$X(3872)$

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

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 fit to the dipion mass spectrum is compatible with both S- and P-wave $J/\psi\rho$ decays implying positive C-parity (ABULENCIA 06B).

Quantum numbers are not established.

$X(3872)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
3871.2± 0.5 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.
3868.6± 1.2±0.2	8	[1] AUBERT	06	BABR	$B^0 \to K^0_S J/\psi\pi^+\pi^-$
3871.3± 0.6±0.1	61	[1] AUBERT	06	BABR	$B^- \to K^- J/\psi\pi^+\pi^-$
3871.8± 3.1±3.0	522	[2,3] ABAZOV	04F	D0	$p\overline{p} \to J/\psi\pi^+\pi^- X$
3871.3± 0.7±0.4	730	[3] 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	[4] AUBERT	05R	BABR	$B^+ \to K^+ J/\psi\pi^+\pi^-$
3836 ±13	58	[3,5] ANTONIAZZI	94	E705	300 $\pi^\pm$ Li $\to J/\psi\pi^+\pi^- X$

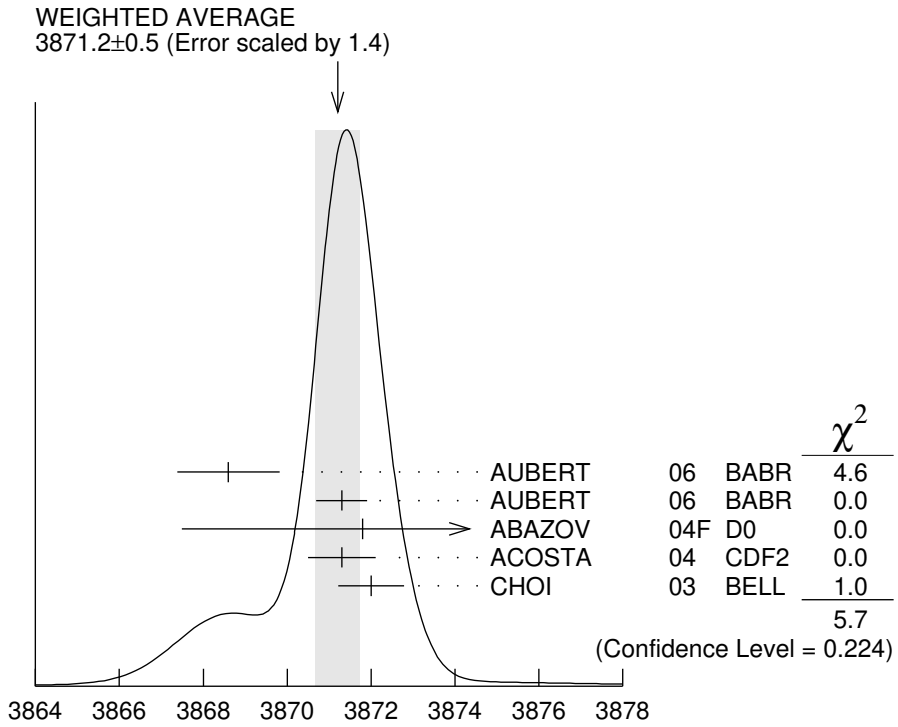
[1] Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV.

[2] Calculated from the corresponding $m_{X(3872)} - m_{J/\psi}$ using $m_{J/\psi}$=3096.916 MeV.

[3] Width consistent with detector resolution.

[4] Calculated from the corresponding $m_{X(3872)^\pm} - m_{\psi(2S)}$ using $m_{\psi(2S)} =$ 3685.96MeV. Superseded by AUBERT 06.

[5] 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	[6] AUBERT	05R	BABR	$B^+ \rightarrow K^+ J/\psi\pi^+\pi^-$

[6] Superseded by AUBERT 06.

X(3872) WIDTH

VALUE (MeV)	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
<2.3	90	36	CHOI	03	BELL	$B \rightarrow K\pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<4.1	90	69	AUBERT	06	BABR	$B \rightarrow K\pi^+\pi^- J/\psi$

X(3872) DECAY MODES

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

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	[7] YUAN	04	RVUE	$e^+e^- \to \pi^+\pi^- J/\psi$

[7] 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)

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

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
< 6.2	90	[8,9] 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	[9] DOBBS	05	CLE3	$e^+e^- \to \pi^+\pi^- J/\psi$
<10	90	[10] YUAN	04	RVUE	$e^+e^- \to \pi^+\pi^- J/\psi$

[8] 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.

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

[10] 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)

$\Gamma(\gamma\gamma) \times \Gamma(\pi^+\pi^- J/\psi(1S))/\Gamma_{total}$ $\Gamma_3\Gamma_2/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<12.9	90	[11] DOBBS	05	CLE3	$e^+e^- \to \pi^+\pi^- J/\psi\gamma$

[11] 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	[12] AUBERT	06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$

[12] 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).

$\Gamma(\gamma\chi_{c1})/\Gamma(\pi^+\pi^- J/\psi(1S))$ — Γ_7/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_8/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	$B \to K\eta J/\psi$

$\Gamma(D^0\overline{D}^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ — Γ_4/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_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	$B \to K D^+D^-$

$\Gamma(D^0\overline{D}^0\pi^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ — 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	$B \to K D^0\overline{D}^0\pi$

X(3872) REFERENCES

ABULENCIA	06B	PRL 96 102002	A. Abulencia *et al.*	(CDF Collab.)
AUBERT	06	PR D73 011101R	B. Aubert *et al.*	(BABAR Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert *et al.*	(BABAR Collab.)
PDG	06	JPG 33 1	W.-M. Yao *et al.*	(PDG Collab.)
AUBERT	05B	PR D71 031501R	B. Aubert *et al.*	(BABAR Collab.)
AUBERT	05D	PR D71 052001	B. Aubert *et al.*	(BABAR Collab.)
AUBERT	05R	PR D71 071103R	B. Aubert *et al.*	(BABAR Collab.)
DOBBS	05	PRL 94 032004	S. Dobbs *et al.*	(CLEO Collab.)
ABAZOV	04F	PRL 93 162002	V.M. Abazov *et al.*	(D0 Collab.)
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AUBERT	04Y	PRL 93 041801	B. Aubert *et al.*	(BaBar Collab.)
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BAI	98E	PR D57 3854	J.Z. Bai *et al.*	(BES Collab.)
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