NODE=M176

$X(3872)$

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

NODE=M176

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

NODE=M176205

NODE=M176M

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*	
3871.9± 0.7 OUR AVERAGE		Error includes scale factor of 2.3. See the ideogram below.				
$3875.1^{+0.7}_{-0.5}\pm0.5$	33 ± 6	[1] AUBERT	08B	BABR	$B \to \overline{D}^{*0} D^0 K$	
3871.4± 0.6±0.1	93.4	AUBERT	08Y	BABR	$B^+ \to K^+ J/\psi\pi^+\pi^-$	
3868.7± 1.5±0.4	9.4	AUBERT	08Y	BABR	$B^0 \to K^0_S J/\psi\pi^+\pi^-$	OCCUR=2
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	$B^- \to K^- J/\psi\pi^+\pi^-$	OCCUR=2
$3875.2\pm 0.7^{+0.9}_{-1.8}$	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	$300\ \pi^\pm \text{Li} \to J/\psi\pi^+\pi^- X$	

[1] May not necessarily be the same state as that observed in the $J/\psi\pi^+\pi^-$ mode. NODE=M176M;LINKAGE=UB

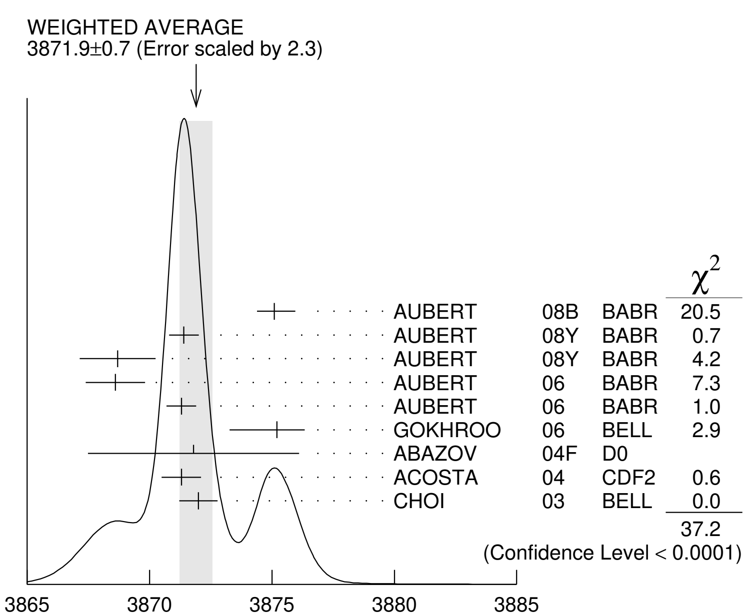
[2] Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV. NODE=M176M;LINKAGE=AE

[3] Calculated from the corresponding $m_{X(3872)} - m_{J/\psi}$ using $m_{J/\psi}$=3096.916 MeV. NODE=M176M;LINKAGE=AB

[4] Width consistent with detector resolution. NODE=M176M;LINKAGE=AC

[5] Calculated from the corresponding $m_{X(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3685.96$MeV. Superseded by AUBERT 06. NODE=M176M;LINKAGE=AU

[6] A lower mass value can be due to an incorrect momentum scale for soft pions. NODE=M176M;LINKAGE=AN



$X(3872)$ MASS (MeV)

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

NODE=M176207

NODE=M176DM

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

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

NODE=M176DM2

NODE=M176DM2

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	$B^+ \to K^+ J/\psi\pi^+\pi^-$

[7] Superseded by AUBERT 06.

NODE=M176DM2;LINKAGE=AU

X(3872) WIDTH

NODE=M176210

NODE=M176W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$3.0^{+1.9}_{-1.4}\pm0.9$		33 ± 6	[8] AUBERT	08B	BABR	$B \to \overline{D}^{*0} D^0 K$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.3	90		AUBERT	08Y	BABR	$B^+ \to K^+ J/\psi\pi^+\pi^-$
<4.1	90	69	AUBERT	06	BABR	$B \to K\pi^+\pi^- J/\psi$
<2.3	90	36	CHOI	03	BELL	$B \to K\pi^+\pi^- J/\psi$

