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$f_1(1420)$

$I^G(J^{PC}) = 0^+(1^{++})$

See the minireview under $\eta(1405)$.

$f_1(1420)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1426.3 ± 0.9 OUR AVERAGE		Error includes scale factor of 1.1.			
1426 ± 6	711	ABDALLAH	03H	DLPH	91.2 $e^+e^- \to K^0_S K^\pm \pi^\mp + X$
1420 ± 14	3651	NICHITIU	02	OBLX	
1428 ± 4 ± 2	20k	ADAMS	01B	E852	18 GeV $\pi^- p \to K^+ K^- \pi^0 n$
1426 ± 1		BARBERIS	97C	OMEG	450 $pp \to p p K^0_S K^\pm \pi^\mp$
1425 ± 8		BERTIN	97	OBLX	0.0 $\overline{p}p \to K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1435 ± 9		PROKOSHKIN	97B	GAM4	100 $\pi^- p \to \eta \pi^0 \pi^0 n$
1430 ± 4		[1] ARMSTRONG	92E	OMEG	85,300 $\pi^+ p$, $pp \to \pi^+ p$, $pp(K\overline{K}\pi)$
1462 ± 20		[2] AUGUSTIN	92	DM2	$J/\psi \to \gamma K \overline{K} \pi$
$1443 {}^{+7}_{-6} {}^{+3}_{-2}$	1100	BAI	90C	MRK3	$J/\psi \to \gamma K^0_S K^\pm \pi^\mp$
1425 ± 10	17	BEHREND	89	CELL	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$
$1442 \pm 5 {}^{+10}_{-17}$	111	BECKER	87	MRK3	e^+e^-, $\omega K \overline{K} \pi$
1423 ± 4		GIDAL	87B	MRK2	$e^+e^- \to e^+e^- K\overline{K}\pi$
1417 ± 13	13	AIHARA	86C	TPC	$e^+e^- \to e^+e^- K\overline{K}\pi$
1422 ± 3		CHAUVAT	84	SPEC	ISR 31.5 pp
1440 ± 10		[3] BROMBERG	80	SPEC	100 $\pi^- p \to K\overline{K}\pi X$
1426 ± 6	221	DIONISI	80	HBC	4 $\pi^- p \to K\overline{K}\pi n$
1420 ± 20		DAHL	67	HBC	1.6–4.2 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1430.8 ± 0.9		[4] SOSA	99	SPEC	$pp \to p_{slow} (K^0_S K^+ \pi^-) p_{fast}$
1433.4 ± 0.8		[4] SOSA	99	SPEC	$pp \to p_{slow} (K^0_S K^- \pi^+) p_{fast}$
1429 ± 3	389	ARMSTRONG	89	OMEG	300 $pp \to K\overline{K}\pi pp$
1425 ± 2	1520	ARMSTRONG	84	OMEG	85 $\pi^+ p$, $pp \to (\pi^+, p)(K\overline{K}\pi)p$
∼ 1420		BITYUKOV	84	SPEC	32 $K^- p \to K^+ K^- \pi^0 Y$

[1] This result supersedes ARMSTRONG 84, ARMSTRONG 89.

[2] From fit to the $K^*(892) K$ 1^{++} partial wave.

[3] Mass error increased to account for $a_0(980)$ mass cut uncertainties.

[4] No systematic error given.

f_1(1420) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
54.9± 2.6 OUR AVERAGE					
51 ±14	711	ABDALLAH	03H	DLPH	91.2 $e^+e^- \rightarrow K^0_S K^\pm \pi^\mp + X$
61 ± 8	3651	NICHITIU	02	OBLX	
38 ± 9 ±6	20k	ADAMS	01B	E852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
58 ± 4		BARBERIS	97C	OMEG	450 $pp \rightarrow pp K^0_S K^\pm \pi^\mp$
45 ±10		BERTIN	97	OBLX	0.0 $\overline{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
90 ±25		PROKOSHKIN	97B	GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
58 ±10		[5] ARMSTRONG	92E	OMEG	85,300 $\pi^+ p$, $pp \rightarrow \pi^+ p$, $pp(K\overline{K}\pi)$
129 ±41		[6] AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \overline{K} \pi$
68 $^{+29}_{-18}$ $^{+8}_{-9}$	1100	BAI	90C	MRK3	$J/\psi \rightarrow \gamma K^0_S K^\pm \pi^\mp$
42 ±22	17	BEHREND	89	CELL	$\gamma\gamma \rightarrow K^0_S K^\pm \pi^\mp$
40 $^{+17}_{-13}$ ±5	111	BECKER	87	MRK3	$e^+e^- \rightarrow \omega K \overline{K} \pi$
35 $^{+47}_{-20}$	13	AIHARA	86C	TPC	$e^+e^- \rightarrow e^+e^- K \overline{K} \pi$
47 ±10		CHAUVAT	84	SPEC	ISR 31.5 pp
62 ±14		BROMBERG	80	SPEC	100 $\pi^- p \rightarrow K \overline{K} \pi X$
40 ±15	221	DIONISI	80	HBC	4 $\pi^- p \rightarrow K \overline{K} \pi n$
60 ±20		DAHL	67	HBC	1.6–4.2 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
68.7± 2.9		[7] SOSA	99	SPEC	$pp \rightarrow p_{slow} (K^0_S K^+ \pi^-) p_{fast}$
58.8± 3.3		[7] SOSA	99	SPEC	$pp \rightarrow p_{slow} (K^0_S K^- \pi^+) p_{fast}$
58 ± 8	389	ARMSTRONG	89	OMEG	300 $pp \rightarrow K \overline{K} \pi pp$
62 ± 5	1520	ARMSTRONG	84	OMEG	85 $\pi^+ p$, $pp \rightarrow (\pi^+, p)(K \overline{K} \pi) p$
∼ 50		BITYUKOV	84	SPEC	32 $K^- p \rightarrow K^+ K^- \pi^0 Y$

