NODE=B063

$N(1535)\ S_{11}$

$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$ Status: ∗∗∗∗

NODE=B063

Most of the results published before 1975 were last included in our 1982 edition, Physics Letters **111B** 1 (1982). Some further obsolete results published before 1984 were last included in our 2006 edition, Journal of Physics, G **33** 1 (2006).

N(1535) BREIT-WIGNER MASS

NODE=B063205

NODE=B063M

→ NOT CHECKED ←

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1525 to 1545 (≈ 1535) OUR ESTIMATE				
1547.0± 0.7	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
1534 ± 7	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
1550 ±40	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
1526 ± 7	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1548 ±15	THOMA	08	DPWA	Multichannel
1546.7± 2.2	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
1526 ± 2	PENNER	02C	DPWA	Multichannel
1530 ±10	BAI	01B	BES	$J/\psi \to p\overline{p}\eta$
1522 ±11	THOMPSON	01	CLAS	$\gamma^* p \to p\eta$
1542 ± 3	VRANA	00	DPWA	Multichannel
1532 ± 5	ARMSTRONG	99B	DPWA	$\gamma^* p \to p\eta$
1549.0± 2.1	ABAEV	96	DPWA	$\pi^- p \to \eta n$
1525 ±10	ARNDT	96	IPWA	$\gamma N \to \pi N$
1535	ARNDT	95	DPWA	$\pi N \to N\pi$
1542 ± 6	BATINIC	95	DPWA	$\pi N \to N\pi, N\eta$
1537	BATINIC	95B	DPWA	$\pi N \to N\pi, N\eta$
1544 ±13	KRUSCHE	95	DPWA	$\gamma p \to p\eta$
1518	LI	93	IPWA	$\gamma N \to \pi N$
1520	[1] LONGACRE	77	IPWA	$\pi N \to N\pi\pi$
1510	[2] LONGACRE	75	IPWA	$\pi N \to N\pi\pi$

N(1535) BREIT-WIGNER WIDTH

NODE=B063210

NODE=B063W

→ NOT CHECKED ←

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
125 to 175 (≈ 150) OUR ESTIMATE				
188.4± 3.8	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
148.2± 8.1	GREEN	97	DPWA	$\pi N \to \pi N, \eta N$
151 ±27	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
240 ±80	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
120 ±20	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
170 ±20	THOMA	08	DPWA	Multichannel
178.0±11.6	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
129 ± 8	PENNER	02C	DPWA	Multichannel
95 ±25	BAI	01B	BES	$J/\psi \to p\overline{p}\eta$
143 ±18	THOMPSON	01	CLAS	$\gamma^* p \to p\eta$
112 ±19	VRANA	00	DPWA	Multichannel
154 ±20	ARMSTRONG	99B	DPWA	$\gamma^* p \to p\eta$
212 ±20	[3] KRUSCHE	97	DPWA	$\gamma N \to \eta N$
168.8±11.6	ABAEV	96	DPWA	$\pi^- p \to \eta n$
103 ± 5	ARNDT	96	IPWA	$\gamma N \to \pi N$
66	ARNDT	95	DPWA	$\pi N \to N\pi$
150 ±15	BATINIC	95	DPWA	$\pi N \to N\pi, N\eta$
145	BATINIC	95B	DPWA	$\pi N \to N\pi, N\eta$
200 ±40	KRUSCHE	95	DPWA	$\gamma p \to p\eta$
84	LI	93	IPWA	$\gamma N \to \pi N$
135	[1] LONGACRE	77	IPWA	$\pi N \to N\pi\pi$
100	[2] LONGACRE	75	IPWA	$\pi N \to N\pi\pi$

