

$\psi(4415)$

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

$\psi(4415)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4421 ± 4	OUR ESTIMATE		
4415.1 ± 7.9	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • •	We do not use the following data for averages, fits, limits, etc. • • •		
4411 ± 7	² PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 ± 6	³ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4429 ± 9	⁴ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4417 ± 10	BRANDELIK	78C DASP	e^+e^-
4414 ± 7	SIEGRIST	76 MRK1	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 $\delta = (234 \pm 88)^\circ$.

² Systematic uncertainties not estimated.

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

⁴ From a fit to BES (BAI 02C) data.

$\psi(4415)$ WIDTH

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

⁵ 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 $\delta = (234 \pm 88)^\circ$.

⁶ Systematic uncertainties not estimated.

⁷ From a fit to Crystal Ball (OSTERHELD 86) data.

⁸ From a fit to BES (BAI 02C) data.

$\psi(4415)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	dominant	
Γ_2 $D^0 D^- \pi^+$		
Γ_3 $(D^0 D^- \pi^+)_{non-res}$	< 2.3 %	90%
Γ_4 $D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+$	(10 ± 4) %	
Γ_5 e^+e^-	(9.4 ± 3.2) × 10 ⁻⁶	

$\psi(4415)$ PARTIAL WIDTHS **$\Gamma(e^+e^-)$ Γ_5**

<u>VALUE (keV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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0.58±0.07 OUR ESTIMATE**0.35±0.12** ⁹ ABLIKIM 08D BES2 $e^+e^- \rightarrow$ hadrons

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

0.72±0.11 ¹⁰ SETH 05A RVUE $e^+e^- \rightarrow$ hadrons0.64±0.23 ¹¹ SETH 05A RVUE $e^+e^- \rightarrow$ hadrons0.49±0.13 BRANDELIK 78C DASP e^+e^- 0.44±0.14 SIEGRIST 76 MRK1 e^+e^- ⁹ 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 $\delta = (234 \pm 88)^\circ$.¹⁰ From a fit to Crystal Ball (OSTERHELD 86) data.¹¹ From a fit to BES (BAI 02C) data. **$\psi(4415)$ BRANCHING RATIOS** **$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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dominant SIEGRIST 76 MRK1 e^+e^- **$\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+)/\Gamma_{\text{total}}$ Γ_4/Γ**

<u>VALUE (units 10^{-2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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10.5±2.4±3.8 ¹² PAKHLOVA 08A BELL 10.6 $e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$ ¹² Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$. **$\Gamma((D^0 D^- \pi^+)_{\text{non-res}})/\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+)$ Γ_3/Γ_4**

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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<0.22 90 ¹³ PAKHLOVA 08A BELL 10.6 $e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$ ¹³ Using 4421 ± 4 MeV for the mass and 62 ± 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)