$f_J(2220)$

$I^G(J^{PC}) = 0^+(2^{++} \text{ or } 4^{++})$

OMITTED FROM SUMMARY TABLE
A REVIEW GOES HERE – Check our WWW List of Reviews

$f_J(2220)$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2231.1± 3.5 OUR AVERAGE					
2235 ± 4 ± 6	74	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma\pi^+\pi^-$
$2230\ ^{+\ 6}_{-\ 7} \pm 16$	46	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma K^+K^-$
$2232\ ^{+\ 8}_{-\ 7} \pm 15$	23	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma K^0_S K^0_S$
2235 ± 4 ± 5	32	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma p\overline{p}$
$2209\ ^{+17}_{-15} \pm 10$		ASTON	88F	LASS	11 $K^-p \to K^+K^-\Lambda$
2230 ±20		BOLONKIN	88	SPEC	40 $\pi^-p \to K^0_S K^0_S n$
2220 ±10	41	[1] ALDE	86B	GA24	38–100 $\pi p \to n\eta\eta'$
2230 ± 6 ±14	93	BALTRUSAIT..86D		MRK3	$e^+e^- \to \gamma K^+K^-$
2232 ± 7 ± 7	23	BALTRUSAIT..86D		MRK3	$e^+e^- \to \gamma K^0_S K^0_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2246 ±36		BAI	98H	BES	$J/\psi \to \gamma\pi^0\pi^0$

[1] ALDE 86B uses data from both the GAMS-2000 and GAMS-4000 detectors.

$f_J(2220)$ WIDTH

VALUE (MeV)	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$23^+_-\ ^{8}_{7}$ OUR AVERAGE						
$19^+_-\ ^{13}_{11} \pm 12$		74	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma\pi^+\pi^-$
$20^+_-\ ^{20}_{15} \pm 17$		46	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma K^+K^-$
$20^+_-\ ^{25}_{16} \pm 14$		23	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma K^0_S K^0_S$
$15^+_-\ ^{12}_{9} \pm 9$		32	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma p\overline{p}$
$60^{+107}_{-\ 57}$			ASTON	88F	LASS	11 $K^-p \to K^+K^-\Lambda$
80± 30			BOLONKIN	88	SPEC	40 $\pi^-p \to K^0_S K^0_S n$
$26^+_-\ ^{20}_{16} \pm 17$		93	BALTRUSAIT..86D		MRK3	$e^+e^- \to \gamma K^+K^-$
$18^+_-\ ^{23}_{15} \pm 10$		23	BALTRUSAIT..86D		MRK3	$e^+e^- \to \gamma K^0_S K^0_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<80	90		ALDE	87C	GAM2	38 $\pi^-p \to \eta'\eta n$

$f_J(2220)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\pi\pi$	seen
Γ_2	$\pi^+\pi^-$	seen
Γ_3	$K\overline{K}$	seen
Γ_4	$p\overline{p}$	seen
Γ_5	$\gamma\gamma$	not seen
Γ_6	$\eta\eta'(958)$	seen
Γ_7	$\phi\phi$	not seen
Γ_8	$\eta\eta$	not seen

$f_J(2220)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(total)$

$\Gamma(K\overline{K}) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_3\Gamma_5/\Gamma$

VALUE (eV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$<$ 1.4	95	[2] ACCIARRI	01H	L3	$\gamma\gamma \to K^0_S K^0_S$, E^{ee}_{cm}= 91, 183–209 GeV
< 5.6	95	[2] GODANG	97	CLE2	$\gamma\gamma \to K^0_S K^0_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$ 86	95	[2] ALBRECHT	90G	ARG	$\gamma\gamma \to K^+K^-$
$<$1000	95	[3] ALTHOFF	85B	TASS	$\gamma\gamma$, $K\overline{K}\pi$

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{total}$ $\Gamma_1\Gamma_5/\Gamma$

VALUE (eV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<2.5	95	ALAM	98C	CLE2	$\gamma\gamma \to \pi^+\pi^-$

[2] Assuming $J^P = 2^+$.
[3] True for $J^P = 0^+$ and $J^P = 2^+$.

$f_J(2220)$ $\Gamma(i)\Gamma(p\overline{p})/\Gamma^2(total)$

$\Gamma(p\overline{p}) \times \Gamma(\pi\pi)/\Gamma^2_{total}$ $\Gamma_4\Gamma_1/\Gamma^2$

VALUE (units 10^{-5})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<18	95	[4] AMSLER	01	CBAR	1.4–1.5 $p\overline{p} \to \pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$(11–42)	99	[5] HASAN	96	SPEC	1.35–1.55 $p\overline{p} \to \pi^+\pi^-$

$\Gamma(p\overline{p}) \times \Gamma(\phi\phi)/\Gamma^2_{total}$ $\Gamma_4\Gamma_7/\Gamma^2$

VALUE (units 10^{-5})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<6	95	[6] EVANGELISTA	98	SPEC	1.1-2.0 $p\overline{p} \to \phi\phi$

$\Gamma(p\overline{p}) \times \Gamma(\eta\eta)/\Gamma^2_{\text{total}}$ $\Gamma_4\Gamma_8/\Gamma^2$

VALUE (units 10^{-5})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<4	95	[4] AMSLER	01	CBAR	1.4–1.5 $p\overline{p} \rightarrow \eta\eta$

[4] For $J^P = 2^+$ in the mass range 2222–2240 MeV and the total width between 10 and 20 MeV.
[5] For $J^P = 2^+$ and $J^P = 4^+$ in the mass range 2220–2245 MeV and the total width of 15 MeV.
[6] For $J^P = 2^+$, the mass of 2235 MeV and the total width of 15 MeV.

