}$ |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 79 ± 14 | ² MO | 10 RVUE | $e^+ e^- \rightarrow \text{hadrons}$ |
| 107 ± 10 | ³ SETH | 05A RVUE | $e^+ e^- \rightarrow \text{hadrons}$ |
| 107 ± 16 | ⁴ SETH | 05A RVUE | $e^+ e^- \rightarrow \text{hadrons}$ |
| 78 ± 20 | BRANDELIK | 78C DASP | $e^+ e^-$ |

¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

$\psi(4160)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective \sqrt{s} near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in \sqrt{s} or absence thereof. See mode listing(s) for details and references.

| Mode | Fraction (Γ_i/Γ) | Confidence level |
|--|--------------------------------|------------------|
| Γ_1 $e^+ e^-$ | $(6.9 \pm 3.3) \times 10^{-6}$ | |
| Γ_2 $\mu^+ \mu^-$ | seen | |
| Γ_3 $D \bar{D}$ | seen | |
| Γ_4 $D^0 \bar{D}^0$ | seen | |
| Γ_5 $D^+ D^-$ | seen | |
| Γ_6 $D^* \bar{D} + \text{c.c.}$ | seen | |
| Γ_7 $D^*(2007)^0 \bar{D}^0 + \text{c.c.}$ | seen | |
| Γ_8 $D^*(2010)^+ D^- + \text{c.c.}$ | seen | |
| Γ_9 $D^* \bar{D}^*$ | seen | |
| Γ_{10} $D^*(2007)^0 \bar{D}^*(2007)^0$ | seen | |
| Γ_{11} $D^*(2010)^+ D^*(2010)^-$ | seen | |
| Γ_{12} $D^0 D^- \pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0 \bar{D}^0 + \text{c.c.}$, $D^*(2010)^+ D^- + \text{c.c.}$) | not seen | |
| Γ_{13} $D \bar{D}^* \pi + \text{c.c.}$ (excl. $D^* \bar{D}^*$) | seen | |
| Γ_{14} $D^0 D^{*-} \pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+ D^*(2010)^-$) | not seen | |
| Γ_{15} $D_s^+ D_s^-$ | not seen | |
| Γ_{16} $D_s^{*+} D_s^- + \text{c.c.}$ | seen | |
| Γ_{17} $J/\psi \pi^+ \pi^-$ | $< 3 \times 10^{-3}$ | 90% |
| Γ_{18} $J/\psi \pi^0 \pi^0$ | $< 3 \times 10^{-3}$ | 90% |
| Γ_{19} $J/\psi K^+ K^-$ | $< 2 \times 10^{-3}$ | 90% |
| Γ_{20} $J/\psi \eta$ | $< 8 \times 10^{-3}$ | 90% |
| Γ_{21} $J/\psi \pi^0$ | $< 1 \times 10^{-3}$ | 90% |
| Γ_{22} $J/\psi \eta'$ | $< 5 \times 10^{-3}$ | 90% |
| Γ_{23} $J/\psi \pi^+ \pi^- \pi^0$ | $< 1 \times 10^{-3}$ | 90% |
| Γ_{24} $\psi(2S) \pi^+ \pi^-$ | $< 4 \times 10^{-3}$ | 90% |
| Γ_{25} $\chi_{c1} \gamma$ | $< 5 \times 10^{-3}$ | 90% |
| Γ_{26} $\chi_{c2} \gamma$ | $< 1.3 \%$ | 90% |
| Γ_{27} $\chi_{c1} \pi^+ \pi^- \pi^0$ | $< 2 \times 10^{-3}$ | 90% |
| Γ_{28} $\chi_{c2} \pi^+ \pi^- \pi^0$ | $< 8 \times 10^{-3}$ | 90% |
| Γ_{29} $h_c(1P) \pi^+ \pi^-$ | $< 5 \times 10^{-3}$ | 90% |
| Γ_{30} $h_c(1P) \pi^0 \pi^0$ | $< 2 \times 10^{-3}$ | 90% |
| Γ_{31} $h_c(1P) \eta$ | $< 2 \times 10^{-3}$ | 90% |
| Γ_{32} $h_c(1P) \pi^0$ | $< 4 \times 10^{-4}$ | 90% |
| Γ_{33} $\phi \pi^+ \pi^-$ | $< 2 \times 10^{-3}$ | 90% |

