

$\psi(4160)$

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

$\psi(4160)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4153 ± 3 OUR ESTIMATE			
4191.7 ± 6.5	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4151 ± 4	² SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4155 ± 5	³ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4159 ± 20	BRANDELIK	78C DASP	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 $\delta = (293 \pm 57)^\circ$.
² From a fit to Crystal Ball (OSTERHELD 86) data.
³ From a fit to BES (BAI 02C) data.

$\psi(4160)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
103 ± 8 OUR ESTIMATE			
71.8 ± 12.3	⁴ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
107 ± 10	⁵ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
107 ± 16	⁶ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
78 ± 20	BRANDELIK	78C DASP	e^+e^-

⁴ 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 $\delta = (293 \pm 57)^\circ$.
⁵ From a fit to Crystal Ball (OSTERHELD 86) data.
⁶ From a fit to BES (BAI 02C) data.

$\psi(4160)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$(8.1 \pm 0.9) \times 10^{-6}$	
Γ_2 $D\bar{D}$	not seen	
Γ_3 $D^0\bar{D}^0$	not seen	
Γ_4 D^+D^-	not seen	
Γ_5 $D^*\bar{D} + \text{c.c.}$	not seen	
Γ_6 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	not seen	
Γ_7 $D^*(2010)^+D^- + \text{c.c.}$	not seen	
Γ_8 $D^*\bar{D}^*$	seen	
Γ_9 $D^*(2007)^0\bar{D}^*(2007)^0$	seen	
Γ_{10} $D^*(2010)^+D^*(2010)^-$	seen	

Γ_{11}	$J/\psi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%
Γ_{12}	$J/\psi \pi^0 \pi^0$	< 3	$\times 10^{-3}$	90%
Γ_{13}	$J/\psi K^+ K^-$	< 2	$\times 10^{-3}$	90%
Γ_{14}	$J/\psi \eta$	< 8	$\times 10^{-3}$	90%
Γ_{15}	$J/\psi \pi^0$	< 1	$\times 10^{-3}$	90%
Γ_{16}	$J/\psi \eta'$	< 5	$\times 10^{-3}$	90%
Γ_{17}	$J/\psi \pi^+ \pi^- \pi^0$	< 1	$\times 10^{-3}$	90%
Γ_{18}	$\psi(2S) \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%
Γ_{19}	$\chi_{c1} \gamma$	< 7	$\times 10^{-3}$	90%
Γ_{20}	$\chi_{c2} \gamma$	< 1.3	%	90%
Γ_{21}	$\chi_{c1} \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%
Γ_{22}	$\chi_{c2} \pi^+ \pi^- \pi^0$	< 8	$\times 10^{-3}$	90%
Γ_{23}	$\phi \pi^+ \pi^-$	< 2	$\times 10^{-3}$	90%

$\psi(4160)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$				Γ_1
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
0.83 ± 0.07 OUR ESTIMATE				
0.48 ± 0.22	⁷ ABLIKIM	08D	BES2 $e^+ e^- \rightarrow$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.83 ± 0.08	⁸ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons	
0.84 ± 0.13	⁹ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons	
0.77 ± 0.23	BRANDELIK	78C	DASP $e^+ e^-$	
⁷ 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 $\delta = (293 \pm 57)^\circ$.				
⁸ From a fit to Crystal Ball (OSTERHELD 86) data.				
⁹ From a fit to BES (BAI 02C) data.				

$\psi(4160)$ BRANCHING RATIOS

$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$				Γ_2/Γ_8
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.02 \pm 0.03 \pm 0.02$	AUBERT	09M	BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$	
$\Gamma(D^*\bar{D} + c.c.)/\Gamma(D^*\bar{D}^*)$				Γ_5/Γ_8
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.34 \pm 0.14 \pm 0.05$	AUBERT	09M	BABR $e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$	
$\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$				Γ_{11}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$				Γ_{12}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

$\Gamma(J/\psi K^+ K^-)/\Gamma_{\text{total}}$					Γ_{13}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<2	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(J/\psi \eta)/\Gamma_{\text{total}}$					Γ_{14}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<8	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(J/\psi \pi^0)/\Gamma_{\text{total}}$					Γ_{15}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<1	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(J/\psi \eta')/\Gamma_{\text{total}}$					Γ_{16}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<5	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(J/\psi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$					Γ_{17}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<1	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(\psi(2S) \pi^+ \pi^-)/\Gamma_{\text{total}}$					Γ_{18}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<4	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(\chi_{c1} \gamma)/\Gamma_{\text{total}}$					Γ_{19}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<7	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(\chi_{c2} \gamma)/\Gamma_{\text{total}}$					Γ_{20}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<13	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(\chi_{c1} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$					Γ_{21}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<2	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(\chi_{c2} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$					Γ_{22}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<8	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons
$\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$					Γ_{23}/Γ
<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<2	90	COAN	06	CLEO	4.12-4.2 $e^+ e^- \rightarrow$ hadrons

$\psi(4160)$ REFERENCES

AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO 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.)