$N(1535)$ POLE POSITION

NODE=B063215

REAL PART

NODE=B063RE
NODE=B063RE

→ NOT CHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1490 to 1530 (≈ 1510) OUR ESTIMATE			
1502	ARNDT 06	DPWA	$\pi N \to \pi N, \eta N$
1487	[4] HOEHLER 93	SPED	$\pi N \to \pi N$
1510 ± 50	CUTKOSKY 80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1508^{+10}_{-30}	THOMA 08	DPWA	Multichannel
1526	ARNDT 04	DPWA	$\pi N \to \pi N, \eta N$
1525	VRANA 00	DPWA	Multichannel
1510 ± 10	[5] ARNDT 98	DPWA	$\pi N \to \pi N, \eta N$
1501	ARNDT 95	DPWA	$\pi N \to N\pi$
1499	ARNDT 91	DPWA	$\pi N \to \pi N$ Soln SM90
1496 or 1499	[6] LONGACRE 78	IPWA	$\pi N \to N\pi\pi$
1525 or 1527	[1] LONGACRE 77	IPWA	$\pi N \to N\pi\pi$

−2×IMAGINARY PART

NODE=B063IM
NODE=B063IM

→ NOT CHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
90 to 250 (≈ 170) OUR ESTIMATE			
95	ARNDT 06	DPWA	$\pi N \to \pi N, \eta N$
260 ± 80	CUTKOSKY 80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
165 ± 15	THOMA 08	DPWA	Multichannel
130	ARNDT 04	DPWA	$\pi N \to \pi N, \eta N$
102	VRANA 00	DPWA	Multichannel
170 ± 30	[5] ARNDT 98	DPWA	$\pi N \to \pi N, \eta N$
124	ARNDT 95	DPWA	$\pi N \to N\pi$
110	ARNDT 91	DPWA	$\pi N \to \pi N$ Soln SM90
103 or 105	[6] LONGACRE 78	IPWA	$\pi N \to N\pi\pi$
135 or 123	[1] LONGACRE 77	IPWA	$\pi N \to N\pi\pi$

$N(1535)$ ELASTIC POLE RESIDUE

NODE=B063220

MODULUS $|r|$

NODE=B063RER
NODE=B063RER

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
16	ARNDT 06	DPWA	$\pi N \to \pi N, \eta N$
120 ± 40	CUTKOSKY 80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
33	ARNDT 04	DPWA	$\pi N \to \pi N, \eta N$
31	ARNDT 95	DPWA	$\pi N \to N\pi$
23	ARNDT 91	DPWA	$\pi N \to \pi N$ Soln SM90

PHASE θ

NODE=B063IMR
NODE=B063IMR

VALUE (°)	DOCUMENT ID	TECN	COMMENT
−16	ARNDT 06	DPWA	$\pi N \to \pi N, \eta N$
$+15 \pm 45$	CUTKOSKY 80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
14	ARNDT 04	DPWA	$\pi N \to \pi N, \eta N$
−12	ARNDT 95	DPWA	$\pi N \to N\pi$
−13	ARNDT 91	DPWA	$\pi N \to \pi N$ Soln SM90

$N(1535)$ DECAY MODES

NODE=B063225;NODE=B063

The following branching fractions are our estimates, not fits or averages.

NODE=B063

	Mode	Fraction (Γ_i/Γ)	
Γ_1	$N\pi$	35–55 %	DESIG=1;OUR EST
Γ_2	$N\eta$	45–60 %	DESIG=2;OUR EST
Γ_3	$N\pi\pi$	1–10 %	DESIG=4;OUR EST
Γ_4	$\Delta\pi$	<1 %	DESIG=181;OUR EST
Γ_5	$\Delta(1232)\pi$, D-wave		DESIG=5
Γ_6	$N\rho$	<4 %	DESIG=182;OUR EST
Γ_7	$N\rho$, S=1/2, S-wave		DESIG=6

Γ_8	$N\rho$, S=3/2, D-wave		DESIG=7
Γ_9	$N(\pi\pi)^{I=0}_{S\text{-wave}}$	<3 %	DESIG=8;OUR EST
Γ_{10}	$N(1440)\pi$	<7 %	DESIG=11;OUR EST
Γ_{11}	$p\gamma$	0.15–0.35 %	DESIG=184;OUR EST
Γ_{12}	$p\gamma$, helicity=1/2	0.15–0.35 %	DESIG=9;OUR EST
Γ_{13}	$n\gamma$	0.004–0.29 %	DESIG=185;OUR EST
Γ_{14}	$n\gamma$, helicity=1/2	0.004–0.29 %	DESIG=10;OUR EST