[5] This result supersedes ARMSTRONG 84, ARMSTRONG 89.
[6] From fit to the $K^*(892) K$ 1^{++} partial wave.
[7] No systematic error given.

f_1(1420) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$K \overline{K} \pi$	dominant
Γ_2	$K \overline{K}^*(892)+$ c.c.	dominant
Γ_3	$\eta \pi \pi$	possibly seen
Γ_4	$a_0(980) \pi$	

Γ_5	$\pi\pi\rho$	
Γ_6	4π	
Γ_7	$\rho^0\gamma$	
Γ_8	$\phi\gamma$	seen

$f_1(1420)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\overline{K}\pi) \times \Gamma(\gamma\gamma^*)/\Gamma_{total}$

VALUE (keV)	CL%	DOCUMENT ID		TECN	COMMENT
1.7±0.4 OUR AVERAGE					
3.0±0.9±0.7		[8,9] BEHREND	89	CELL	$e^+e^- \rightarrow e^+e^- K^0_S K\pi$
$2.3^{+1.0}_{-0.9}\pm0.8$		HILL	89	JADE	$e^+e^- \rightarrow e^+e^- K^\pm K^0_S \pi^\mp$
1.3±0.5±0.3		AIHARA	88B	TPC	$e^+e^- \rightarrow e^+e^- K^\pm K^0_S \pi^\mp$
1.6±0.7±0.3		[8,10] GIDAL	87B	MRK2	$e^+e^- \rightarrow e^+e^- K\overline{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.0	95	JENNI	83	MRK2	$e^+e^- \rightarrow e^+e^- K\overline{K}\pi$

[8] Assume a ρ-pole form factor.
[9] A ϕ - pole form factor gives considerably smaller widths.
[10] Published value divided by 2.

$f_1(1420)$ BRANCHING RATIOS

$\Gamma(K\overline{K}^*(892)+\text{c.c.})/\Gamma(K\overline{K}\pi)$ — Γ_2/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.76±0.06	BROMBERG	80	SPEC	$100\ \pi^- p \rightarrow K\overline{K}\pi X$
0.86±0.12	DIONISI	80	HBC	$4\ \pi^- p \rightarrow K\overline{K}\pi n$

$\Gamma(\pi\pi\rho)/\Gamma(K\overline{K}\pi)$ — Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.3	95	CORDEN	78	OMEG	12–15 $\pi^- p$
<2.0		DAHL	67	HBC	1.6–4.2 $\pi^- p$

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.1	95	ARMSTRONG	91B	OMEG	$300\ pp \rightarrow pp\eta\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.35±0.75		KOPKE	89	MRK3	$J/\psi \rightarrow \omega\eta\pi\pi(K\overline{K}\pi)$
<0.6	90	GIDAL	87	MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
<0.5	95	CORDEN	78	OMEG	12–15 $\pi^- p$
1.5 ±0.8		DEFOIX	72	HBC	$0.7\ \overline{p}p$

$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$ — Γ_4/Γ_3

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
>0.1	90	PROKOSHKIN	97B	GAM4	100 $\pi^- p \rightarrow \eta\pi^0\pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen in either mode		ANDO	86	SPEC	8 $\pi^- p$
not seen in either mode		CORDEN	78	OMEG	12–15 $\pi^- p$
0.4±0.2		DEFOIX	72	HBC	0.7 $\overline{p}p \rightarrow 7\pi$

$\Gamma(4\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_6/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.90	95	DIONISI	80	HBC	4 $\pi^- p$

$\Gamma(K\overline{K}\pi)/[\Gamma(K\overline{K}^*(892)+\text{c.c.})+\Gamma(a_0(980)\pi)]$ — $\Gamma_1/(\Gamma_2+\Gamma_4)$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65±0.27	[11] DIONISI	80	HBC	4 $\pi^- p$

[11] Calculated using $\Gamma(K\overline{K})/\Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.

