

$\psi(4415)$ 

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

### $\psi(4415)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>4421 ± 4</b>	<b>OUR ESTIMATE</b>		
<b>4415.1 ± 7.9</b>	<sup>1</sup> ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • •	We do not use the following data for averages, fits, limits, etc. • • •		
4411 ± 7	<sup>2</sup> PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 ± 6	<sup>3</sup> SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4429 ± 9	<sup>4</sup> SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4417 ± 10	BRANDELIK	78C DASP	$e^+e^-$
4414 ± 7	SIEGRIST	76 MRK1	$e^+e^-$

<sup>1</sup> 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  $\delta = (234 \pm 88)^\circ$ .

<sup>2</sup> Systematic uncertainties not estimated.

<sup>3</sup> From a fit to Crystal Ball (OSTERHELD 86) data.

<sup>4</sup> From a fit to BES (BAI 02C) data.

### $\psi(4415)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>62 ± 20</b>	<b>OUR ESTIMATE</b>		
<b>71.5 ± 19.0</b>	<sup>5</sup> ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • •	We do not use the following data for averages, fits, limits, etc. • • •		
77 ± 20	<sup>6</sup> PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
119 ± 16	<sup>7</sup> SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
118 ± 35	<sup>8</sup> SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
66 ± 15	BRANDELIK	78C DASP	$e^+e^-$
33 ± 10	SIEGRIST	76 MRK1	$e^+e^-$

<sup>5</sup> 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  $\delta = (234 \pm 88)^\circ$ .

<sup>6</sup> Systematic uncertainties not estimated.

<sup>7</sup> From a fit to Crystal Ball (OSTERHELD 86) data.

<sup>8</sup> From a fit to BES (BAI 02C) data.

### $\psi(4415)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
$\Gamma_1$ hadrons	dominant	
$\Gamma_2$ $D^0 D^- \pi^+$		
$\Gamma_3$ $(D^0 D^- \pi^+)_{non-res}$	< 2.3 %	90%
$\Gamma_4$ $D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+$	(10 ± 4) %	
$\Gamma_5$ $e^+e^-$	(9.4 ± 3.2) × 10 <sup>-6</sup>	

**$\psi(4415)$  PARTIAL WIDTHS** **$\Gamma(e^+e^-)$   $\Gamma_5$** 

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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**0.58±0.07 OUR ESTIMATE**

<b>0.35±0.12</b>	<sup>9</sup> ABLIKIM	08D	BES2	$e^+e^- \rightarrow$ hadrons
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.72±0.11	<sup>10</sup> SETH	05A	RVUE	$e^+e^- \rightarrow$ hadrons
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0.64±0.23	<sup>11</sup> SETH	05A	RVUE	$e^+e^- \rightarrow$ hadrons
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0.49±0.13	BRANDELIK	78C	DASP	$e^+e^-$
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0.44±0.14	SIEGRIST	76	MRK1	$e^+e^-$
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<sup>9</sup> 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  $\delta = (234 \pm 88)^\circ$ .

<sup>10</sup> From a fit to Crystal Ball (OSTERHELD 86) data.

<sup>11</sup> From a fit to BES (BAI 02C) data.

 **$\psi(4415)$  BRANCHING RATIOS** **$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$   $\Gamma_1/\Gamma$** 

VALUE	DOCUMENT ID	TECN	COMMENT
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<b>dominant</b>	SIEGRIST	76	MRK1	$e^+e^-$
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 **$\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+)/\Gamma_{\text{total}}$   $\Gamma_4/\Gamma$** 

VALUE (units $10^{-2}$ )	DOCUMENT ID	TECN	COMMENT
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<b>10.5±2.4±3.8</b>	<sup>12</sup> PAKHLOVA	08A	BELL	10.6 $e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
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<sup>12</sup> Using  $4421 \pm 4$  MeV for the mass and  $62 \pm 20$  MeV for the width of  $\psi(4415)$ .

 **$\Gamma((D^0 D^- \pi^+)_{\text{non-res}})/\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+)$   $\Gamma_3/\Gamma_4$** 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<b>&lt;0.22</b>	90	<sup>13</sup> PAKHLOVA	08A	BELL 10.6 $e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
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<sup>13</sup> Using  $4421 \pm 4$  MeV for the mass and  $62 \pm 20$  MeV for the width of  $\psi(4415)$ .

 **$\psi(4415)$  REFERENCES**

ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
SETH	05A	PR D72 017501	K.K. Seth	
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)
SIEGRIST	76	PRL 36 700	J.L. Siegrist <i>et al.</i>	(LBL, SLAC)

**OTHER RELATED PAPERS**

PAKHLOVA	08	PR D77 011103R	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
BURMESTER	77	PL 66B 395	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)
LUTH	77	PL 70B 120	V. Luth <i>et al.</i>	(LBL, SLAC)