$N(1535)$ BRANCHING RATIOS

NODE=B063230

$\Gamma(N\pi)/\Gamma_{\text{total}}$ — Γ_1/Γ

NODE=B063R1
NODE=B063R1
→ NOT CHECKED ←

VALUE	DOCUMENT ID		TECN	COMMENT
0.35 to 0.55 OUR ESTIMATE				
0.355±0.002	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
0.394±0.009	GREEN	97	DPWA	$\pi N \to \pi N$, ηN
0.51 ±0.05	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
0.50 ±0.10	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
0.38 ±0.04	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.37 ±0.09	THOMA	08	DPWA	Multichannel
0.360±0.009	ARNDT	04	DPWA	$\pi N \to \pi N$, ηN
0.36 ±0.01	PENNER	02C	DPWA	Multichannel
0.35 ±0.08	VRANA	00	DPWA	Multichannel
0.330±0.011	ABAEV	96	DPWA	$\pi^- p \to \eta n$
0.31	ARNDT	95	DPWA	$\pi N \to N\pi$
0.34 ±0.09	BATINIC	95	DPWA	$\pi N \to N\pi$, $N\eta$

$\Gamma(N\eta)/\Gamma_{\text{total}}$ — Γ_2/Γ

NODE=B063R7
NODE=B063R7
→ NOT CHECKED ←

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
+0.45–0.60 OUR ESTIMATE					
0.529±0.010 OUR AVERAGE					
0.53 ±0.01		PENNER	02C	DPWA	Multichannel
0.51 ±0.05		VRANA	00	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.40 ±0.10		THOMA	08	DPWA	Multichannel
>0.45	95	[7] ARMSTRONG	99B	DPWA	$p\,(e,e'p)\,\eta$
0.568±0.011		GREEN	97	DPWA	$\pi N \to \pi N$, ηN
0.591±0.017		ABAEV	96	DPWA	$\pi^- p \to \eta n$
0.63 ±0.07		BATINIC	95	DPWA	$\pi N \to N\pi$, $N\eta$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \to N(1535) \to N\eta$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

NODE=B063R2
NODE=B063R2
→ NOT CHECKED ←

VALUE	DOCUMENT ID		TECN	COMMENT
+0.44 to +0.50 OUR ESTIMATE				
+0.47±0.02	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$

Note: Signs of couplings from $\pi N \to N\pi\pi$ analyses were changed in the 1986 edition to agree with the baryon-first convention; the overall phase ambiguity is resolved by choosing a negative sign for the $\Delta(1620)$ S_{31} coupling to $\Delta(1232)\pi$.

NODE=B063310

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \to N(1535) \to \Delta(1232)\pi$, D-wave — $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

NODE=B063R3
NODE=B063R3
→ NOT CHECKED ←

VALUE	DOCUMENT ID		TECN	COMMENT
−0.04 to +0.06 OUR ESTIMATE				
+0.00±0.04	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
0.00	[1] LONGACRE	77	IPWA	$\pi N \to N\pi\pi$
+0.06	[2] LONGACRE	75	IPWA	$\pi N \to N\pi\pi$

$\Gamma(\Delta(1232)\pi$, D-wave$)/\Gamma_{\text{total}}$ — Γ_5/Γ

NODE=B063R10
NODE=B063R10

VALUE	DOCUMENT ID		TECN	COMMENT
0.01±0.01	VRANA	00	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.23±0.08	THOMA	08	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(1535) \to N\rho$, S=1/2, S-wave — $(\Gamma_1\Gamma_7)^{1/2}/\Gamma$

NODE=B063R4
NODE=B063R4
→ NOT CHECKED ←

VALUE	DOCUMENT ID		TECN	COMMENT
−0.14 to −0.06 OUR ESTIMATE				
−0.10±0.03	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
−0.10	[1] LONGACRE	77	IPWA	$\pi N \to N\pi\pi$
−0.09	[2] LONGACRE	75	IPWA	$\pi N \to N\pi\pi$

