# $\psi(4160)$

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

## $\psi(4160)$ MASS

| *VALUE* (MeV) | *DOCUMENT ID* | *TECN* | *COMMENT* |
|---|---|---|---|
| **4153± 3 OUR ESTIMATE** | | | |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| 4151± 4 | [1] SETH | 05A RVUE | $e^+e^- \to$ hadrons |
| 4155± 5 | [2] SETH | 05A RVUE | $e^+e^- \to$ hadrons |
| 4159±20 | BRANDELIK | 78C DASP | $e^+e^-$ |

[1] From a fit to Crystal Ball (OSTERHELD 86) data.
[2] From a fit to BES (BAI 02C) data.

## $\psi(4160)$ WIDTH

| *VALUE* (MeV) | *DOCUMENT ID* | *TECN* | *COMMENT* |
|---|---|---|---|
| **103± 8 OUR ESTIMATE** | | | |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| 107±10 | [3] SETH | 05A RVUE | $e^+e^- \to$ hadrons |
| 107±16 | [4] SETH | 05A RVUE | $e^+e^- \to$ hadrons |
| 78±20 | BRANDELIK | 78C DASP | $e^+e^-$ |

[3] From a fit to Crystal Ball (OSTERHELD 86) data.
[4] From a fit to BES (BAI 02C) data.

## $\psi(4160)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) | | Confidence level |
|---|---|---|---|---|
| $\Gamma_1$ | $e^+e^-$ | $(8.1\pm0.9)\times10^{-6}$ | | |
| $\Gamma_2$ | $J/\psi\pi^+\pi^-$ | $< 3$ | $\times10^{-3}$ | 90% |
| $\Gamma_3$ | $J/\psi\pi^0\pi^0$ | $< 3$ | $\times10^{-3}$ | 90% |
| $\Gamma_4$ | $J/\psi K^+K^-$ | $< 2$ | $\times10^{-3}$ | 90% |
| $\Gamma_5$ | $J/\psi\eta$ | $< 8$ | $\times10^{-3}$ | 90% |
| $\Gamma_6$ | $J/\psi\pi^0$ | $< 1$ | $\times10^{-3}$ | 90% |
| $\Gamma_7$ | $J/\psi\eta'$ | $< 5$ | $\times10^{-3}$ | 90% |
| $\Gamma_8$ | $J/\psi\pi^+\pi^-\pi^0$ | $< 1$ | $\times10^{-3}$ | 90% |
| $\Gamma_9$ | $\psi(2S)\pi^+\pi^-$ | $< 4$ | $\times10^{-3}$ | 90% |
| $\Gamma_{10}$ | $\chi_{c1}\gamma$ | $< 7$ | $\times10^{-3}$ | 90% |
| $\Gamma_{11}$ | $\chi_{c2}\gamma$ | $< 1.3$ | % | 90% |
| $\Gamma_{12}$ | $\chi_{c1}\pi^+\pi^-\pi^0$ | $< 2$ | $\times10^{-3}$ | 90% |
| $\Gamma_{13}$ | $\chi_{c2}\pi^+\pi^-\pi^0$ | $< 8$ | $\times10^{-3}$ | 90% |
| $\Gamma_{14}$ | $\phi\pi^+\pi^-$ | $< 2$ | $\times10^{-3}$ | 90% |

## $\psi(4160)$ PARTIAL WIDTHS

### $\Gamma(e^+e^-)$ $\Gamma_1$

| VALUE (keV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.83±0.07 OUR ESTIMATE** | | | | |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.83±0.08 | [5] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 0.84±0.13 | [6] SETH | 05A | RVUE | $e^+e^- \to$ hadrons |
| 0.77±0.23 | BRANDELIK | 78C | DASP | $e^+e^-$ |

[5] From a fit to Crystal Ball (OSTERHELD 86) data.
[6] From a fit to BES (BAI 02C) data.

## $\psi(4160)$ BRANCHING RATIOS

### $\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{total}$ $\Gamma_2/\Gamma$

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

### $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{total}$ $\Gamma_3/\Gamma$

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

### $\Gamma(J/\psi K^+K^-)/\Gamma_{total}$ $\Gamma_4/\Gamma$

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

### $\Gamma(J/\psi\eta)/\Gamma_{total}$ $\Gamma_5/\Gamma$

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

### $\Gamma(J/\psi\pi^0)/\Gamma_{total}$ $\Gamma_6/\Gamma$

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

### $\Gamma(J/\psi\eta')/\Gamma_{total}$ $\Gamma_7/\Gamma$

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

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

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

### $\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma_{total}$ $\Gamma_9/\Gamma$

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

### $\Gamma(\chi_{c1}\gamma)/\Gamma_{total}$ $\Gamma_{10}/\Gamma$

| *VALUE* (units $10^{-3}$) | *CL%* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| **<7** | 90 | COAN | 06 | CLEO | 4.12–4.2 $e^+e^-$ → hadrons |

### $\Gamma(\chi_{c2}\gamma)/\Gamma_{total}$ $\Gamma_{11}/\Gamma$

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

### $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{total}$ $\Gamma_{12}/\Gamma$

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

### $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{total}$ $\Gamma_{13}/\Gamma$

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

### $\Gamma(\phi\pi^+\pi^-)/\Gamma_{total}$ $\Gamma_{14}/\Gamma$

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

## $\psi(4160)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| COAN | 06 | PRL 96 162003 | T.E. Coan *et al.* | (CLEO Collab.) |
| SETH | 05A | PR D72 017501 | K.K. Seth | |
| BAI | 02C | PRL 88 101802 | J.Z. Bai *et al.* | (BES Collab.) |
| OSTERHELD | 86 | SLAC-PUB-4160 | A. Osterheld *et al.* | (SLAC Crystal Ball Collab.) |
| BRANDELIK | 78C | PL 76B 361 | R. Brandelik *et al.* | (DASP Collab.) |


## OTHER RELATED PAPERS


| | | | | |
|---|---|---|---|---|
| IDDIR | 98 | PL B433 125 | F. Iddir *et al.* | |
| ONO | 84 | ZPHY C26 307 | S. Ono | (ORSAY) |
| BURMESTER | 77 | PL 66B 395 | J. Burmester *et al.* | (DESY, HAMB, SIEG+) |