$X(3872)$

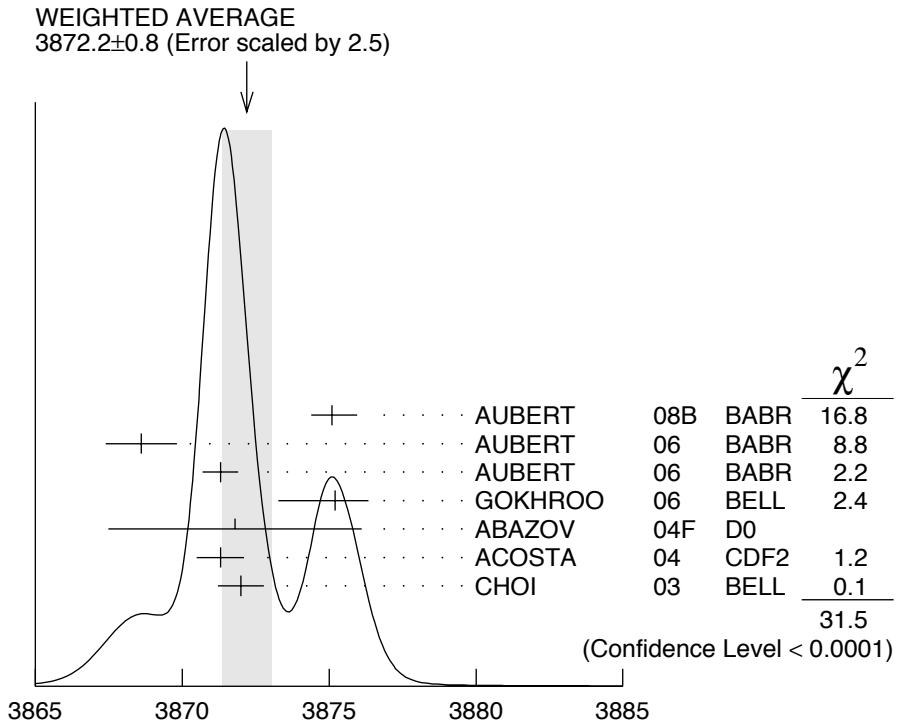
$I^G(J^{PC}) = 0^?(?^{?+})$

Seen by CHOI 03 in $B \to K\pi^+\pi^- J/\psi(1S)$ decays as a narrow peak in the invariant mass distribution of the $\pi^+\pi^- J/\psi(1S)$ final state, but not seen in the $\gamma\chi_{c1}$ final state of these decays. Possibly absent in the invariant mass spectrum of the final state $\pi^+\pi^- J/\psi(1S)$ in e^+e^- collisions. Interpretation as a 1^{--} charmonium state not favored. Isovector hypothesis excluded by AUBERT 05B. A helicity amplitude analysis of the $X(3872) \to J/\psi\pi^+\pi^-$ decay gives two possible J^{PC} assignments: $J^{PC} = 1^{++}$ and 2^{-+} (ABULENCIA 07E).

$X(3872)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3872.2± 0.8 OUR AVERAGE		Error includes scale factor of 2.5. See the ideogram below.			
$3875.1^{+\ 0.7}_{-\ 0.5} \pm 0.5$	33 ± 6	[1] AUBERT	08B	BABR	$B \to \overline{D}^{*0} D^0 K$
3868.6± 1.2±0.2	8	[2] AUBERT	06	BABR	$B^0 \to K^0_S J/\psi\pi^+\pi^-$
3871.3± 0.6±0.1	61	[2] AUBERT	06	BABR	$B^- \to K^- J/\psi\pi^+\pi^-$
$3875.2\pm\ 0.7^{+0.9}_{-1.8}$	24 ± 6	[1] GOKHROO	06	BELL	$B \to D^0\overline{D}^0\pi^0 K$
3871.8± 3.1±3.0	522	[3,4] ABAZOV	04F	D0	$p\overline{p} \to J/\psi\pi^+\pi^- X$
3871.3± 0.7±0.4	730	[4] ACOSTA	04	CDF2	$p\overline{p} \to J/\psi\pi^+\pi^- X$
3872.0± 0.6±0.5	36	CHOI	03	BELL	$B \to K\pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3873.4± 1.4	25	[5] AUBERT	05R	BABR	$B^+ \to K^+ J/\psi\pi^+\pi^-$
3836 ±13	58	[4,6] ANTONIAZZI	94	E705	300 $\pi^\pm$Li → $J/\psi\pi^+\pi^- X$

[1] May not necessarily be the same state as that observed in the $J/\psi\pi^+\pi^-$ mode.
[2] Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV.
[3] Calculated from the corresponding $m_{X(3872)} - m_{J/\psi}$ using $m_{J/\psi}$=3096.916 MeV.
[4] Width consistent with detector resolution.
[5] Calculated from the corresponding $m_{X(3872)^\pm} - m_{\psi(2S)}$ using $m_{\psi(2S)} =$ 3685.96MeV. Superseded by AUBERT 06.
[6] A lower mass value can be due to an incorrect momentum scale for soft pions.



$m_{X(3872)^{\pm}} - m_{J/\psi}$

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
774.9±3.1±3.0	522	ABAZOV	04F	D0	$p\overline{p} \rightarrow J/\psi\pi^+\pi^- X$

$m_{X(3872)^{\pm}} - m_{\psi(2S)}$

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
187.4±1.4	25	[7] AUBERT	05R	BABR	$B^+ \rightarrow K^+ J/\psi\pi^+\pi^-$

[7] Superseded by AUBERT 06.