| | | | | |
|---------------|---|----------|------------------|-----|
| Γ_{34} | $\gamma\chi_{c1}(3872)$ | < 1.8 | $\times 10^{-3}$ | 90% |
| Γ_{35} | $\gamma\chi_{c0}(3915) \rightarrow \gamma J/\psi \pi^+ \pi^-$ | < 1.36 | $\times 10^{-4}$ | 90% |
| Γ_{36} | $\gamma X(3930) \rightarrow \gamma J/\psi \pi^+ \pi^-$ | < 1.18 | $\times 10^{-4}$ | 90% |
| Γ_{37} | $\gamma X(3940) \rightarrow \gamma J/\psi \pi^+ \pi^-$ | < 1.47 | $\times 10^{-4}$ | 90% |
| Γ_{38} | $\gamma\chi_{c0}(3915) \rightarrow \gamma\gamma J/\psi$ | < 1.26 | $\times 10^{-4}$ | 90% |
| Γ_{39} | $\gamma X(3930) \rightarrow \gamma\gamma J/\psi$ | < 8.8 | $\times 10^{-5}$ | 90% |
| Γ_{40} | $\gamma X(3940) \rightarrow \gamma\gamma J/\psi$ | < 1.79 | $\times 10^{-4}$ | 90% |
| Γ_{41} | $K^+ K^-$ | | | |
| Γ_{42} | $K_S^0 K^\pm \pi^\mp$ | | | |
| Γ_{43} | $\rho^+ \rho^0 \rho^-$ | not seen | | |
| Γ_{44} | $\Lambda \bar{\Lambda}$ | < 1.5 | $\times 10^{-6}$ | 90% |

$\psi(4160)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$ Γ_1

| VALUE (keV) | DOCUMENT ID | TECN | COMMENT |
|---|----------------------|----------|-------------------------------|
| 0.48±0.22 | ¹ ABLIKIM | 08D BES2 | $e^+ e^- \rightarrow$ hadrons |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| 0.4 to 1.1 | ² MO | 10 RVUE | $e^+ e^- \rightarrow$ hadrons |
| 0.83±0.08 | ³ SETH | 05A RVUE | $e^+ e^- \rightarrow$ hadrons |
| 0.84±0.13 | ⁴ SETH | 05A RVUE | $e^+ e^- \rightarrow$ hadrons |
| 0.77±0.23 | BRANDELIK | 78C DASP | $e^+ e^-$ |

¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different $e^+ e^-$ partial widths. We quote only the range of values.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

$\Gamma(\mu^+ \mu^-)$ Γ_2

| VALUE (keV) | DOCUMENT ID | TECN | COMMENT |
|-----------------------|------------------------|-----------|-----------------------------------|
| 2.45±1.24±0.94 | ^{1,2} ABLIKIM | 20AG BES3 | $e^+ e^- \rightarrow \mu^+ \mu^-$ |

¹ 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 $\Gamma(\mu^+ \mu^-) = \Gamma(e^+ e^-)$.

² From solution 1 of 8 with equal fit quality. Other solutions range from $2.08 \pm 0.99 \pm 0.80$ to $2.45 \pm 1.24 \pm 0.94$ keV.

$\psi(4160) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

$\Gamma(J/\psi \eta') \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{22} \Gamma_1 / \Gamma$

| VALUE (eV) | EVTS | DOCUMENT ID | TECN | COMMENT |
|------------|------|------------------------|----------|------------------------------------|
| 0.17±0.04 | 86 | ^{1,2} ABLIKIM | 20A BES3 | $e^+ e^- \rightarrow \eta' J/\psi$ |

1.07±0.09 86 1,3 ABLIKIM 20A BES3 $e^+e^- \rightarrow \eta' J/\psi$ ¹Based 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 $\sqrt{s} = 4.18$ GeV, $\sigma(e^+e^- \rightarrow \eta' J/\psi) = 2.4 \pm 0.3 \pm 0.2$ pb.²Solution I of the fit, corresponding to a phase of -0.03 ± 0.44 rad.³Solution II of the fit, corresponding to a phase of 2.54 ± 0.04 rad.

| $\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ | | | | | $\Gamma_{25}\Gamma_1/\Gamma$ |
|---|------------|--------------------|-------------|----------------|--|
| <u>VALUE (eV)</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> | |
| <2.2 | 90 | ¹ HAN | 15 | BELL | 10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$ |