$f_J(2220)$ BRANCHING RATIOS

$\Gamma(p\overline{p})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.0	95	[8] EVANGELISTA	97	SPEC	1.96-2.40 $\overline{p}p \rightarrow K^0_S K^0_S$
<1.1	99.7	[7] BARNES	93	SPEC	1.3-1.57 $\overline{p}p \rightarrow K^0_S K^0_S$
<2.6	99.7	[7] BARDIN	87	CNTR	1.3-1.5 $\overline{p}p \rightarrow K^+K^-$
<3.6	99.7	[7] SCULLI	87	CNTR	1.29-1.55 $\overline{p}p \rightarrow K^+K^-$

[7] Assuming Γ = 30-35 MeV, $J^P = 2^+$ and B($f_J(2220) \rightarrow K\overline{K}$) = 100%.

$\Gamma(\pi\pi)/\Gamma(K\overline{K})$ Γ_1/Γ_3

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
1.0±0.5	BAI	96B	BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma 2\pi, K\overline{K}$

$\Gamma(p\overline{p})/\Gamma(K\overline{K})$ Γ_4/Γ_3

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.17±0.09	BAI	96B	BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\overline{p}, K\overline{K}$

[8] Assuming $\Gamma \sim$ 20 MeV, $J^P = 2^+$ and B($f_J(2220) \rightarrow K\overline{K}$) = 100%.

$f_J(2220)$ REFERENCES

ACCIARRI	01H	PL B501 173	M. Acciarri *et al.*	(L3 Collab.)
AMSLER	01	PL B520 175	C. Amsler *et al.*	(Crystal Barrel Collab.)
ALAM	98C	PRL 81 3328	M.S. Alam *et al.*	(CLEO Collab.)
BAI	98H	PRL 81 1179	J.Z. Bai *et al.*	(BES Collab.)
EVANGELISTA	98	PR D57 5370	C. Evangelista *et al.*	(JETSET Collab.)
EVANGELISTA	97	PR D56 3803	C. Evangelista *et al.*	(LEAR Collab.)
GODANG	97	PRL 79 3829	R. Godang *et al.*	(CLEO Collab.)
BAI	96B	PRL 76 3502	J.Z. Bai *et al.*	(BES Collab.)
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)
BARNES	93	PL B309 469	P.D. Barnes, P. Birien, W.H. Breunlich	
ALBRECHT	90G	ZPHY C48 183	H. Albrecht *et al.*	(ARGUS Collab.)
ASTON	88F	PL B215 199	D. Aston *et al.*	(SLAC, NAGO, CINC, INUS) JP
BOLONKIN	88	NP B309 426	B.V. Bolonkin *et al.*	(ITEP, SERP)
ALDE	87C	SJNP 45 255	D. Alde *et al.*	
		Translated from YAF 45 405.		
BARDIN	87	PL B195 292	G. Bardin *et al.*	(SACL, FERR, CERN, PADO+)
SCULLI	87	PRL 58 1715	J. Sculli *et al.*	(NYU, BNL)
ALDE	86B	PL B177 120	D.M. Alde *et al.*	(SERP, BELG, LANL, LAPP)
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)
ALTHOFF	85B	ZPHY C29 189	M. Althoff *et al.*	(TASSO Collab.)

OTHER RELATED PAPERS

CHUA	02	PL B544 139	C.-K. Chua, W.-S. Hou, S.U. Tsai	
LIU	02	PL B529 65	L.C. Liu	
LIU	00A	JPG 26 L59	L.C. Liu, W.H. Ma	
WANG	00A	PR D62 017503	Z. Wang	
ANISOVICH	99D	PL B452 180	A.V. Anisovich *et al.*	
Also	99F	NP A651 253	A.V. Anisovich *et al.*	
ANISOVICH	99F	NP A651 253	A.V. Anisovich *et al.*	
GODFREY	99	RMP 71 1411	S. Godfrey, J. Napolitano	
PROKOSHKIN	99	PAN 62 356	Yu.D. Prokoshkin	
		Translated from YAF 62 396.		
HUANG	96	PL B380 189	T. Huang *et al.*	(BHEP, BEIJ)
BARDIN	87	PL B195 292	G. Bardin *et al.*	(SACL, FERR, CERN, PADO+)
YAOUANC	85	ZPHY C28 309	A. Le Yaouanc *et al.*	(ORSAY, TOKY)
GODFREY	84	PL 141B 439	S. Godfrey, R. Kokoski, N. Isgur	(TNTO)
SHATZ	84	PL 138B 209	M.P. Shatz	(CIT)
WILLEY	84	PRL 52 585	R.S. Willey	(PITT)
EISENHAND...	75	NP B96 109	E. Eisenhandler *et al.*	(LOQM, LIVP, DARE+)