# $\psi(4415)$ [a]

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

[a] $J^{PC}$ known by production in $e^+e^-$ via single photon annihilation. $I^G$ is not known; interpretation of this state as a single resonance is unclear because of the expectation of substantial threshold effects in this energy region.

## $\psi(4415)$ MASS

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **4415 ± 5 OUR AVERAGE** | | | | |
| 4413.6± 9.0±0.8 | [1] ABLIKIM | 24D | BES3 | $e^+e^- \to \omega\gamma J/\psi$ |
| 4414.6± 3.4±6.1 | ABLIKIM | 23BH | BES3 | $e^+e^- \to D_s^{*+}D_s^{*-}$ |
| 4415.1± 7.9 | [2] ABLIKIM | 08D | BES2 | $e^+e^- \to$ hadrons |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 4412 ±15 | [3] MO | 10 | RVUE | $e^+e^- \to$ hadrons |
| 4411 ± 7 | [4] PAKHLOVA | 08A | BELL | 10.6 $e^+e^- \to D^0D^-\pi^+\gamma$ |
| 4425 ± 6 | [5] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 4429 ± 9 | [6] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 4417 ±10 | BRANDELIK | 78C | DASP | $e^+e^-$ |
| 4414 ± 7 | SIEGRIST | 76 | MRK1 | $e^+e^-$ |

[1] Assuming one single Breit-Wigner resonance in $\omega\chi_{c2}(1P)$ ($\chi_{c2} \to \gamma J/\psi$).

[2] 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 $\delta = (234 \pm 88)^\circ$.

[3] 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.

[4] Systematic uncertainties not estimated.

[5] From a fit to Crystal Ball (OSTERHELD 86) data.

[6] From a fit to BES (BAI 02C) data.

## $\psi(4415)$ WIDTH

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **110 ±13 OUR AVERAGE** | Error includes scale factor of 1.6. See the ideogram below. | | | |
| 110.5±15.0±2.9 | [7] ABLIKIM | 24D | BES3 | $e^+e^- \to \omega\gamma J/\psi$ |
| 122.5± 7.5±8.1 | ABLIKIM | 23BH | BES3 | $e^+e^- \to D_s^{*+}D_s^{*-}$ |
| 71.5±19.0 | [8] ABLIKIM | 08D | BES2 | $e^+e^- \to$ hadrons |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 118 ±32 | [9] MO | 10 | RVUE | $e^+e^- \to$ hadrons |
| 77 ±20 | [10] PAKHLOVA | 08A | BELL | 10.6 $e^+e^- \to D^0D^-\pi^+\gamma$ |
| 119 ±16 | [11] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 118 ±35 | [12] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 66 ±15 | BRANDELIK | 78C | DASP | $e^+e^-$ |
| 33 ±10 | SIEGRIST | 76 | MRK1 | $e^+e^-$ |

[7] Assuming one single Breit-Wigner resonance in $\omega\chi_{c2}(1P)$ ($\chi_{c2} \to \gamma J/\psi$).

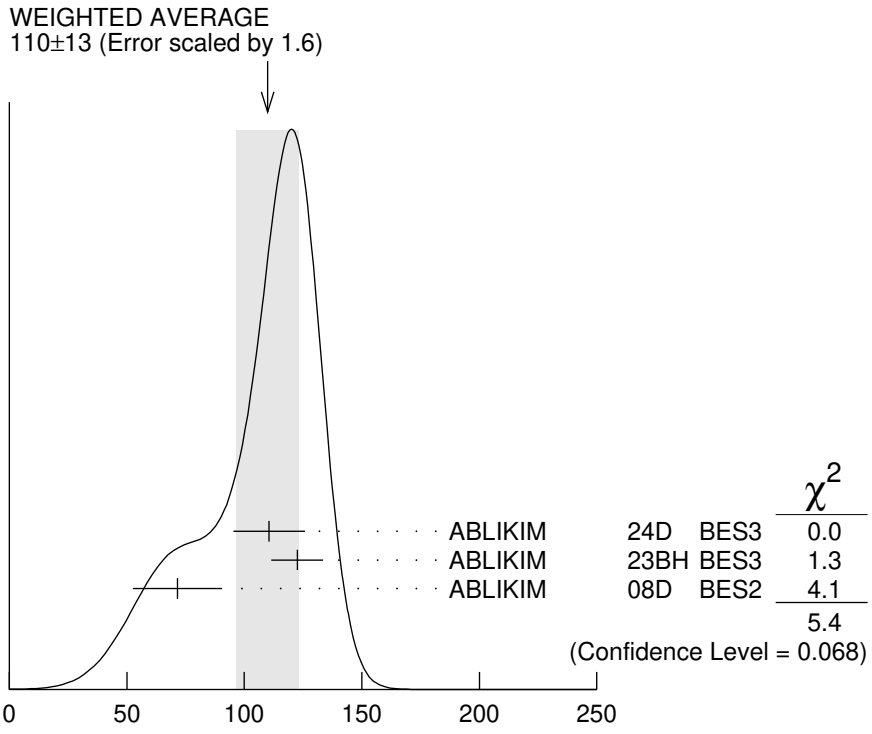
[8] Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

[9] 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.