$\Gamma(N\rho$, S=1/2, S-wave$)/\Gamma_{total}$ — Γ_7/Γ

NODE=B063R8
NODE=B063R8

VALUE	DOCUMENT ID		TECN	COMMENT
0.02±0.01	VRANA	00	DPWA	Multichannel

$\Gamma(N\rho$, S=3/2, D-wave$)/\Gamma_{total}$ — Γ_8/Γ

NODE=B063R9
NODE=B063R9

VALUE	DOCUMENT ID		TECN	COMMENT
0.00±0.01	VRANA	00	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(1535) \to N(\pi\pi)^{I=0}_{S\text{-wave}}$ — $(\Gamma_1\Gamma_9)^{1/2}/\Gamma$

NODE=B063R5
NODE=B063R5
→ NOT CHECKED ←

VALUE	DOCUMENT ID		TECN	COMMENT
+0.03 to +0.13 OUR ESTIMATE				
+0.07±0.04	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
+0.08	[1] LONGACRE	77	IPWA	$\pi N \to N\pi\pi$
+0.09	[2] LONGACRE	75	IPWA	$\pi N \to N\pi\pi$

$\Gamma(N(\pi\pi)^{I=0}_{S\text{-wave}})/\Gamma_{total}$ — Γ_9/Γ

NODE=B063R11
NODE=B063R11

VALUE	DOCUMENT ID		TECN	COMMENT
0.02±0.01	VRANA	00	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(1535) \to N(1440)\pi$ — $(\Gamma_1\Gamma_{10})^{1/2}/\Gamma$

NODE=B063R6
NODE=B063R6

VALUE	DOCUMENT ID		TECN	COMMENT
+0.10±0.05	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$

$\Gamma(N(1440)\pi)/\Gamma_{total}$ — Γ_{10}/Γ

NODE=B063R12
NODE=B063R12

VALUE	DOCUMENT ID		TECN	COMMENT
0.08±0.02	[8] STAROSTIN	03		$\pi^- p \to n 3\pi^0$
0.10±0.09	VRANA	00	DPWA	Multichannel

$N(1535)$ PHOTON DECAY AMPLITUDES

NODE=B063235

Papers on γN amplitudes predating 1981 may be found in our 2006 edition, Journal of Physics, G **33** 1 (2006).

NODE=B063235

$N(1535) \to p\gamma$, helicity-1/2 amplitude $A_{1/2}$

NODE=B063A1
NODE=B063A1
→ NOT CHECKED ←

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
+0.090±0.030 OUR ESTIMATE				
0.091±0.002	DUGGER	07	DPWA	$\gamma N \to \pi N$
0.120±0.011±0.015	[3] KRUSCHE	97	DPWA	$\gamma N \to \eta N$
0.060±0.015	ARNDT	96	IPWA	$\gamma N \to \pi N$
0.097±0.006	BENMERROU..	95	DPWA	$\gamma N \to N\eta$
0.095±0.011	[9] BENMERROU..	91		$\gamma p \to p\eta$
0.053±0.015	CRAWFORD	83	IPWA	$\gamma N \to \pi N$
0.077±0.021	AWAJI	81	DPWA	$\gamma N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.066	DRECHSEL	07	DPWA	$\gamma N \to \pi N$
0.090	PENNER	02D	DPWA	Multichannel
0.110 to 0.140	KRUSCHE	95	DPWA	$\gamma p \to p\eta$
0.125±0.025	KRUSCHE	95C	IPWA	$\gamma d \to \eta N(N)$
0.061±0.003	LI	93	IPWA	$\gamma N \to \pi N$
0.055	WADA	84	DPWA	Compton scattering

