$N(2080)\ D_{13}$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$ Status: $**$

OMITTED FROM SUMMARY TABLE

There is some evidence for two resonances in this wave between 1800 and 2200 MeV (see CUTKOSKY 80). However, the solution of HOEHLER 79 is quite different.

Most of the results published before 1975 are now obsolete and have been omitted. They may be found in our 1982 edition, Physics Letters **111B** (1982).

N(2080) BREIT-WIGNER MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
≈ 2080 OUR ESTIMATE				
1804± 55	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
1920	BELL	83	DPWA	$\pi^- p \to \Lambda K^0$
1880±100	[1] CUTKOSKY	80	IPWA	$\pi N \to \pi N$
2060± 80	[1] CUTKOSKY	80	IPWA	$\pi N \to \pi N$
1900	SAXON	80	DPWA	$\pi^- p \to \Lambda K^0$
2081± 20	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1946± 1	PENNER	02C	DPWA	Multichannel
1895	MART	00	DPWA	$\gamma p \to \Lambda K^+$
2003± 18	VRANA	00	DPWA	Multichannel
1986± 75	BATINIC	95	DPWA	$\pi N \to N\pi$, $N\eta$
1880	BAKER	79	DPWA	$\pi^- p \to n\eta$

N(2080) BREIT-WIGNER WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
450±185	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
320	BELL	83	DPWA	$\pi^- p \to \Lambda K^0$
180± 60	[1] CUTKOSKY	80	IPWA	$\pi N \to \pi N$ (lower m)
300±100	[1] CUTKOSKY	80	IPWA	$\pi N \to \pi N$ (higher m)
240	SAXON	80	DPWA	$\pi^- p \to \Lambda K^0$
265± 40	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
859± 7	PENNER	02C	DPWA	Multichannel
372	MART	00	DPWA	$\gamma p \to \Lambda K^+$
1070±858	VRANA	00	DPWA	Multichannel
1050±225	BATINIC	95	DPWA	$\pi N \to N\pi$, $N\eta$
87	BAKER	79	DPWA	$\pi^- p \to n\eta$

N(2080) POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1880±100	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (lower m)
2050± 70	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1824	VRANA	00	DPWA	Multichannel
not seen	ARNDT	91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
160±80	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (lower m)
200±80	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)
• • • We do not use the following data for averages, fits, limits, etc. • • •				
614	VRANA	00	DPWA	Multichannel
not seen	ARNDT	91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90

N(2080) ELASTIC POLE RESIDUE

MODULUS |r|

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
10± 5	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (lower m)
30±20	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
100± 80	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (lower m)
0±100	[1] CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)

N(2080) DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1	$N\pi$		
Γ_2	$N\eta$	(3.5±3.5) %	2.5
Γ_3	$N\omega$	(21 ±7) %	
Γ_4	ΛK		
Γ_5	ΣK	(7 ±4) $\times 10^{-3}$	
Γ_6	$N\pi\pi$		
Γ_7	$\Delta(1232)\pi$, S-wave		
Γ_8	$\Delta(1232)\pi$, D-wave		
Γ_9	$N\rho$, S=3/2, S-wave		
Γ_{10}	$N(\pi\pi)^{I=0}_{S\text{-wave}}$		
Γ_{11}	$p\gamma$, helicity=1/2		
Γ_{12}	$p\gamma$, helicity=3/2		
Γ_{13}	$n\gamma$, helicity=1/2		
Γ_{14}	$n\gamma$, helicity=3/2		
Γ_{15}	$p\gamma$		

