$X(3872)$

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

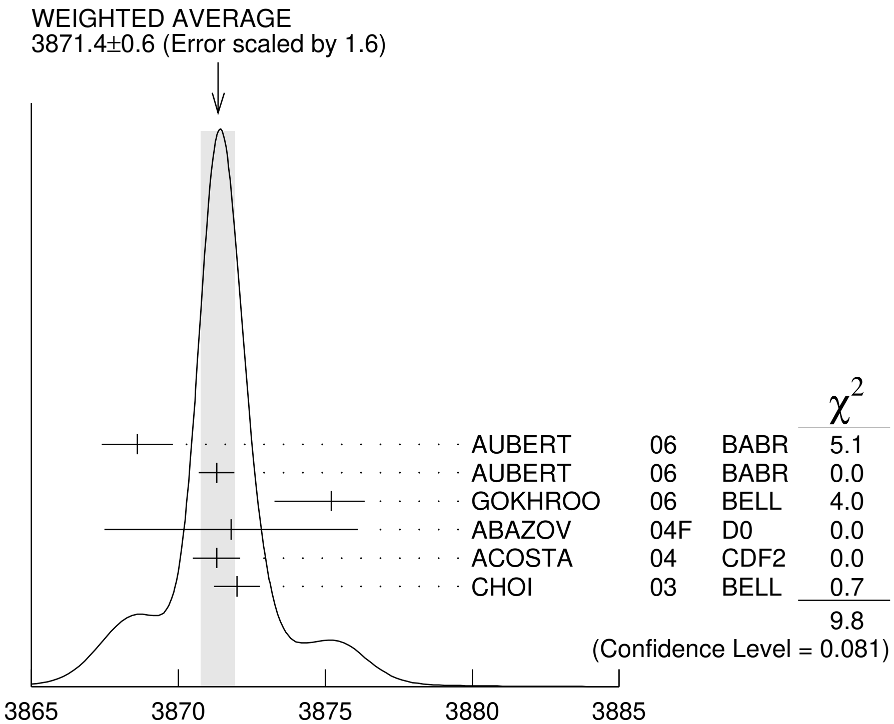
Seen by CHOI 03 in $B \to K\pi^+\pi^- J/\psi(1S)$ decays as a narrow peak in the invariant mass distribution of the $\pi^+\pi^- J/\psi(1S)$ final state, but not seen in the $\gamma\chi_{c1}$ final state of these decays. Possibly absent in the invariant mass spectrum of the final state $\pi^+\pi^- J/\psi(1S)$ 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*
3871.4± 0.6 OUR AVERAGE		Error includes scale factor of 1.6. 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	$B^- \to K^- J/\psi\pi^+\pi^-$
3875.2± $0.7^{+0.9}_{-1.8}$	24 ± 6	GOKHROO	06	BELL	$B \to D^0\overline{D}^0\pi^0 K$
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 Superseded by AUBERT 06.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.



X(3872) MASS (MeV)

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

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	$D^0 \overline{D}{}^0 \pi^0$	seen
Γ_7	$\gamma \chi_{c1}$	
Γ_8	$\eta J/\psi$	
Γ_9	$\gamma J/\psi$	

$X(3872)$ 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	[7] YUAN	04	RVUE	$e^+ e^- \rightarrow \pi^+\pi^- J/\psi$

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

$X(3872)$ $\Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

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

VALUE (eV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$<$ 6.2	90	[8,9] AUBERT	05D	BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+\pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$ 8.3	90	[9] DOBBS	05	CLE3	$e^+ e^- \rightarrow \pi^+\pi^- J/\psi$
<10	90	[10] YUAN	04	RVUE	$e^+ e^- \rightarrow \pi^+\pi^- J/\psi$

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

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

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

$X(3872)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

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

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	$e^+ e^- \rightarrow \pi^+\pi^- J/\psi\gamma$

[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).

$\Gamma(D^0\overline{D}{}^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ — 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
seen	[13] GOKHROO	06	BELL	$B \to D^0\overline{D}{}^0\pi^0 K$

[13] Supersedes CHISTOV 04.

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

$\Gamma(\gamma J/\psi)/\Gamma_{total}$ — Γ_9/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
>0.010	19	[14] AUBERT,BE	06M	BABR	$B^+ \to K^+ J/\psi\gamma$

[14] 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($B^+ \to X(3872)K^+$) $< 3.2 \times 10^{-4}$.

$X(3872)$ REFERENCES

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AUBERT	06	PR D73 011101R	B. Aubert *et al.*	(BABAR Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert *et al.*	(BABAR Collab.)
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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.)
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