

$f_1(1420)$

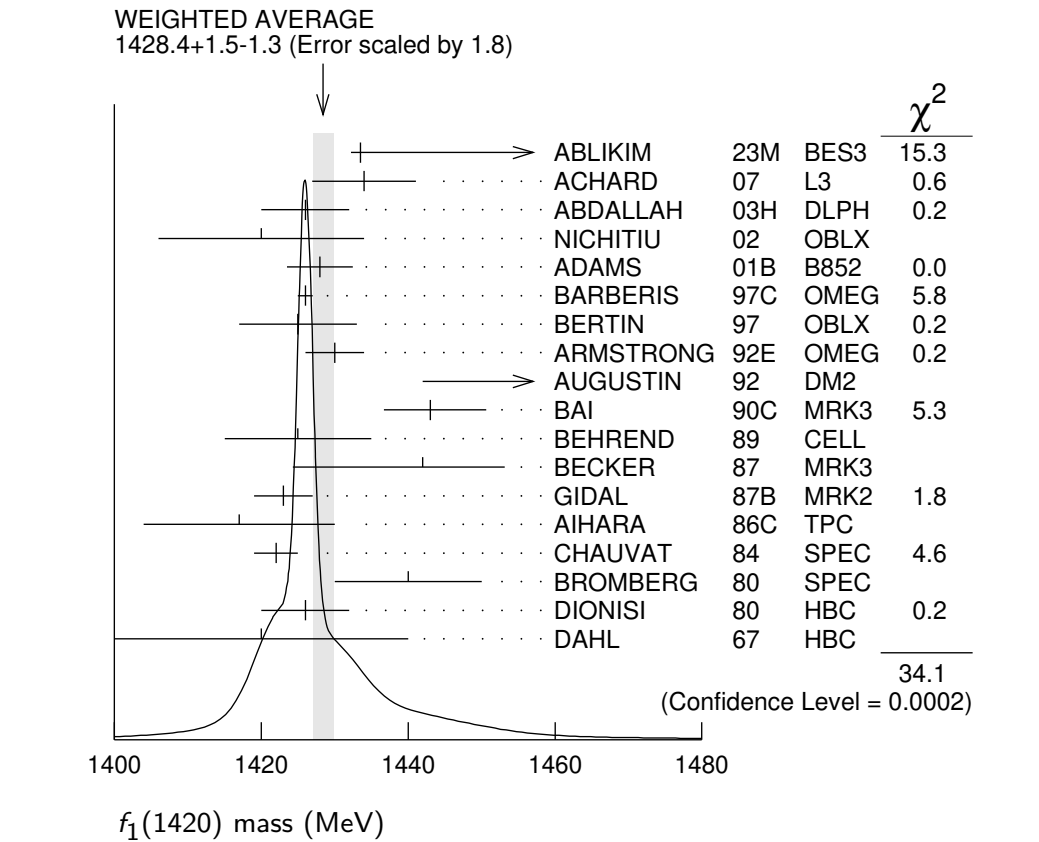
$$I^G(J^{PC}) = 0^+(1^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

 $f_1(1420)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1428.4^{+1.5}_{-1.3}$ OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
$1433.5 \pm 1.1^{+27.9}_{-0.7}$	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
$1434 \pm 5 \pm 5$	133	¹ ACHARD	07 L3	$183\text{--}209 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
1426 ± 6	711	ABDALLAH	03H DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1420 ± 14	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
$1428 \pm 4 \pm 2$	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1426 ± 1		BARBERIS	97C OMEG	$450 p p \rightarrow p p K_S^0 K^\pm \pi^\mp$
1425 ± 8		BERTIN	97 OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1430 ± 4		² ARMSTRONG	92E OMEG	$85,300 \pi^+ p, p p \rightarrow \pi^+ p, p p (K \bar{K} \pi)$
1462 ± 20		³ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
$1443^{+7}_{-6} {}^{+3}_{-2}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 10	17	BEHREND	89 CELL	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
$1442 \pm 5 {}^{+10}_{-17}$	111	BECKER	87 MRK3	$e^+ e^-, \omega K \bar{K} \pi$
1423 ± 4		GIDAL	87B MRK2	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
1417 ± 13	13	AIHARA	86C TPC	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
1422 ± 3		CHAUVAT	84 SPEC	ISR 31.5 $p p$
1440 ± 10		⁴ BROMBERG	80 SPEC	$100 \pi^- p \rightarrow K \bar{K} \pi X$
1426 ± 6	221	DIONISI	80 HBC	$4 \pi^- p \rightarrow K \bar{K} \pi n$
1420 ± 20		DAHL	67 HBC	$1.6\text{--}4.2 \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1430.8 ± 0.9		⁵ SOSA	99 SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
1433.4 ± 0.8		⁵ SOSA	99 SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
1435 ± 9		PROKOSHKIN	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1429 ± 3	389	ARMSTRONG	89 OMEG	$300 p p \rightarrow K \bar{K} \pi p p$
1425 ± 2	1520	ARMSTRONG	84 OMEG	$85 \pi^+ p, p p \rightarrow (\pi^+, p) (K \bar{K} \pi) p$
~ 1420		BITYUKOV	84 SPEC	$32 K^- p \rightarrow K^+ K^- \pi^0 \gamma$

