$\psi(4415)$

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

$\psi(4415)$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
4421 ± 4 OUR ESTIMATE				
4415.1± 7.9	[1] ABLIKIM	08D	BES2	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4411 ± 7	[2] PAKHLOVA	08A	BELL	10.6 $e^+e^- \to D^0D^-\pi^+\gamma$
4425 ± 6	[3] SETH	05A	RVUE	$e^+e^- \to$ hadrons
4429 ± 9	[4] SETH	05A	RVUE	$e^+e^- \to$ 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	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
77 ±20	[6] PAKHLOVA	08A	BELL	10.6 $e^+e^- \to D^0D^-\pi^+\gamma$
119 ±16	[7] SETH	05A	RVUE	$e^+e^- \to$ hadrons
118 ±35	[8] SETH	05A	RVUE	$e^+e^- \to$ 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	$D\overline{D}$	not seen	
Γ_3	$D^0\overline{D}^0$	not seen	
Γ_4	D^+D^-	not seen	
Γ_5	$D^*\overline{D}$ + c.c.	not seen	
Γ_6	$D^*(2007)^0\overline{D}^0$ + c.c.	not seen	
Γ_7	$D^*(2010)^+D^-$ + c.c.	not seen	
Γ_8	$D^*\overline{D}^*$	not seen	
Γ_9	$D^*(2007)^0\overline{D}^*(2007)^0$ + c.c.	not seen	
Γ_{10}	$D^*(2010)^+D^*(2010)^-$ + c.c.	not seen	
Γ_{11}	$D^0D^-\pi^+$		
Γ_{12}	$(D^0D^-\pi^+)_{non-res}$	$<$ 2.3 %	90%
Γ_{13}	$D\overline{D}_2^*(2460) \rightarrow D^0D^-\pi^+$	(10 $\pm$4) %	
Γ_{14}	$D^0D^{*-}\pi^+$	$<$ 11 %	90%
Γ_{15}	e^+e^-	(9.4$\pm$3.2) $\times 10^{-6}$	

$\psi(4415)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$ Γ_{15}

VALUE (keV)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.58$\pm$0.07 OUR ESTIMATE				
0.35$\pm$0.12	[9] ABLIKIM	08D	BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.72$\pm$0.11	[10] SETH	05A	RVUE	$e^+e^- \rightarrow$ hadrons
0.64$\pm$0.23	[11] SETH	05A	RVUE	$e^+e^- \rightarrow$ hadrons
0.49$\pm$0.13	BRANDELIK	78C	DASP	e^+e^-
0.44$\pm$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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
dominant	SIEGRIST	76	MRK1	e^+e^-

$\Gamma(D\overline{D})/\Gamma(D^*\overline{D}^*)$ Γ_2/Γ_8

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

$\Gamma(D^*\overline{D}+\text{c.c.})/\Gamma(D^*\overline{D}^*)$ Γ_5/Γ_8

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

$\Gamma(D\overline{D}_2^*(2460) \to D^0D^-\pi^+)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
10.5±2.4±3.8	[12] PAKHLOVA	08A	BELL	10.6 $e^+e^- \to D^0D^-\pi^+\gamma$

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

$\Gamma((D^0D^-\pi^+)_{non-res})/\Gamma(D\overline{D}_2^*(2460) \to D^0D^-\pi^+)$ Γ_{12}/Γ_{13}

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.22	90	[13] PAKHLOVA	08A	BELL	10.6 $e^+e^- \to D^0D^-\pi^+\gamma$

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

$\Gamma(D^0D^{*-}\pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{14}/\Gamma \times \Gamma_{15}/\Gamma$

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.99 × 10^{-6}	90	[14] PAKHLOVA	09	BELL	$e^+e^- \to \psi(4415) \to D^0D^{*-}\pi^+$

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

$\psi(4415)$ REFERENCES

AUBERT	09M	PR D79 092001	B. Aubert *et al.*	(BABAR Collab.)
PAKHLOVA	09	PR D80 091101R	G. Pakhlova *et al.*	(BELLE Collab.)
ABLIKIM	08D	PL B660 315	M. Ablikim *et al.*	(BES Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova *et al.*	(BELLE 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.)
SIEGRIST	76	PRL 36 700	J.L. Siegrist *et al.*	(LBL, SLAC)