[10] Systematic uncertainties not estimated.

[11] From a fit to Crystal Ball (OSTERHELD 86) data.

[12] From a fit to BES (BAI 02C) data.




## $\psi(4415)$ DECAY MODES

Due to the complexity of the $c\overline{c}$ 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 $2\sigma$ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

| | Mode | Fraction ($\Gamma_i/\Gamma$) | Confidence level |
|---|---|---|---|
| $\Gamma_1$ | $D\overline{D}$ | seen | |
| $\Gamma_2$ | $D^0\overline{D}^0$ | seen | |
| $\Gamma_3$ | $D^+D^-$ | seen | |
| $\Gamma_4$ | $D^*\overline{D}$ + c.c. | seen | |
| $\Gamma_5$ | $D^*(2007)^0\overline{D}^0$ + c.c. | seen | |
| $\Gamma_6$ | $D^*(2010)^+D^-$ + c.c. | seen | |

| | | | | | |
|---|---|---|---|---|---|
| $\Gamma_7$ | $D^*\overline{D}^*$ | seen | | | |
| $\Gamma_8$ | $D^*(2007)^0\overline{D}^*(2007)^0$ + c.c. | seen | | | |
| $\Gamma_9$ | $D^*(2010)^+D^*(2010)^-$ + c.c. | seen | | | |
| $\Gamma_{10}$ | $D^0D^-\pi^+$ (excl. $D^*(2010)^+D^-$ +c.c. | $<$ 2.3 | % | | 90% |
| $\Gamma_{11}$ | $D\overline{D}_2^*(2460) \to D^0D^-\pi^+$+c.c. | (10 ±4 ) | % | | |
| $\Gamma_{12}$ | $D^0D^{*-}\pi^+$+c.c. | $<$ 31 | % | | 90% |
| $\Gamma_{13}$ | $D_1(2420)\overline{D}$ + c.c. | possibly seen | | | |
| $\Gamma_{14}$ | $D_s^+D_s^-$ | not seen | | | |
| $\Gamma_{15}$ | $\omega\chi_{c2}$ | ( 9 ±4 ) | $\times 10^{-3}$ | | |
| $\Gamma_{16}$ | $D_s^{*+}D_s^-$ +c.c. | seen | | | |
| $\Gamma_{17}$ | $D_s^{*+}D_s^{*-}$ | seen | | | |
| $\Gamma_{18}$ | $\psi_2(3823)\pi^+\pi^-$ | possibly seen | | | |
| $\Gamma_{19}$ | $\psi(3770)\pi^+\pi^-$ | possibly seen | | | |
| $\Gamma_{20}$ | $J/\psi\eta$ | $<$ 1.0 | % | | 90% |
| $\Gamma_{21}$ | $\chi_{c1}\gamma$ | $<$ 1.3 | $\times 10^{-3}$ | | 90% |
| $\Gamma_{22}$ | $\chi_{c2}\gamma$ | $<$ 7 | $\times 10^{-3}$ | | 90% |
| $\Gamma_{23}$ | $\Lambda\overline{\Lambda}$ | $<$ 5 | $\times 10^{-6}$ | | 90% |
| $\Gamma_{24}$ | $\Sigma^+\overline{\Sigma}^-$ | $<$ 1.8 | $\times 10^{-4}$ | | 90% |
| $\Gamma_{25}$ | $\Xi^0\overline{\Xi}^0$ | $<$ 1.4 | $\times 10^{-4}$ | | 90% |
| $\Gamma_{26}$ | $\Xi^-\overline{\Xi}^+$ | $<$ 6 | $\times 10^{-5}$ | | 90% |
| $\Gamma_{27}$ | $pK^-\overline{\Lambda}$ + c.c. | $<$ 1.0 | $\times 10^{-5}$ | | 90% |
| $\Gamma_{28}$ | $\Lambda\overline{\Xi}^+K^-$ + c.c. | $<$ 4 | $\times 10^{-5}$ | | 90% |
| $\Gamma_{29}$ | $\Sigma^0\overline{\Xi}^+K^-$ + c.c. | $<$ 2.5 | $\times 10^{-4}$ | | 90% |
| $\Gamma_{30}$ | $\omega\pi^0$ | not seen | | | |
| $\Gamma_{31}$ | $\omega\eta$ | not seen | | | |
| $\Gamma_{32}$ | $e^+e^-$ | ( 3.2±1.2) | $\times 10^{-6}$ | | |
| $\Gamma_{33}$ | $\mu^+\mu^-$ | ( 1.1±0.4) | $\times 10^{-5}$ | | |