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

NODE=M176W;LINKAGE=UB

X(3872) DECAY MODES

NODE=M176215;NODE=M176

	Mode	Fraction (Γ_i/Γ)	
Γ_1	e^+e^-		DESIG=1
Γ_2	$\pi^+\pi^- J/\psi(1S)$	seen	DESIG=2;OUR EVAL;→ NOT CHECKED ←
Γ_3	$\rho^0 J/\psi(1S)$	seen	DESIG=10;OUR EVAL;→ NOT CHECKED ←
Γ_4	$\gamma\gamma$		DESIG=5
Γ_5	$D^0\overline{D}^0$	not seen	DESIG=6;OUR EVAL;→ NOT CHECKED ←
Γ_6	D^+D^-	not seen	DESIG=7;OUR EVAL;→ NOT CHECKED ←
Γ_7	$D^0\overline{D}^0\pi^0$	seen	DESIG=8;OUR EVAL;→ NOT CHECKED ←
Γ_8	$\gamma\chi_{c1}$		DESIG=3
Γ_9	$\eta J/\psi$		DESIG=4
Γ_{10}	$\gamma J/\psi$		DESIG=9

X(3872) PARTIAL WIDTHS

NODE=M176220

$\Gamma(e^+e^-)$ Γ_1

NODE=M176W1
NODE=M176W1

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).

NODE=M176W1;LINKAGE=A

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

NODE=M176230

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

NODE=M176G1
NODE=M176G1

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.

NODE=M176G1;LINKAGE=AU

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

NODE=M176G1;LINKAGE=DO

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

NODE=M176G1;LINKAGE=A

$X(3872)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(total)$

NODE=M176232

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

NODE=M176H1
NODE=M176H1

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.

NODE=M176H1;LINKAGE=DO

$X(3872)$ BRANCHING RATIOS

NODE=M176235

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

NODE=M176R6
NODE=M176R6

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).

NODE=M176R6;LINKAGE=AU

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

NODE=M176R6;LINKAGE=AV

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

NODE=M176R3
NODE=M176R3

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

NODE=M176R4
NODE=M176R4

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

NODE=M176R5
NODE=M176R5

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.

NODE=M176R5;LINKAGE=GO

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

NODE=M176R1
NODE=M176R1

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

NODE=M176R2
NODE=M176R2

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

NODE=M176R7
NODE=M176R7

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

NODE=M176R7;LINKAGE=AU

$X(3872)$ REFERENCES

NODE=M176

AUBERT	08B	PR D77 011102R	B. Aubert *et al.*	(BABAR Collab.)	REFID=52120
AUBERT	08Y	PR D77 111101R	B. Aubert *et al.*	(BABAR Collab.)	REFID=52265
ABULENCIA	07E	PRL 98 132002	A. Abulencia *et al.*	(CDF Collab.)	REFID=51722
ABULENCIA	06B	PRL 96 102002	A. Abulencia *et al.*	(CDF Collab.)	REFID=51061
AUBERT	06	PR D73 011101R	B. Aubert *et al.*	(BABAR Collab.)	REFID=51017
AUBERT	06E	PRL 96 052002	B. Aubert *et al.*	(BABAR Collab.)	REFID=51059
AUBERT,BE	06M	PR D74 071101R	B. Aubert *et al.*	(BABAR Collab.)	REFID=51454
GOKHROO	06	PRL 97 162002	G. Gokhroo *et al.*	(BELLE Collab.)	REFID=51432
PDG	06	JPG 33 1	W.-M. Yao *et al.*	(PDG Collab.)	REFID=51004
AUBERT	05B	PR D71 031501R	B. Aubert *et al.*	(BABAR Collab.)	REFID=50498
AUBERT	05D	PR D71 052001	B. Aubert *et al.*	(BABAR Collab.)	REFID=50509
AUBERT	05R	PR D71 071103R	B. Aubert *et al.*	(BABAR Collab.)	REFID=50627
DOBBS	05	PRL 94 032004	S. Dobbs *et al.*	(CLEO Collab.)	REFID=50458
ABAZOV	04F	PRL 93 162002	V.M. Abazov *et al.*	(D0 Collab.)	REFID=50200
ACOSTA	04	PRL 93 072001	D. Acosta *et al.*	(CDF Collab.)	REFID=49742
AUBERT	04Y	PRL 93 041801	B. Aubert *et al.*	(BaBar Collab.)	REFID=49997
CHISTOV	04	PRL 93 051803	R. Chistov *et al.*	(BELLE Collab.)	REFID=50002
PDG	04	PL B592 1	S. Eidelman *et al.*		REFID=49653
YUAN	04	PL B579 74	C.Z. Yuan *et al.*		REFID=49677
CHOI	03	PRL 91 262001	S.-K. Choi *et al.*	(BELLE Collab.)	REFID=49628
BAI	98E	PR D57 3854	J.Z. Bai *et al.*	(BES Collab.)	REFID=46339
ANTONIAZZI	94	PR D50 4258	L. Antoniazzi *et al.*	(E705 Collab.)	REFID=44074