$N(1535) \to n\gamma$, helicity-1/2 amplitude $A_{1/2}$

NODE=B063A2
NODE=B063A2
→ NOT CHECKED ←

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
−0.046±0.027 OUR ESTIMATE				
−0.020±0.035	ARNDT	96	IPWA	$\gamma N \to \pi N$
0.035±0.014	AWAJI	81	DPWA	$\gamma N \to \pi N$
−0.062±0.003	FUJII	81	DPWA	$\gamma N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.051	DRECHSEL	07	DPWA	$\gamma N \to \pi N$
−0.024	PENNER	02D	DPWA	Multichannel
−0.100±0.030	KRUSCHE	95C	IPWA	$\gamma d \to \eta N(N)$
−0.046±0.005	LI	93	IPWA	$\gamma N \to \pi N$

$N(1535) \rightarrow N\gamma$, ratio $A^n_{1/2}/A^p_{1/2}$

NODE=B063A3
NODE=B063A3

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*	*TECN*
• • • We do not use the following data for averages, fits, limits, etc. • • •		
-0.84 ± 0.15	MUKHOPAD... 95B	IPWA

N(1535) FOOTNOTES

NODE=B063

[1] LONGACRE 77 pole positions are from a search for poles in the unitarized T-matrix; the first (second) value uses, in addition to $\pi N \rightarrow N\pi\pi$ data, elastic amplitudes from a Saclay (CERN) partial-wave analysis. The other LONGACRE 77 values are from eyeball fits with Breit-Wigner circles to the T-matrix amplitudes. NODE=B063;LINKAGE=L7

[2] From method II of LONGACRE 75: eyeball fits with Breit-Wigner circles to the T-matrix amplitudes. NODE=B063;LINKAGE=L5

[3] KRUSCHE 97 fits with the mass fixed at 1544 MeV. NODE=B063;LINKAGE=K7

[4] See HOEHLER 93 for a detailed discussion of the evidence for and the pole parameters of N and Δ resonances as determined from Argand diagrams of πN elastic partial-wave amplitudes and from plots of the speeds with which the amplitudes traverse the diagrams. NODE=B010;LINKAGE=H9

[5] ARNDT 98 also lists pole residues, which display more model dependence than do the associated pole positions. NODE=B063;LINKAGE=A

[6] LONGACRE 78 values are from a search for poles in the unitarized T-matrix. The first (second) value uses, in addition to $\pi N \rightarrow N\pi\pi$ data, elastic amplitudes from a Saclay (CERN) partial-wave analysis. NODE=B063;LINKAGE=L8

[7] The best value ARMSTRONG 99B obtains is $\simeq 0.55$; this assumes S_{11} dominance in the reaction $p(e,\, e'\, p)\, \eta$ at $Q^2 = 4$ $(\mathrm{GeV}/c)^2$. NODE=B063R;LINKAGE=RA

[8] This STAROSTIN 03 value is an estimate made using simplest assumptions. NODE=B063R12;LINKAGE=S

[9] BENMERROUCHE 91 uses an effective Lagrangian approach to analyze η photoproduction data. NODE=B063;LINKAGE=O

N(1535) REFERENCES

NODE=B063

For early references, see Physics Letters **111B** 1 (1982).