## $\psi(4415)$ PARTIAL WIDTHS

### $\Gamma(e^+e^-)$ $\Gamma_{32}$

| VALUE (keV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.35±0.12** | [13] ABLIKIM | 08D | BES2 | $e^+e^- \to$ hadrons |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.4 to 0.8 | [14] MO | 10 | RVUE | $e^+e^- \to$ hadrons |
| 0.72±0.11 | [15] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 0.64±0.23 | [16] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 0.49±0.13 | BRANDELIK | 78C | DASP | $e^+e^-$ |
| 0.44±0.14 | SIEGRIST | 76 | MRK1 | $e^+e^-$ |

[13] 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 $\delta = (234 \pm 88)^\circ$.

[14] 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.

[15] From a fit to Crystal Ball (OSTERHELD 86) data.

[16] From a fit to BES (BAI 02C) data.

### $\Gamma(\mu^+\mu^-)$ $\Gamma_{33}$

| VALUE (keV) | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **1.25±0.28±0.35** | [17,18] | ABLIKIM | 20AG | BES3 | $e^+e^- \to \mu^+\mu^-$ |

[17] From a fit to the $e^+e^- \to \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+\mu^-) = \Gamma(e^+e^-)$.

[18] From solution 1 of 8 with equal fit quality. Other solutions range from $1.24 \pm 0.28 \pm 0.35$ to $1.27 \pm 0.41 \pm 0.36$ keV.

## $\psi(4415)$ $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(total)$

### $\Gamma(\omega\chi_{c2}) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{15}\Gamma_{32}/\Gamma$

| VALUE (eV) | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **3.17±0.39±0.24** | [19] | ABLIKIM | 24D | BES3 | $e^+e^- \to \omega\gamma J/\psi$ |

[19] Assuming one single Breit-Wigner resonance in $\omega\chi_{c2}(1P)$ ($\chi_{c2} \to \gamma J/\psi$).

### $\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{20}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<3.6** | 90 | WANG | 13B | BELL | $e^+e^- \to J/\psi\eta\gamma$ |

### $\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{21}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.47** | 90 | [20] HAN | 15 | BELL | 10.58 $e^+e^- \to \chi_{c1}\gamma$ |

[20] Using $B(\eta \to \gamma\gamma) = (39.41 \pm 0.21)\%$.

### $\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{22}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<2.3** | 90 | [21] HAN | 15 | BELL | 10.58 $e^+e^- \to \chi_{c2}\gamma$ |

[21] Using $B(\eta \to \gamma\gamma) = (39.41 \pm 0.21)\%$.

### $\Gamma(\Lambda\overline{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{23}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<1.8 × 10$^{-3}$** | 90 | [22] ABLIKIM | 21AS | BES3 | $e^+e^- \to \psi(4415)$ |

[22] From a measurement of the $e^+e^- \to \Lambda\overline{\Lambda}$ cross section between 3.5 and 4.6 GeV.

### $\Gamma(\Sigma^+\overline{\Sigma}^-) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{24}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<62.1 × 10$^{-3}$** | 90 | [23] ABLIKIM | 24AH | BES3 | $e^+e^- \to \Sigma^+\overline{\Sigma}^-$ |

[23] Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

### $\Gamma(\Xi^0\overline{\Xi}^0) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{25}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<48.0 × 10$^{-3}$** | 90 | [24] ABLIKIM | 24CD | BES3 | $e^+e^- \to \psi(4415)$ |

[24] From a fit to $e^+e^- \to \Xi^0\overline{\Xi}^0$ cross sections.

### $\Gamma(\Xi^-\overline{\Xi}^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{26}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<21.7 \times 10^{-3}$** | 90 | [25] ABLIKIM | 23BK | BES3 | $e^+e^- \to \psi(4415)$ |

[25] From a fit to $e^+e^- \to \Xi^-\overline{\Xi}^+$ cross sections.