N(2080) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ — Γ_1/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.23 ± 0.03	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
0.10 ± 0.04	[1] CUTKOSKY	80	IPWA	$\pi N \to \pi N$ (lower m)
0.14 ± 0.07	[1] CUTKOSKY	80	IPWA	$\pi N \to \pi N$ (higher m)
0.06 ± 0.02	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.12 ± 0.02	PENNER	02C	DPWA	Multichannel
0.13 ± 0.03	VRANA	00	DPWA	Multichannel
0.09 ± 0.02	BATINIC	95	DPWA	$\pi N \to N\pi$, $N\eta$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.035 ± 0.035 OUR AVERAGE	Error includes scale factor of 2.5.			
$0.07\ \pm0.02$	PENNER	02C	DPWA	Multichannel
$0.00\ \pm0.02$	VRANA	00	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.07\ \pm0.04$	BATINIC	95	DPWA	$\pi N \to N\pi$, $N\eta$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(2080) \to N\eta$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.065	BAKER	79	DPWA	$\pi^- p \to n\eta$

$\Gamma(N\omega)/\Gamma_{total}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.21 ± 0.07	PENNER	02C	DPWA	Multichannel

$\Gamma(\Lambda K)/\Gamma_{total}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.002 ± 0.002	PENNER	02C	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(2080) \to \Lambda K$ — $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.04$	BELL	83	DPWA	$\pi^- p \to \Lambda K^0$
$+0.03$	SAXON	80	DPWA	$\pi^- p \to \Lambda K^0$

$\Gamma(\Sigma K)/\Gamma_{total}$ — Γ_5/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.007 ± 0.004	PENNER	02C	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(2080) \to \Sigma K$ — $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.014 to 0.037	[2] DEANS	75	DPWA	$\pi N \to \Sigma K$

$(\Gamma_i\Gamma_f)^{½}/\Gamma_{total}$ in $N\pi \rightarrow N(2080) \rightarrow \Delta(1232)\pi$, S-wave — $(\Gamma_1\Gamma_7)^{½}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
-0.09 ± 0.09	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$\Gamma(\Delta(1232)\pi, S\text{-wave})/\Gamma_{total}$ — Γ_7/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.40 ± 0.10	VRANA	00	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{½}/\Gamma_{total}$ in $N\pi \rightarrow N(2080) \rightarrow \Delta(1232)\pi$, D-wave — $(\Gamma_1\Gamma_8)^{½}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.22\pm0.07$	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{total}$ — Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.17 ± 0.10	VRANA	00	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{½}/\Gamma_{total}$ in $N\pi \rightarrow N(2080) \rightarrow N\rho$, S=3/2, S-wave — $(\Gamma_1\Gamma_9)^{½}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
-0.24 ± 0.06	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$\Gamma(N\rho, S=3/2, S\text{-wave})/\Gamma_{total}$ — Γ_9/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.06 ± 0.06	VRANA	00	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{½}/\Gamma_{total}$ in $N\pi \rightarrow N(2080) \rightarrow N(\pi\pi)^{I=0}_{S\text{-wave}}$ — $(\Gamma_1\Gamma_{10})^{½}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.25\pm0.06$	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$\Gamma(N(\pi\pi)^{I=0}_{S\text{-wave}})/\Gamma_{total}$ — Γ_{10}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.24 ± 0.24	VRANA	00	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{½}/\Gamma_{total}$ in $p\gamma \rightarrow N(2080) \rightarrow N\eta$ — $(\Gamma_{15}\Gamma_2)^{½}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
0.0037	HICKS	73	MPWA	$\gamma p \rightarrow p\eta$

$N(2080)$ PHOTON DECAY AMPLITUDES

$N(2080) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
-0.020 ± 0.008	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.012	PENNER	02D	DPWA	Multichannel
0.026 ± 0.052	DEVENISH	74	DPWA	$\gamma N \rightarrow \pi N$

$N(2080) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.017±0.011	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.010	PENNER	02D	DPWA	Multichannel
0.128±0.057	DEVENISH	74	DPWA	$\gamma N \rightarrow \pi N$

$N(2080) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.007±0.013	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.023	PENNER	02D	DPWA	Multichannel
0.053±0.083	DEVENISH	74	DPWA	$\gamma N \rightarrow \pi N$