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

| $\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ | | | | | $\Gamma_{26}\Gamma_1/\Gamma$ |
|---|------------|--------------------|-------------|----------------|--|
| <u>VALUE (eV)</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> | |
| ••• We do not use the following data for averages, fits, limits, etc. ••• | | | | | |
| <6.1 | 90 | ¹ HAN | 15 | BELL | 10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$ |

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

| $\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ | | | | | $\Gamma_{42}\Gamma_1/\Gamma$ |
|---|--|----------------------|-------------|----------------|--|
| <u>VALUE (eV)</u> | | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> | |
| ••• We do not use the following data for averages, fits, limits, etc. ••• | | | | | |
| 2.71 ± 0.13 ± 0.12 | | ¹ ABLIKIM | 19AE | BES3 | $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$ |
| 0.0095±0.0088±0.0004 | | ² ABLIKIM | 19AE | BES3 | $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$ |

¹Solution I of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 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 17.²Solution II of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 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.

$\psi(4160) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$

| $\Gamma(J/\psi\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ | | | | | $\Gamma_{20}/\Gamma \times \Gamma_1/\Gamma$ |
|--|--|--------------------|-------------|----------------|---|
| <u>VALUE (units 10^{-8})</u> | | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> | |
| ••• We do not use the following data for averages, fits, limits, etc. ••• | | | | | |
| 2.8±0.9±0.9 | | ¹ WANG | 13B | BELL | $e^+e^- \rightarrow J/\psi\eta\gamma$ |
| 12.8±1.7±2.0 | | ² WANG | 13B | BELL | $e^+e^- \rightarrow J/\psi\eta\gamma$ |

¹Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.²Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.

$\psi(4160)$ BRANCHING RATIOS

| $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ | | | | | Γ_2/Γ |
|--|--|--------------------|-------------|----------------|-----------------------------------|
| <u>VALUE</u> | | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> | |
| seen | | ¹ AAIJ | 13BC | LHCB | $B^+ \rightarrow K^+ \mu^+ \mu^-$ |

¹AAIJ 13BC report $B(B^+ \rightarrow K^+ \psi(4160)) B(\psi(4160) \rightarrow \mu^+ \mu^-) = (3.5_{-0.8}^{+0.9}) \times 10^{-9}$.

$$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*) \quad \Gamma_3/\Gamma_9$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|-----------------------|--------------------|-------------|---|
| 0.02±0.03±0.02 | AUBERT | 09M | BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$ |

$$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|--------------------|-------------|--|
| seen | CRONIN-HEN..09 | CLEO | $e^+e^- \rightarrow D^0\bar{D}^0$ |
| seen | PAKHLOVA | 08 | BELL $e^+e^- \rightarrow D^0\bar{D}^0\gamma$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| not seen | AUBERT | 09M | BABR $e^+e^- \rightarrow D^0\bar{D}^0\gamma$ |

$$\Gamma(D^+D^-)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|--------------------|-------------|--|
| seen | CRONIN-HEN..09 | CLEO | $e^+e^- \rightarrow D^+D^-$ |
| seen | PAKHLOVA | 08 | BELL $e^+e^- \rightarrow D^+D^-\gamma$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| not seen | AUBERT | 09M | BABR $e^+e^- \rightarrow D^+D^-\gamma$ |

$$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|--------------------|-------------|---|
| seen | AUBERT | 09M | BABR $e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$ |
| seen | CRONIN-HEN..09 | CLEO | $e^+e^- \rightarrow D^{*0}\bar{D}^0$ |

$$\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|----------------------|-------------|---|
| seen | ¹ ZHUKOVA | 18 | BELL $e^+e^- \rightarrow D^{*+}D^-\gamma$ |
| seen | AUBERT | 09M | BABR $e^+e^- \rightarrow D^{*+}D^-\gamma$ |
| seen | CRONIN-HEN..09 | CLEO | $e^+e^- \rightarrow D^{*+}D^-$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| seen | PAKHLOVA | 07 | BELL $e^+e^- \rightarrow D^{*+}D^-\gamma$ |

¹Supersedes PAKHLOVA 07.

$$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*) \quad \Gamma_6/\Gamma_9$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|-----------------------|--------------------|-------------|---|
| 0.34±0.14±0.05 | AUBERT | 09M | BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$ |