### $\Gamma(pK^-\overline{\Lambda}+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{27}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<3.4 \times 10^{-3}$** | 90 | [26] ABLIKIM | 23BL | BES3 | $e^+e^- \to \psi(4415)$ |

[26] From a fit to $e^+e^- \to pK^-\overline{\Lambda}+$ c.c. cross sections.

### $\Gamma(\Lambda\overline{\Xi}^+K^-+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{28}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<14.3 \times 10^{-3}$** | 90 | [27] ABLIKIM | 24AL | BES3 | $e^+e^- \to \Lambda\overline{\Xi}^+K^-$ + c.c. |

[27] A fit to the Born cross section of $e^+e^- \to \Lambda\overline{\Xi}^+K^-$ + c.c. including interference with the continuum. Two solutions from the fit.

### $\Gamma(\Sigma^0\overline{\Xi}^+K^-+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{29}\Gamma_{32}/\Gamma$

| VALUE (eV) | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<87.0 \times 10^{-3}$** | 90 | [28] ABLIKIM | 24AL | BES3 | $e^+e^- \to \Sigma^0\overline{\Xi}^+K^-$ + c.c. |

[28] A fit to the Born cross section of $e^+e^- \to \Sigma^0\overline{\Xi}^+K^-$ + c.c. including interference with the continuum. Two solutions from the fit.

## $\psi(4415)$ $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$

### $\Gamma(D^0D^{*-}\pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{12}/\Gamma \times \Gamma_{32}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<0.99 \times 10^{-6}$** | 90 | [29] PAKHLOVA | 09 | BELL | $e^+e^- \to D^0D^{*-}\pi^+$ |

[29] Using 4421 ± 4 MeV for the mass of $\psi(4415)$.

## $\psi(4415)$ BRANCHING RATIOS

### $\Gamma(D^0\overline{D}^0)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | [30] ABLIKIM | 24BH | BES3 | $e^+e^- \to D^0\overline{D}^0$ |
| **seen** | PAKHLOVA | 08 | BELL | $e^+e^- \to D^0\overline{D}^0\gamma$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| not seen | AUBERT | 09M | BABR | $e^+e^- \to D^0\overline{D}^0\gamma$ |

[30] A precision measurement of the $e^+e^- \to D^0\overline{D}^0$ cross section shows complex structure in this mass region.

### $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | [31] ABLIKIM | 24BH | BES3 | $e^+e^- \to D^+D^-$ |
| **seen** | PAKHLOVA | 08 | BELL | $e^+e^- \to D^+D^-\gamma$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| not seen | AUBERT | 09M | BABR | $e^+e^- \to D^+D^-\gamma$ |

[31] A precision measurement of the $e^+e^- \to D^+D^-$ cross section shows complex structure in this mass region.

### $\Gamma(D^*(2007)^0\overline{D}^0+\text{c.c.})/\Gamma_{\text{total}}$ $\Gamma_5/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | AUBERT | 09M | BABR | $e^+e^- \to D^{*0}\overline{D}^0\gamma$ |

### $\Gamma(D^*(2010)^+D^-+\text{c.c.})/\Gamma_{\text{total}}$ $\Gamma_6/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | [32] ZHUKOVA | 18 | BELL | $e^+e^- \to D^{*+}D^-\gamma$ |
| **seen** | AUBERT | 09M | BABR | $e^+e^- \to D^{*+}D^-\gamma$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | PAKHLOVA | 07 | BELL | $e^+e^- \to D^{*+}D^-\gamma$ |

[32] Supersedes PAKHLOVA 07.

### $\Gamma(D\overline{D})/\Gamma(D^*\overline{D}^*)$ $\Gamma_1/\Gamma_7$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.14±0.12±0.03** | AUBERT | 09M | BABR | $e^+e^- \to \gamma D^{(*)}\overline{D}^{(*)}$ |

### $\Gamma(D^*\overline{D}+\text{c.c.})/\Gamma(D^*\overline{D}^*)$ $\Gamma_4/\Gamma_7$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.17±0.25±0.03** | AUBERT | 09M | BABR | $e^+e^- \to \gamma D^{(*)}\overline{D}^{(*)}$ |

### $\Gamma(D^*(2007)^0\overline{D}^*(2007)^0+\text{c.c.})/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | AUBERT | 09M | BABR | $e^+e^- \to D^{*0}\overline{D}^{*0}\gamma$ |

### $\Gamma(D^*(2010)^+D^*(2010)^-+\text{c.c.})/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | [33] ZHUKOVA | 18 | BELL | $e^+e^- \to D^{*+}D^{*-}\gamma$ |
| **seen** | AUBERT | 09M | BABR | $e^+e^- \to D^{*+}D^{*-}\gamma$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | PAKHLOVA | 07 | BELL | $e^+e^- \to D^{*+}D^{*-}\gamma$ |

[33] Supersedes PAKHLOVA 07.