$N(2080) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
−0.053±0.034	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.009	PENNER	02D	DPWA	Multichannel
0.100±0.141	DEVENISH	74	DPWA	$\gamma N \rightarrow \pi N$

$N(2080)$ $\gamma p \rightarrow \Lambda K^+$ AMPLITUDES

$(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{total}$ in $p\gamma \rightarrow N(2080) \rightarrow \Lambda K^+$ (E_{2-} amplitude)

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.29^{+0.7}_{-0.2}$	MART	00	DPWA	$\gamma p \rightarrow \Lambda K^+$
5.5 ±0.3	WORKMAN	90	DPWA	
4.09	TANABE	89	DPWA	

$p\gamma \rightarrow N(2080) \rightarrow \Lambda K^+$ phase angle θ (E_{2-} amplitude)

VALUE (degrees)	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
−48 ±5	WORKMAN	90	DPWA
−35.9	TANABE	89	DPWA

$(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{total}$ in $p\gamma \rightarrow N(2080) \rightarrow \Lambda K^+$ (M_{2-} amplitude)

VALUE (units 10^{-3})	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •			
−6.7 ±0.2	WORKMAN	90	DPWA
−4.09	TANABE	89	DPWA

N(2080) FOOTNOTES

[1] CUTKOSKY 80 finds a lower mass D_{13} resonance, as well as one in this region. Both are listed here.

[2] The range given for DEANS 75 is from the four best solutions. Disagrees with $\pi^+ p \rightarrow \Sigma^+ K^+$ data of WINNIK 77 around 1920 MeV.

N(2080) REFERENCES

For early references, see Physics Letters **111B** 70 (1982).

PENNER	02C	PR C66 055211	G. Penner, U. Mosel	(GIES)
PENNER	02D	PR C66 055212	G. Penner, U. Mosel	(GIES)
MART	00	PR C61 012201	T. Mart, C. Bennhold	
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman,, T.-S.H. Lee	(PITT+)
BATINIC	95	PR C51 2310	M. Batinic *et al.*	(BOSK, UCLA)
Also	98	PR C57 1004 (erratum)	M. Batinic *et al.*	
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KENT) IJP
Also	84	PR D30 904	D.M. Manley *et al.*	(VPI)
ARNDT	91	PR D43 2131	R.A. Arndt *et al.*	(VPI, TELE) IJP
WORKMAN	90	PR C42 781	R.L. Workman	(VPI)
TANABE	89	PR C39 741	H. Tanabe, M. Kohno, C. Bennhold	(MANZ)
Also	89	NC 102A 193	M. Kohno, H. Tanabe, C. Bennhold	(MANZ)
BELL	83	NP B222 389	K.W. Bell *et al.*	(RL) IJP
PDG	82	PL 111B	M. Roos *et al.*	(HELS, CIT, CERN)
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)
Also	82	NP B197 365	K. Fujii *et al.*	(NAGO)
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky *et al.*	(CMU, LBL) IJP
Also	79	PR D20 2839	R.E. Cutkosky *et al.*	(CMU, LBL) IJP
SAXON	80	NP B162 522	D.H. Saxon *et al.*	(RHEL, BRIS) IJP
BAKER	79	NP B156 93	R.D. Baker *et al.*	(RHEL) IJP
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT) IJP
Also	80	Toronto Conf. 3	R. Koch	(KARLT) IJP
WINNIK	77	NP B128 66	M. Winnik *et al.*	(HAIF) I
DEANS	75	NP B96 90	S.R. Deans *et al.*	(SFLA, ALAH) IJP
DEVENISH	74	PL 52B 227	R.C.E. Devenish, D.H. Lyth, W.A. Rankin	(DESY+) IJP
HICKS	73	PR D7 2614	H.R. Hicks *et al.*	(CMU, ORNL, SFLA) IJP