$\Gamma(a_0(980)\pi)/\Gamma(K\overline{K}^*(892)+\text{c.c.})$ — Γ_4/Γ_2

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
0.04 ±0.01 ±0.01		BARBERIS	98C	OMEG	450 $pp \rightarrow p_f f_1(1420) p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.04	68	ARMSTRONG	84	OMEG	85 $\pi^+ p$

$\Gamma(4\pi)/\Gamma(K\overline{K}\pi)$ — Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.62	95	ARMSTRONG	89G	OMEG	85 $\pi p \rightarrow 4\pi X$

$\Gamma(\rho^0\gamma)/\Gamma_{total}$ — Γ_7/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.08	95	[12] ARMSTRONG	92C	SPEC	300 $pp \rightarrow pp\pi^+\pi^-\gamma$

[12] Using the data on the $\overline{K}K\pi$ mode from ARMSTRONG 89.

$\Gamma(\rho^0\gamma)/\Gamma(K\overline{K}\pi)$ — Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.02	95	BARBERIS	98C	OMEG	450 $pp \rightarrow p_f f_1(1420) p_s$

$\Gamma(\phi\gamma)/\Gamma(K\overline{K}\pi)$ — Γ_8/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.003 ±0.001 ±0.001	BARBERIS	98C	OMEG	450 $pp \rightarrow p_f f_1(1420) p_s$

$f_1(1420)$ REFERENCES

ABDALLAH	03H	PL B569 129	J. Abdallah *et al.*	(DELPHI Collab.)	
NICHITIU	02	PL B545 261	F. Nichitiu *et al.*	(OBELIX Collab.)	
ADAMS	01B	PL B516 264	G.S. Adams *et al.*	(BNL E852 Collab.)	
SOSA	99	PRL 83 913	M. Sosa *et al.*		
BARBERIS	98C	PL B440 225	D. Barberis *et al.*	(WA 102 Collab.)	
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BERTIN	97	PL B400 226	A. Bertin *et al.*	(OBELIX Collab.)	
PROKOSHKIN	97B	SPD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky		
		Translated from DANS 354 751.			
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	
ARMSTRONG	92E	ZPHY C56 29	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	JPC
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	
BAI	90C	PRL 65 2507	Z. Bai *et al.*	(Mark III Collab.)	
ARMSTRONG	89	PL B221 216	T.A. Armstrong *et al.*	(CERN, CDEF, BIRM+)	JPC
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong *et al.*	(CERN, BIRM, BARI+)	
BEHREND	89	ZPHY C42 367	H.J. Behrend *et al.*	(CELLO Collab.)	
HILL	89	ZPHY C42 355	P. Hill *et al.*	(JADE Collab.)	JP
KOPKE	89	PRPL 174 67	L. Kopke *et al.*	(CERN)	
AIHARA	88B	PL B209 107	H. Aihara *et al.*	(TPC-2γ Collab.)	
BECKER	87	PRL 59 186	J.J. Becker *et al.*	(Mark III Collab.)	JP
GIDAL	87	PRL 59 2012	G. Gidal *et al.*	(LBL, SLAC, HARV)	
GIDAL	87B	PRL 59 2016	G. Gidal *et al.*	(LBL, SLAC, HARV)	
AIHARA	86C	PRL 57 2500	H. Aihara *et al.*	(TPC-2γ Collab.)	JP
ANDO	86	PRL 57 1296	A. Ando *et al.*	(KEK, KYOT, NIRS, SAGA+)	
ARMSTRONG	84	PL 146B 273	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	JP
BITYUKOV	84	SJNP 39 735	S. Bityukov *et al.*	(SERP)	
		Translated from YAF 39 1165.			
CHAUVAT	84	PL 148B 382	P. Chauvat *et al.*	(CERN, CLER, UCLA+)	
JENNI	83	PR D27 1031	P. Jenni *et al.*	(SLAC, LBL)	
BROMBERG	80	PR D22 1513	C.M. Bromberg *et al.*	(CIT, FNAL, ILLC+)	
DIONISI	80	NP B169 1	C. Dionisi *et al.*	(CERN, MADR, CDEF+)	IJP
CORDEN	78	NP B144 253	M.J. Corden *et al.*	(BIRM, RHEL, TELA+)	
DEFOIX	72	NP B44 125	C. Defoix *et al.*	(CDEF, CERN)	
DAHL	67	PR 163 1377	O.I. Dahl *et al.*	(LRL)	IJP
Also	65	PRL 14 1074	D.H. Miller *et al.*	(LRL, UCB)	

OTHER RELATED PAPERS

PROKOSHKIN	99	PAN 62 356	Yu.D. Prokoshkin		
		Translated from YAF 62 396.			
IIZUKA	91	PTP 86 885	J. Iizuka, H. Koibuchi	(NAGO)	
ISHIDA	89	PTP 82 119	S. Ishida *et al.*	(NIHO)	
AIHARA	88C	PR D38 1	H. Aihara *et al.*	(TPC-2γ Collab.)	JPC
BITYUKOV	88	PL B203 327	S.I. Bityukov *et al.*	(SERP)	
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