### $\Gamma(D\overline{D}_2^*(2460) \to D^0D^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ $\Gamma_{11}/\Gamma$

| VALUE (units $10^{-2}$) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **10.5±2.4±3.8** | [34] PAKHLOVA | 08A | BELL | 10.6 $e^+e^- \to D^0D^-\pi^+\gamma$ |

[34] Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

### $\Gamma(D^0D^-\pi^+(\text{excl. } D^*(2010)^+D^- + \text{c.c.})/\Gamma(D\overline{D}_2^*(2460) \to D^0D^-\pi^+ + \text{c.c.})$ $\Gamma_{10}/\Gamma_{11}$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.22** | 90 | [35] PAKHLOVA | 08A | BELL | 10.6 $e^+e^- \to D^0D^-\pi^+\gamma$ |

[35] Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

### $\Gamma(D_1(2420)\overline{D}+\text{c.c.})/\Gamma_{\text{total}}$ $\Gamma_{13}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **possibly seen** | [36] ABLIKIM | 19AR | BES3 | $e^+e^- \to \pi^+\pi^- D\overline{D}$ |

[36] Evidence for $e^+e^- \to D_1(2420)\overline{D}+$ c.c. between $\sqrt{s}$ = 4.3 and 4.6 GeV, not necessarily resonant.

### $\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$ $\Gamma_{14}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **not seen** | PAKHLOVA | 11 | BELL | $e^+e^- \to D_s^+ D_s^- \gamma$ |
| **not seen** | DEL-AMO-SA.. | 10N | BABR | $e^+e^- \to D_s^+ D_s^- \gamma$ |

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

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

### $\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$ $\Gamma_{17}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **seen** | ABLIKIM | 23BH | BES3 | $e^+e^- \to D_s^{*+} D_s^{*-}$ |

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

| | | | | |
|---|---|---|---|---|
| not seen | PAKHLOVA | 11 | BELL | $e^+e^- \to D_s^{*+} D_s^{*-} \gamma$ |
| not seen | DEL-AMO-SA.. | 10N | BABR | $e^+e^- \to D_s^{*+} D_s^{*-} \gamma$ |

### $\Gamma(\psi_2(3823)\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_{18}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **possibly seen** | 19 | [37] ABLIKIM | 15S | BES3 | $e^+e^- \to \pi^+\pi^- \chi_{c1}\gamma$ |

[37] From a fit of $e^+e^- \to \pi^+\pi^-\psi_2(3823)$, $\psi_2(3823) \to \chi_{c1}\gamma$ cross sections taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to the $\psi(4415)$ line shape.

### $\Gamma(\psi(3770)\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_{19}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **possibly seen** | [38] ABLIKIM | 19AR | BES3 | $e^+e^- \to \pi^+\pi^- D\overline{D}$ |

[38] Observe $e^+e^- \to \pi^+\pi^-\psi(3770)$ at $\sqrt{s} = 4.26$, 4.36, and 4.42 GeV but cannot establish if continuum or resonant.

### $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ $\Gamma_{30}/\Gamma$

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

### $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ $\Gamma_{31}/\Gamma$

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

## $\psi(4415)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| ABLIKIM | 24AH | JHEP 2405 022 | M. Ablikim *et al.* | (BESIII Collab.) |
| ABLIKIM | 24AL | JHEP 2407 258 | M. Ablikim *et al.* | (BESIII Collab.) |
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| ABLIKIM | 23BH | PRL 131 151903 | M. Ablikim *et al.* | (BESIII Collab.) |
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| ZHUKOVA | 18 | PR D97 012002 | V. Zhukova *et al.* | (BELLE Collab.) |
| ABLIKIM | 15S | PRL 115 011803 | M. Ablikim *et al.* | (BESIII Collab.) |
| HAN | 15 | PR D92 012011 | Y.L. Han *et al.* | (BELLE Collab.) |
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| PAKHLOVA | 11 | PR D83 011101 | G. Pakhlova *et al.* | (BELLE Collab.) |
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| MO | 10 | PR D82 077501 | X.H. Mo, C.Z. Yuan, P. Wang | (BHEP) |
| AUBERT | 09M | PR D79 092001 | B. Aubert *et al.* | (BABAR Collab.) |
| PAKHLOVA | 09 | PR D80 091101 | G. Pakhlova *et al.* | (BELLE Collab.) |
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