- ¹ From a fit with a width fixed at 55 MeV.
- ² This result supersedes ARMSTRONG 84, ARMSTRONG 89.
- ³ From fit to the $K^*(892)K$ 1^{++} partial wave.
- ⁴ Mass error increased to account for $a_0(980)$ mass cut uncertainties.
- ⁵ No systematic error given.



$f_1(1420)$ WIDTH

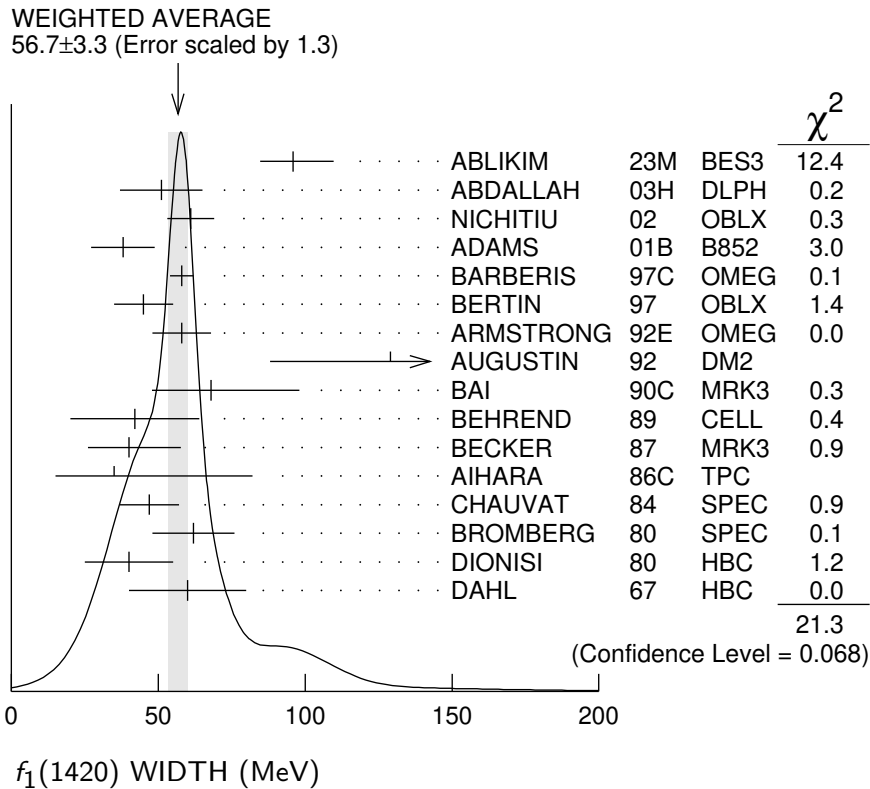
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
56.7± 3.3 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
95.9± 2.3 ^{+13.6} _{-10.9}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
51 ± 14	711	ABDALLAH	03H DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
61 ± 8	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
38 ± 9 ± 6	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
58 ± 4		BARBERIS	97C OMEG	$450 p p \rightarrow p p K_S^0 K^\pm \pi^\mp$
45 ± 10		BERTIN	97 OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
58 ± 10		⁶ ARMSTRONG	92E OMEG	$85,300 \pi^+ p, p p \rightarrow \pi^+ p, p p (K \bar{K} \pi)$
129 ± 41		⁷ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

68	$+29$ -18	$+8$ -9	1100	BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
42	± 22		17	BEHREND	89	CELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
40	$+17$ -13	± 5	111	BECKER	87	MRK3	$e^+e^- \rightarrow \omega K \bar{K} \pi$
35	$+47$ -20		13	AIHARA	86C	TPC	$e^+e^- \rightarrow e^+e^- K \bar{K} \pi$
47	± 10			CHAUVAT	84	SPEC	ISR 31.5 pp
62	± 14			BROMBERG	80	SPEC	100 $\pi^- p \rightarrow K \bar{K} \pi X$
40	± 15		221	DIONISI	80	HBC	4 $\pi^- p \rightarrow K \bar{K} \pi n$
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 $\pm$ 2.9				⁸ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
58.8 $\pm$ 3.3				⁸ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
90 $\pm$ 25				PROKOSHKIN	97B	GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
58 $\pm$ 8			389	ARMSTRONG	89	OMEG	300 $pp \rightarrow K \bar{K} \pi pp$
62 $\pm$ 5			1520	ARMSTRONG	84	OMEG	85 $\pi^+ p, pp \rightarrow (\pi^+, p)(K \bar{K} \pi)p$
$\sim$ 50				BITYUKOV	84	SPEC	32 $K^- p \rightarrow K^+ K^- \pi^0 \gamma$

⁶ This result supersedes ARMSTRONG 84, ARMSTRONG 89.