OTHER RELATED PAPERS

ALBUQUERQ...	09	NP A815 53	R.M. Albuquerque, M. Nielsen		REFID=52657
GRINSTEIN	09	PL B671 440	B. Grinstein, R. Jora, A.D. Polosa	(UCSD, ROMAI)	REFID=52673
ABLIKIM	08H	PRL 101 102004	M. Ablikim *et al.*	(BES Collab.)	REFID=52254
BRAATEN	08	PR D77 014029	E. Braaten, M. Lu		REFID=52150
BUGG	08	JPG 35 075005	D.V. Bugg		REFID=52272
CHAO	08	PL B661 348	K.-T. Chao		REFID=52203
CHOI	08	PRL 100 142001	S.-K. Choi *et al.*	(BELLE Collab.)	REFID=52178
DING	08	PR D77 014033	G.-J. Ding, J.-J. Zhu, M.-L. Yan		REFID=52151
DONG	08	PR D77 094013	Y. Dong *et al.*		REFID=52278
DUBYNSKIY	08	PR D77 014013	S. Dubynskiy, M.B. Voloshin		REFID=52149
DUBYNSKIY	08A	PL B666 344	S. Dubynskiy, M.B. Voloshin	(MINN, ITEP)	REFID=52279
DUDEK	08	PR D78 094504	J.J. Dudek, E. Rrapaj		REFID=52581
DUNWOODIE	08	PRL 100 062006	W. Dunwoodie, V. Ziegler		REFID=52156
EICHTEN	08	RMP 80 1161	E. Eichten *et al.*		REFID=52670
GUO	08	PL B665 26	F.-K. Guo, C. Hanhart, U.-G. Meissner		REFID=52280
KALASHNIK...	08	PR D77 054025	Yu.S. Kalashnikova, A.V. Nefediev		REFID=52202
LEE	08	PL B661 28	S.H. Lee *et al.*		REFID=52165
LEE	08B	PR D78 076001	S.H. Lee, K. Morita, M. Nielsen		REFID=52589
LI	08	PR D77 054001	Y. Li, C.-D. Lu, W. Wang		REFID=52179
LIU	08A	PR D77 034003	X. Liu *et al.*		REFID=52155
LIU	08D	PR D77 094015	X. Liu *et al.*		REFID=52292
LIU	08G	EPJ C56 63	Y.-R. Liu *et al.*		REFID=52295
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
MAIANI	08	NJP 10 073004	L. Maiani, A.D. Polosa, V. Riquer		REFID=52297
MENG	08	PR D77 074003	C. Meng, K.-T Chao		REFID=52298
MIZUK	08	PR D78 072004	R. Mizuk *et al.*	(BELLE Collab.)	REFID=52535
PAKHLOVA	08B	PRL 101 172001	C. Pakhlova *et al.*	(BELLE Collab.)	REFID=52596
SIMONOV	08	PAN 71 1048	Yu.A. Simonov		REFID=52306
		Translated from YAF 71 1074.			
THOMAS	08	PR D78 034007	C.E. Thomas, F.E. Close	(OXFTP)	REFID=52308
YUAN	08	PR D77 011105R	C.Z. Yuan *et al.*	(BELLE Collab.)	REFID=52135
BRAATEN	07	PR D76 054010	E. Braaten *et al.*		REFID=51947
BRAATEN	07A	PR D76 094028	E. Braaten, M. Lu		REFID=52051
CHIU	07	PL B646 95	T.-W. Chiu, T.-H. Hsieh		REFID=51639
COLANGELO	07	PL B650 166	P. Colangelo *et al.*		REFID=51707
FLEMING	07	PR D76 034006	S. Fleming *et al.*		REFID=51895
GAMERMANN	07	EPJ A33 119	D. Gamermann, E. Oset		REFID=51896
HANHART	07A	PR D76 034007	C. Hanhart *et al.*		REFID=51899
KONG	07	PL B657 192	Y. Kong, A. Zhang		REFID=52062
MAIANI	07B	PRL 99 182003	L. Maiani, A. Polosa		REFID=51954
MATHEUS	07	PR D75 014005	R. Matheus *et al.*		REFID=51626
MATHEUS	07A	PR D76 056005	R.D. Matheus		REFID=51955