X(3872) WIDTH

VALUE (MeV)	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{3.0^{+1.9}_{-1.4}\pm0.9}$		33 ± 6	[8] AUBERT	08B	BABR	$B \rightarrow \overline{D}^{*0} D^0 K$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<4.1	90	69	AUBERT	06	BABR	$B \rightarrow K\pi^+\pi^- J/\psi$
<2.3	90	36	CHOI	03	BELL	$B \rightarrow K\pi^+\pi^- J/\psi$

[8] May not necessarily be the same state as that observed in the $J/\psi\pi^+\pi^-$ mode.

X(3872) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	e^+e^-	
Γ_2	$\pi^+\pi^- J/\psi(1S)$	seen
Γ_3	$\rho^0 J/\psi(1S)$	seen
Γ_4	$\gamma\gamma$	
Γ_5	$D^0\overline{D}^0$	not seen
Γ_6	D^+D^-	not seen
Γ_7	$D^0\overline{D}^0\pi^0$	seen
Γ_8	$\gamma\chi_{c1}$	
Γ_9	$\eta J/\psi$	
Γ_{10}	$\gamma J/\psi$	

X(3872) PARTIAL WIDTHS

$\Gamma(e^+e^-)$ Γ_1

VALUE (keV)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.28	90	[9] YUAN	04	RVUE	$e^+e^- \to \pi^+\pi^- J/\psi$

[9] Using BAI 98E data on $e^+e^- \to \pi^+\pi^-\ell^+\ell^-$. Assuming that $\Gamma(\pi^+\pi^- J/\psi)$ of $X(3872)$ is the same as that of $\psi(2S)$ (85.4 keV).

X(3872) Γ(i)Γ(e^+e^-)/Γ(total)

$\Gamma(\pi^+\pi^- J/\psi(1S)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_1/\Gamma$

VALUE (eV)	CL%		DOCUMENT ID		TECN	COMMENT
< 6.2	90	[10,11]	AUBERT	05D	BABR	10.6 $e^+e^- \to K^+K^-\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 8.3	90	[11]	DOBBS	05	CLE3	$e^+e^- \to \pi^+\pi^- J/\psi$
<10	90	[12]	YUAN	04	RVUE	$e^+e^- \to \pi^+\pi^- J/\psi$

[10] Using $B(X(3872) \to J/\psi\pi^+\pi^-) \cdot B(J/\psi \to \mu^+\mu^-) \cdot \Gamma(X(3872) \to e^+e^-) < 0.37$ eV from AUBERT 05D and $B(J/\psi \to \mu^+\mu^-) = 0.0588 \pm 0.0010$ from the PDG 04.

[11] Assuming $X(3872)$ has $J^{PC} = 1^{--}$.

[12] Using BAI 98E data on $e^+e^- \to \pi^+\pi^-\ell^+\ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \to \mu^+\mu^-) = (5.88 \pm 0.10)\%$.

X(3872) Γ(i)Γ(γγ)/Γ(total)

$\Gamma(\gamma\gamma) \times \Gamma(\pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_2/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<12.9	90	[13] DOBBS	05	CLE3	$e^+e^- \to \pi^+\pi^- J/\psi\gamma$

[13] Assuming $X(3872)$ has positive C parity and spin 0.

X(3872) BRANCHING RATIOS

$\Gamma(\pi^+\pi^- J/\psi(1S))/\Gamma_{total}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
>0.042	90	[14,15] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$

[14] Calculated by us using $B(B^\pm \to K^\pm X(3872)) < 3.2 \times 10^{-4}$ from AUBERT 06E and $B(B^\pm \to K^\pm X(3872)) \times B(X(3872) \to J/\psi\pi^+\pi^-) = (11.4 \pm 2.0) \times 10^{-6}$ from the 2006 Edition of this *Review* (PDG 06).

[15] Decay proceeds via the $\rho^0 J/\psi$ (ABULENCIA 06B).

$\Gamma(D^0\overline{D}^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_5/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	CHISTOV	04	BELL	$B \to K D^0 \overline{D}^0$

$\Gamma(D^+ D^-)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_6/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	CHISTOV	04	BELL	$B \to K D^+ D^-$

$\Gamma(D^0\overline{D}^0\pi^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_7/Γ_2

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[16] GOKHROO	06	BELL	$B \to D^0 \overline{D}^0 \pi^0 K$

[16] May not necessarily be the same state as that observed in the $J/\psi\pi^+\pi^-$ mode. Supersedes CHISTOV 04.

$\Gamma(\gamma\chi_{c1})/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_8/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.89	90	CHOI	03	BELL	$B \to K \pi^+\pi^- J/\psi$

$\Gamma(\eta J/\psi)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_9/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.6	90	AUBERT	04Y	BABR	$B \to K \eta J/\psi$

$\Gamma(\gamma J/\psi)/\Gamma_{total}$ Γ_{10}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
>0.010	19	[17] AUBERT,BE	06M	BABR	$B^+ \to K^+ J/\psi\gamma$

[17] AUBERT,BE 06M reports $[B(X(3872) \to \gamma J/\psi)] \times [B(B^+ \to X(3872) K^+)] = (3.3 \pm 1.0 \pm 0.3) \times 10^{-6}$. We divide by our best value $B(B^+ \to X(3872) K^+) < 3.2 \times 10^{-4}$.

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