

$\psi(4040)$

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

$\psi(4040)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
4039 ± 1 OUR ESTIMATE			
4039.6 ± 4.3	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4037 ± 2	² SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4040 ± 1	³ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4040 ± 10	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 $\delta = (130 \pm 46)^\circ$.

² From a fit to Crystal Ball (OSTERHELD 86) data.

³ From a fit to BES (BAI 02C) data.

$\psi(4040)$ WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
80 ± 10 OUR ESTIMATE			
84.5 ± 12.3	⁴ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
85 ± 10	⁵ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
89 ± 6	⁶ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
52 ± 10	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 $\delta = (130 \pm 46)^\circ$.

⁵ From a fit to Crystal Ball (OSTERHELD 86) data.

⁶ From a fit to BES (BAI 02C) data.

$\psi(4040)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$(1.07 \pm 0.16) \times 10^{-5}$	
Γ_2 $D^0\bar{D}^0$	seen	
Γ_3 $D^*(2007)^0\bar{D}^0 + c.c.$	seen	
Γ_4 $D^*(2007)^0\bar{D}^*(2007)^0$	seen	
Γ_5 $J/\psi(1S)$ hadrons		
Γ_6 $J/\psi\pi^+\pi^-$	< 4	$\times 10^{-3}$ 90%
Γ_7 $J/\psi\pi^0\pi^0$	< 2	$\times 10^{-3}$ 90%
Γ_8 $J/\psi\eta$	< 7	$\times 10^{-3}$ 90%

Γ_9	$J/\psi \pi^0$	< 2	$\times 10^{-3}$	90%
Γ_{10}	$J/\psi \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%
Γ_{11}	$\chi_{c1} \gamma$	< 1.1	%	90%
Γ_{12}	$\chi_{c2} \gamma$	< 1.7	%	90%
Γ_{13}	$\chi_{c1} \pi^+ \pi^- \pi^0$	< 1.1	%	90%
Γ_{14}	$\chi_{c2} \pi^+ \pi^- \pi^0$	< 3.2	%	90%
Γ_{15}	$\phi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%
Γ_{16}	$\mu^+ \mu^-$			

$\psi(4040)$ PARTIAL WIDTHS

$\Gamma(e^+ e^-)$				Γ_1
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
0.86 ± 0.07 OUR ESTIMATE				
0.83 ± 0.20	⁷ ABLIKIM	08D	BES2 $e^+ e^- \rightarrow$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.88 ± 0.11	⁸ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons	
0.91 ± 0.13	⁹ SETH	05A	RVUE $e^+ e^- \rightarrow$ hadrons	
0.75 ± 0.15	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 $\delta = (130 \pm 46)^\circ$.				
⁸ From a fit to Crystal Ball (OSTERHELD 86) data.				
⁹ From a fit to BES (BAI 02C) data.				

$\psi(4040)$ BRANCHING RATIOS

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1.0	FELDMAN	77	MRK1 $e^+ e^-$	
$\Gamma(D^0 \bar{D}^0)/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$				Γ_2/Γ_3
VALUE	DOCUMENT ID	TECN	COMMENT	
0.05 ± 0.03	¹⁰ GOLDHABER	77	MRK1 $e^+ e^-$	
$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$				Γ_4/Γ_3
VALUE	DOCUMENT ID	TECN	COMMENT	
32.0 ± 12.0	¹⁰ GOLDHABER	77	MRK1 $e^+ e^-$	
$\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$				Γ_6/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 4	90	COAN	06	CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons
$\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$				Γ_7/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 2	90	COAN	06	CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$					Γ_8/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<7	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	
$\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$					Γ_9/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<2	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	
$\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_{10}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<2	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	
$\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$					Γ_{11}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<11	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	
$\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$					Γ_{12}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<17	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	
$\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_{13}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<11	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	
$\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_{14}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<32	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	
$\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{15}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<3	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons	

¹⁰ Phase-space factor (p^3) explicitly removed.

$\psi(4040)$ REFERENCES

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.)
		Also ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)

————— **OTHER RELATED PAPERS** —————

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