$f_J(2220)$

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

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$f_J(2220)$ 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 $^{+6}_{-7}$ ±16	46	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma K^+K^-$
2232 $^{+8}_{-7}$ ±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 $^{+17}_{-15}$ ±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 $^{+13}_{-11}$ ±12		74	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma\pi^+\pi^-$
20 $^{+20}_{-15}$ ±17		46	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma K^+K^-$
20 $^{+25}_{-16}$ ±14		23	BAI	96B	BES	$e^+e^- \to J/\psi \to \gamma K^0_S K^0_S$
15 $^{+12}_{-9}$ ± 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 $^{+20}_{-16}$ ±17		93	BALTRUSAIT...	86D	MRK3	$e^+e^- \to \gamma K^+K^-$
18 $^{+23}_{-15}$ ±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

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

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

VALUE (eV)	CL%	DOCUMENT ID		TECN	COMMENT
< 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	$\gamma\gamma$, $K\overline{K}\pi$

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

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

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

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

$\Gamma(p\overline{p}) \times \Gamma(\pi^+\pi^-)/\Gamma_{total}$ — $\Gamma_4\Gamma_2/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID		TECN	COMMENT
<3.9	99	[4] HASAN	96	SPEC	$\overline{p}p \to \pi^-\pi^+$

[4] Assuming Γ = 15 MeV and $J^P = 2^+$

$\Gamma(p\overline{p}) \times \Gamma(\phi\phi)/\Gamma_{total}$ — $\Gamma_4\Gamma_7/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID		TECN	COMMENT
<0.9	95	[5] EVANGELISTA	98	SPEC	1.1-2.0 $p\overline{p} \to \phi\phi$

[5] Assuming $J^P = 2^+$, M=2235 MeV and Γ_{total} = 15 MeV.

$f_J(2220)$ BRANCHING RATIOS

$\Gamma(p\overline{p})/\Gamma_{total}$ — 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	[6] 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 $\overline{p}p \rightarrow K^+ K^-$	

[6] Assuming $\Gamma \sim 20$ MeV, $J^P = 2^+$ and B($f_J(2220) \rightarrow K\overline{K}$) = 100%.
[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	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\overline{p}, K\overline{K}$

$f_J(2220)$ REFERENCES

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BAI	98H	PRL 81 1179	J.Z. Bai *et al.*	(BES Collab.)
EVANGELISTA	98	PR D57 5370	C. Evangelista *et al.*	(JETSET Collab.)
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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.)
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