⁷ From fit to the $K^*(892) K 1^{++}$ partial wave.

⁸ No systematic error given.



$f_1(1420)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$K\bar{K}\pi$	seen
Γ_2	$K\bar{K}^*(892)+\text{c.c.}$	seen
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

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

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

VALUE (keV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
1.9±0.4 OUR AVERAGE					
3.2±0.6±0.7		133	^{9,10} ACHARD	07 L3	183–209 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
3.0±0.9±0.7			^{11,12} BEHREND	89 CELL	$e^+e^- \rightarrow e^+e^- K_S^0 K\pi$
2.3 ^{+1.0} _{-0.9} ±0.8			HILL	89 JADE	$e^+e^- \rightarrow e^+e^- K^\pm K_S^0 \pi^\mp$
1.3±0.5±0.3			AIHARA	88B TPC	$e^+e^- \rightarrow e^+e^- K^\pm K_S^0 \pi^\mp$
1.6±0.7±0.3			^{11,13} GIDAL	87B MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.0	95		JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$

⁹ From a fit with a width fixed at 55 MeV.
¹⁰ The form factor parameter from the fit is 926 ± 78 MeV.
¹¹ Assume a ρ -pole form factor.
¹² A ϕ -pole form factor gives considerably smaller widths.
¹³ Published value divided by 2.

$f_1(1420)$ BRANCHING RATIOS

$\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma(K\bar{K}\pi)$	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 $\pi^- p \rightarrow K\bar{K}\pi X$
0.86±0.12	DIONISI 80 HBC 4 $\pi^- p \rightarrow K\bar{K}\pi n$

$\Gamma(\pi\pi\rho)/\Gamma(K\bar{K}\pi)$	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 $\pi^- p$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	ARMSTRONG 91B	OMEG	300 $pp \rightarrow p p \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.35 ± 0.75		KOPKE	89	MRK3 $J/\psi \rightarrow \omega \eta \pi \pi (K\bar{K}\pi)$
<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 $\bar{p} p$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.1	90	PROKOSHKIN 97B	GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
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 $\bar{p} p \rightarrow 7\pi$

 $\Gamma(4\pi)/\Gamma(K\bar{K}^*(892)+c.c.)$ 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 $\pi^- p$

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

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.65 ± 0.27	¹⁴ DIONISI	80	HBC 4 $\pi^- p$
¹⁴ Calculated using $\Gamma(K\bar{K})/\Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.			

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.042 ± 0.014 OUR AVERAGE				
0.44 ± 0.19		ABLIKIM	21U	BES3 $D_s^+ \rightarrow f_1(1420)\pi^+$
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 $\pi^+ p$

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

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

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.08	95	¹⁵ ARMSTRONG 92C	SPEC	300 $pp \rightarrow p p \pi^+ \pi^- \gamma$
¹⁵ Using the data on the $\bar{K} K \pi$ mode from ARMSTRONG 89.				

$\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$			Γ_7/Γ_1		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.02	95	BARBERIS	98C	OMEG	450 $pp \rightarrow$ $\rho_f f_1(1420) p_S$

$\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$			Γ_8/Γ_1		
VALUE		DOCUMENT ID	TECN	COMMENT	
$0.003 \pm 0.001 \pm 0.001$		BARBERIS	98C	OMEG	450 $pp \rightarrow$ $\rho_f f_1(1420) p_S$

$f_1(1420)$ REFERENCES

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21U	PR D104 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>	
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
PROKOSHKIN	97B	PD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky	
Translated from DANS 354 751.				
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
ARMSTRONG	92E	ZPHY C56 29	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JPC
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+) JPC
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
HILL	89	ZPHY C42 355	P. Hill <i>et al.</i>	(JADE Collab.) JP
KOPKE	89	PRPL 174 67	L. Kopke <i>et al.</i>	(CERN)
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.) JP
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
GIDAL	87B	PRL 59 2016	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
AIHARA	86C	PRL 57 2500	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP
BITYUKOV	84	SJNP 39 735	S. Bityukov <i>et al.</i>	(SERP)
Translated from YAF 39 1165.				
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+) IJP
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP
Also		PRL 14 1074	D.H. Miller <i>et al.</i>	(LRL, UCB)