NODE=B063

THOMA	08	PL B659 87	U. Thoma *et al.*	(CB-ELSA Collab.)	REFID=52087
DRECHSEL	07	EPJ A34 69	D. Drechsel, S.S. Kamalov, L. Tiator	(MAINZ, JINR)	REFID=52105
DUGGER	07	PR C76 025211	M. Dugger *et al.*	(Jefferson Lab CLAS Collab.)	REFID=52039
ARNDT	06	PR C74 045205	R.A. Arndt *et al.*	(GWU)	REFID=51535
PDG	06	JPG 33 1	W.-M. Yao *et al.*	(PDG Collab.)	REFID=51004
ARNDT	04	PR C69 035213	R.A. Arndt *et al.*	(GWU, TRIU)	REFID=49947
STAROSTIN	03	PR C67 068201	A. Starostin *et al.*	(BNL Crystal Ball Collab.)	REFID=49429
PENNER	02C	PR C66 055211	G. Penner, U. Mosel	(GIES)	REFID=49129
PENNER	02D	PR C66 055212	G. Penner, U. Mosel	(GIES)	REFID=49130
BAI	01B	PL B510 75	J.Z. Bai *et al.*	(BES Collab.)	REFID=48266
THOMPSON	01	PRL 86 1702	R. Thompson *et al.*	(Jefferson CLAS Collab.)	REFID=48083
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman,, T.-S.H. Lee	(PITT+)	REFID=47593
ARMSTRONG	99B	PR D60 052004	C.S. Armstrong *et al.*		REFID=47206
ARNDT	98	PR C58 3636	R.A. Arndt *et al.*		REFID=46532
GREEN	97	PR C55 R2167	A.M. Green, S. Wycech	(HELS, WINR)	REFID=45462
KRUSCHE	97	PL B397 171	B. Krusche *et al.*	(GIES, RPI, SASK)	REFID=45318
ABAEV	96	PR C53 385	V.V. Abaev, B.M.K. Nefkens	(UCLA)	REFID=44674
ARNDT	96	PR C53 430	R.A. Arndt, I.I. Strakovsky, R.L. Workman	(VPI)	REFID=44675
ARNDT	95	PR C52 2120	R.A. Arndt *et al.*	(VPI, BRCO)	REFID=44535
BATINIC	95	PR C51 2310	M. Batinic *et al.*	(BOSK, UCLA)	REFID=44253
Also		PR C57 1004 (erratum)	M. Batinic *et al.*		REFID=46020
BATINIC	95B	PR C52 2188	M. Batinic, I. Slaus, A. Svarc	(BOSK)	REFID=44536
BENMERROU...	95	PR D51 3237	M. Benmerrouche, N.C. Mukhopadhyay, J.F. Zhang		REFID=44218
KRUSCHE	95	PRL 74 3736	B. Krusche *et al.*	(GIES, MANZ, GLAS+)	REFID=44204
KRUSCHE	95C	PL B358 40	B. Krusche *et al.*	(GIES, MANZ, GLAS+)	REFID=44572
MUKHOPAD...	95B	PL B364 1	N.C. Mukhopadhyay, J.F. Zhang, M. Benmerrouche		REFID=44580
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)	REFID=43821
LI	93	PR C47 2759	Z.J. Li *et al.*	(VPI)	REFID=43327
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KENT) IJP	REFID=41535
Also		PR D30 904	D.M. Manley *et al.*	(VPI)	REFID=30071
ARNDT	91	PR D43 2131	R.A. Arndt *et al.*	(VPI, TELE) IJP	REFID=41467
BENMERROU...	91	PRL 67 1070	M. Benmerrouche, N.C. Mukhopadhyay	(RPI)	REFID=41607
WADA	84	NP B247 313	Y. Wada *et al.*	(INUS)	REFID=30072
CRAWFORD	83	NP B211 1	R.L. Crawford, W.T. Morton	(GLAS)	REFID=30070
PDG	82	PL 111B 1	M. Roos *et al.*	(HELS, CIT, CERN)	REFID=41167
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)	REFID=30067
Also		NP B197 365	K. Fujii *et al.*	(NAGO)	REFID=30068
FUJII	81	NP B187 53	K. Fujii *et al.*	(NAGO, OSAK)	REFID=30069
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky *et al.*	(CMU, LBL) IJP	REFID=30064
Also		PR D20 2839	R.E. Cutkosky *et al.*	(CMU, LBL) IJP	REFID=40096
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT) IJP	REFID=30058
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP	REFID=30859
LONGACRE	78	PR D17 1795	R.S. Longacre *et al.*	(LBL, SLAC)	REFID=30054
LONGACRE	77	NP B122 493	R.S. Longacre, J. Dolbeau	(SACL) IJP	REFID=30051
Also		NP B108 365	J. Dolbeau *et al.*	(SACL) IJP	REFID=30052
LONGACRE	75	PL 55B 415	R.S. Longacre *et al.*	(LBL, SLAC) IJP	REFID=30047