MENG	07	PR D75 114002	C. Meng, K.-T. Chao		REFID=51720
ROSNER	07	PR D76 114002	J. Rosner		REFID=52077
VIJANDE	07	PR D76 094022	J. Vijande *et al.*		REFID=52054
VOLOSHIN	07	PR D76 014007	M.B. Voloshin		REFID=51905
ABD-EL-HADY	06	PR D73 073010	A. Abd-El-Hady		REFID=51124
ALFIKY	06	PL B640 238	M. AlFiky, F. Gabbiani, A.A. Petrov	(WAYN)	REFID=51135
BRAATEN	06	PR D73 011501	E. Braaten		REFID=51025
BRIERE	06	PR D74 031106R	R.A. Briere *et al.*	(CLEO Collab.)	REFID=51149
COAN	06A	PRL 96 182002	T.E. Coan *et al.*	(CLEO Collab.)	REFID=51155
DUBYNSKIY	06	PR D74 094017	S. Dubynskiy, M. Voloshin		REFID=51520
EICHTEN	06	PR D73 014014	E.J. Eichten, K. Lane, C. Quigg		REFID=51027
HOGAASEN	06	PR D73 054013	H. Hogaasen *et al.*		REFID=51167
HOU	06	PR D74 017504	W.-S. Hou		REFID=51168
KARLINER	06	PL B638 221	M. Karliner, H.J. Lipkin		REFID=51172
NAVARRA	06	PL B639 272	F.S. Navarra, M. Nielsen		REFID=51181
ROSNER	06C	PR D74 076006	J.L. Rosner		REFID=51471
SWANSON	06	PRPL 429 243	E.S. Swanson	(PITT)	REFID=51188
VOLOSHIN	06	IJMP A21 1239	M. Voloshin		REFID=51193
YUAN	06	PL B634 399	C.Z. Yuan, P. Wang, X.H. Mo		REFID=51044
BIGI	05	PR D72 114016	I. Bigi *et al.*		REFID=50994
BRAATEN	05	PR D72 014012	E. Braaten, M. Kusunoki		REFID=50782
BRAATEN	05A	PR D72 054022	E. Braaten, M. Kusunoki		REFID=50783
BRAATEN	05B	PR D71 074005	E. Braaten, M. Kusunoki		REFID=51040
BUGG	05	PR D71 016006	D. Bugg		REFID=50457
KALASHNIK...	05A	PR D72 034010	Yu.S. Kalashnikova		REFID=50798
KIM	05	PR D71 034025	T. Kim, P. Ko		REFID=50499
LI	05	PL B605 306	B.A. Li		REFID=50339
MAIANI	05	PR D71 014028	L. Maiani *et al.*		REFID=50460
SETH	05	PL B612 1	K.K. Seth		REFID=50814
SUZUKI	05	PR D72 114013	M. Suzuki		REFID=51002
BARNES	04	PR D69 054008	T. Barnes, S. Godfrey		REFID=49756
BRAATEN	04	PR D69 074005	E. Braaten *et al.*		REFID=49760
BRAATEN	04A	PR D69 114012	E. Braaten, M. Kusunoki		REFID=49761
BRAATEN	04B	PRL 93 162001	E. Braaten, M. Kusunoki, S. Nussinov		REFID=50199
BUGG	04B	PL B598 8	D.V. Bugg		REFID=50169
CLOSE	04	PL B578 119	F.E. Close, P.R. Page		REFID=49673
EICHTEN	04	PR D69 094019	E. Eichten, K. Lane, C. Quigg		REFID=49767
PAKVASA	04	PL B579 67	S. Pakvasa, M. Suzuki		REFID=49674
ROSNER	04	PR D70 094023	J.L. Rosner		REFID=50495
SWANSON	04A	PL B588 189	E. Swanson		REFID=49781
SWANSON	04B	PL B598 197	E. Swanson		REFID=50168
TORNQVIST	04	PL B590 209	N. Tornqvist		REFID=49782
VOLOSHIN	04	PL B579 316	M.B. Voloshin		REFID=49676
VOLOSHIN	04A	PL B604 69	M.B. Voloshin		REFID=50205
WONG	04	PR C69 055202	C. Wong		REFID=50177
BAI	98E	PR D57 3854	J.Z. Bai *et al.*	(BES Collab.)	REFID=46339