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|--------------------|-------------|--|
| seen | AUBERT | 09M | BABR $e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$ |
| seen | CRONIN-HEN..09 | CLEO | $e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$ |

$$\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|----------------------|-------------|--|
| seen | ¹ ZHUKOVA | 18 | BELL $e^+e^- \rightarrow D^{*+}D^{*-}\gamma$ |
| seen | AUBERT | 09M | BABR $e^+e^- \rightarrow D^{*+}D^{*-}\gamma$ |
| seen | CRONIN-HEN..09 | CLEO | $e^+e^- \rightarrow D^{*+}D^{*-}$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| seen | PAKHLOVA | 07 | BELL $e^+e^- \rightarrow D^{*+}D^{*-}\gamma$ |

¹Supersedes PAKHLOVA 07.

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.)}) / \Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|----------|--------------|------|--|
| not seen | PAKHLOVA 08A | BELL | $e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$ |

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*) / \Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

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

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-)) / \Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|----------|-------------|------|---|
| not seen | PAKHLOVA 09 | BELL | $e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$ |

$$\Gamma(D_s^+ D_s^-) / \Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|----------|-----------------|------|--|
| not seen | PAKHLOVA 11 | BELL | $e^+ e^- \rightarrow D_s^+ D_s^- \gamma$ |
| not seen | DEL-AMO-SA..10N | BABR | $e^+ e^- \rightarrow D_s^+ D_s^- \gamma$ |
| not seen | CRONIN-HEN..09 | CLEO | $e^+ e^- \rightarrow D_s^+ D_s^-$ |

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-------|-----------------|------|---|
| seen | PAKHLOVA 11 | BELL | $e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$ |
| seen | DEL-AMO-SA..10N | BABR | $e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$ |
| seen | CRONIN-HEN..09 | CLEO | $e^+ e^- \rightarrow D_s^{*+} D_s^-$ |

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

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <3 | 90 | COAN 06 | CLEO | 4.12–4.2 $e^+ e^- \rightarrow$ hadrons |

$$\Gamma(J/\psi \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <3 | 90 | COAN 06 | CLEO | 4.12–4.2 $e^+ e^- \rightarrow$ hadrons |

$$\Gamma(J/\psi K^+ K^-) / \Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma$$

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <2 | 90 | COAN 06 | CLEO | 4.12–4.2 $e^+ e^- \rightarrow$ hadrons |

$$\Gamma(J/\psi \eta) / \Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma$$

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <8 | 90 | COAN 06 | CLEO | 4.12–4.2 $e^+ e^- \rightarrow$ hadrons |

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

| | | | | |
|---------------|----------------------|-----|------|--|
| possibly seen | ¹ ABLIKIM | 15L | BES3 | $e^+ e^- \rightarrow J/\psi \eta$ |
| seen | WANG | 13B | BELL | $e^+ e^- \rightarrow J/\psi \eta \gamma$ |

¹ An enhancement around 4.2 GeV is observed.

$\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <1 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(J/\psi\eta')/\Gamma_{\text{total}}$ Γ_{22}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <5 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{23}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <1 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{24}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <4 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_{25}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|---------|
|--------------------------|-----|-------------|------|---------|

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

| | | | | |
|----|----|------|----|--|
| <7 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |
|----|----|------|----|--|

$\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <13 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <2 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|--|
| <8 | 90 | COAN | 06 | CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|---------------------|------|---|
| <5 | 90 | ¹ PEDLAR | 11 | CLEO $e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$ |

¹At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 15.6 \pm 2.3 \pm 1.9 \pm 3.0$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

$\Gamma(h_c(1P)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|---------------------|------|---|
| <2 | 90 | ¹ PEDLAR | 11 | CLEO $e^+e^- \rightarrow h_c(1P)\pi^0\pi^0$ |

¹At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0\pi^0) = 3.0 \pm 3.3 \pm 1.1 \pm 0.6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

$\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

| VALUE (units 10^{-3}) | CL% | EVTS | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|------|------------------------|------|----------------------------------|
| <2 | 90 | | ¹ PEDLAR 11 | CLEO | $e^+e^- \rightarrow h_c(1P)\eta$ |

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

possibly seen 41 ² ABLIKIM 17R BES3 $e^+e^- \rightarrow h_c(1P)\eta$

¹ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\eta) = 4.7 \pm 1.7 \pm 1.0 \pm 0.9$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

² An enhancement around 4.2 GeV is observed.

$\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|------------------------|------|-----------------------------------|
| <0.4 | 90 | ¹ PEDLAR 11 | CLEO | $e^+e^- \rightarrow h_c(1P)\pi^0$ |

¹ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0) = -0.7 \pm 1.8 \pm 0.7 \pm 0.1$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

$\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

| VALUE (units 10^{-3}) | CL% | DOCUMENT ID | TECN | COMMENT |
|--------------------------|-----|-------------|------|---------------------------------------|
| <2 | 90 | COAN 06 | CLEO | 4.12–4.2 $e^+e^- \rightarrow$ hadrons |

$\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$ Γ_{34}/Γ

| VALUE | CL% | DOCUMENT ID | COMMENT |
|-----------------------|-----|------------------------|--|
| <1.8 $\times 10^{-3}$ | 90 | ^{1,2} XIAO 13 | $\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$ |

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

<0.012 90 ^{1,3} XIAO 13 $\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

² XIAO 13 reports $[\Gamma(\psi(4160) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))] < 0.68 \times 10^{-4}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 3.8 \times 10^{-2}$.

³ XIAO 13 reports $[\Gamma(\psi(4160) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \gamma J/\psi)] < 1.05 \times 10^{-4}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \gamma J/\psi) = 8 \times 10^{-3}$.

$\Gamma(\gamma\chi_{c0}(3915) \rightarrow \gamma J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ

| VALUE | CL% | DOCUMENT ID | COMMENT |
|------------------------|-----|----------------------|--|
| <1.36 $\times 10^{-4}$ | 90 | ¹ XIAO 13 | $\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$ |

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

$\Gamma(\gamma\chi(3930) \rightarrow \gamma J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

| VALUE | CL% | DOCUMENT ID | COMMENT |
|------------------------|-----|----------------------|--|
| <1.18 $\times 10^{-4}$ | 90 | ¹ XIAO 13 | $\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$ |

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

$\Gamma(\gamma\chi(3940) \rightarrow \gamma J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ

| VALUE | CL% | DOCUMENT ID | COMMENT |
|------------------------|-----|----------------------|--|
| <1.47 $\times 10^{-4}$ | 90 | ¹ XIAO 13 | $\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$ |

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

$\Gamma(\gamma\chi_{c0}(3915) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{38}/Γ

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|------------------------|-----|-------------------|------|--|
| $<1.26 \times 10^{-4}$ | 90 | ¹ XIAO | 13 | $\psi(4160) \rightarrow \gamma\gamma J/\psi$ |

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration. $\Gamma(\gamma\chi(3930) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{39}/Γ

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|------------------------|-----|-------------------|------|--|
| $<0.88 \times 10^{-4}$ | 90 | ¹ XIAO | 13 | $\psi(4160) \rightarrow \gamma\gamma J/\psi$ |

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration. $\Gamma(\gamma\chi(3940) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{40}/Γ

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|------------------------|-----|-------------------|------|--|
| $<1.79 \times 10^{-4}$ | 90 | ¹ XIAO | 13 | $\psi(4160) \rightarrow \gamma\gamma J/\psi$ |

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration. $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{41}/Γ

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

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

| | | | | |
|---------------------|----|------------------------|----|--------------------------------------|
| $<2 \times 10^{-5}$ | 90 | ¹ DRUZHININ | 15 | RVUE $e^+e^- \rightarrow \psi(3770)$ |
|---------------------|----|------------------------|----|--------------------------------------|

¹ DRUZHININ 15 uses BABAR and CLEO data taking into account interference of the processes $e^+e^- \rightarrow K^+K^-$ and $e^+e^- \rightarrow K_S^0 K_L^0$. $\Gamma(p\bar{p}p\bar{p})/\Gamma_{\text{total}}$ Γ_{43}/Γ

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

 $\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{44}\Gamma_1/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | TECN | COMMENT |
|-----------------------|-----|----------------------|-----------|---------------------------------|
| $<0.7 \times 10^{-3}$ | 90 | ¹ ABLIKIM | 21AS BES3 | $e^+e^- \rightarrow \psi(4160)$ |

¹ From a measurement of the $e^+e^- \rightarrow \Lambda\bar{\Lambda}$ cross section between 3.5 and 4.6 GeV. $\psi(4160)$ REFERENCES

| | | | | |
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