

$N(1680) 5/2^+$ $I(J^P) = \frac{1}{2}(\frac{5}{2}^+)$ Status: ****

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* (generic for all A,B,E,G) **G33** 1 (2006).

 $N(1680)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1680 to 1690 (≈ 1685) OUR ESTIMATE			
1676 ± 2	SHKLYAR	13	DPWA Multichannel
1689 ± 6	ANISOVICH	12A	DPWA Multichannel
1680.1 ± 0.2	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1680 ± 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
1684 ± 3	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1682.7 ± 0.5	SHRESTHA	12A	DPWA Multichannel
1685 ± 5	ANISOVICH	10	DPWA Multichannel
1680 ± 7	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1684 ± 8	THOMA	08	DPWA Multichannel
1683.2 ± 0.7	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
1679 ± 3	VRANA	00	DPWA Multichannel
1679 ± 5	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
1678	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
1684 ± 4	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$
1660	¹ LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
1670	² LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$

 $N(1680)$ BREIT-WIGNER WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
120 to 140 (≈ 130) OUR ESTIMATE			
115 ± 1	SHKLYAR	13	DPWA Multichannel
118 ± 6	ANISOVICH	12A	DPWA Multichannel
128.0 ± 1.1	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
120 ± 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
128 ± 8	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
126 ± 1	SHRESTHA	12A	DPWA Multichannel
117 ± 12	ANISOVICH	10	DPWA Multichannel
142 ± 7	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
105 ± 8	THOMA	08	DPWA Multichannel
134.4 ± 3.8	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
128 ± 9	VRANA	00	DPWA Multichannel

124 ± 4	ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
126	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
139 ± 8	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$
150	¹ LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$
130	² LONGACRE	75	IPWA	$\pi N \rightarrow N\pi\pi$

N(1680) POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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1665 to 1680 (≈ 1675) OUR ESTIMATE

1676 ± 6	ANISOVICH	12A	DPWA	Multichannel
1674	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
1673	³ HOEHLER	93	ARGD	$\pi N \rightarrow \pi N$
1667 ± 5	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1660	SHKLYAR	13	DPWA	Multichannel
1669	SHRESTHA	12A	DPWA	Multichannel
1672 ± 4	ANISOVICH	10	DPWA	Multichannel
1666 ± 8	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
1674 ± 5	THOMA	08	DPWA	Multichannel
1678	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
1667	VRANA	00	DPWA	Multichannel
1670	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
1670	ARNDT	91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90
1668 or 1674	⁴ LONGACRE	78	IPWA	$\pi N \rightarrow N\pi\pi$
1656 or 1653	¹ LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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110 to 135 (≈ 120) OUR ESTIMATE

113 ± 4	ANISOVICH	12A	DPWA	Multichannel
115	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
135	³ HOEHLER	93	ARGD	$\pi N \rightarrow \pi N$
110 ± 10	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

• • • We do not use the following data for averages, fits, limits, etc. • • •

98	SHKLYAR	13	DPWA	Multichannel
119	SHRESTHA	12A	DPWA	Multichannel
114 ± 12	ANISOVICH	10	DPWA	Multichannel
135 ± 6	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
95 ± 10	THOMA	08	DPWA	Multichannel
120	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
122	VRANA	00	DPWA	Multichannel
120	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
116	ARNDT	91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90
132 or 137	⁴ LONGACRE	78	IPWA	$\pi N \rightarrow N\pi\pi$
145 or 143	¹ LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$

***N*(1680) ELASTIC POLE RESIDUE**

MODULUS $|r|$

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
40±5 OUR ESTIMATE			
43±4	ANISOVICH	12A	DPWA Multichannel
42	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
44	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
34±2	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
33	SHKLYAR	13	DPWA Multichannel
44	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
43	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
40	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
37	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

PHASE θ

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-10±10 OUR ESTIMATE			
- 2±10	ANISOVICH	12A	DPWA Multichannel
- 4	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
-17	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
-25± 5	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-32	SHKLYAR	13	DPWA Multichannel
-19	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
+ 1	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
-14	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

***N*(1680) INELASTIC POLE RESIDUE**

The “normalized residue” is the residue divided by $\Gamma_{pole}/2$.

Normalized residue in $N\pi \rightarrow N(1680) \rightarrow \Delta\pi, P\text{-wave}$

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
15±3	-70 ± 45	ANISOVICH	12A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1680) \rightarrow \Delta\pi, F\text{-wave}$

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
23±4	85 ± 15	ANISOVICH	12A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1680) \rightarrow N(\pi\pi)_{S\text{-wave}}^{I=0}$

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
26±4	-56 ± 15	ANISOVICH	12A	DPWA Multichannel

$N(1680)$ PHOTON DECAY AMPLITUDES

Papers on γN amplitudes predating 1981 may be found in our 2006 edition, *Journal of Physics* (generic for all A,B,E,G) **G33** 1 (2006).

 $N(1680) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.015±0.006 OUR ESTIMATE			
-0.013±0.003	ANISOVICH	12A	DPWA Multichannel
-0.007±0.002	WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
-0.017±0.001	DUGGER	07	DPWA $\gamma N \rightarrow \pi N$
-0.017±0.018	CRAWFORD	83	IPWA $\gamma N \rightarrow \pi N$
-0.009±0.006	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.003±0.001	SHKLYAR	13	DPWA Multichannel
-0.017±0.001	SHRESTHA	12A	DPWA Multichannel
-0.012±0.006	ANISOVICH	10	DPWA Multichannel
-0.025	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$
-0.010±0.004	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
-0.006±0.002	LI	93	IPWA $\gamma N \rightarrow \pi N$

 $N(1680) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
+0.133±0.012 OUR ESTIMATE			
0.135±0.006	ANISOVICH	12A	DPWA Multichannel
0.140±0.002	WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
0.134±0.002	DUGGER	07	DPWA $\gamma N \rightarrow \pi N$
0.132±0.010	CRAWFORD	83	IPWA $\gamma N \rightarrow \pi N$
0.115±0.008	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.116±0.001	SHKLYAR	13	DPWA Multichannel
0.136±0.001	SHRESTHA	12A	DPWA Multichannel
0.136±0.012	ANISOVICH	10	DPWA Multichannel
0.134	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$
0.145±0.005	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
0.154±0.002	LI	93	IPWA $\gamma N \rightarrow \pi N$

 $N(1680) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
+0.029±0.010 OUR ESTIMATE			
0.026±0.004	CHEN	12A	DPWA $\gamma N \rightarrow \pi N$
0.017±0.014	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
0.032±0.003	FUJII	81	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.029±0.002	SHRESTHA	12A	DPWA Multichannel
0.028	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$
0.030±0.005	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
0.022±0.002	LI	93	IPWA $\gamma N \rightarrow \pi N$

$N(1680) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
-0.033±0.009 OUR ESTIMATE			
-0.029±0.002	CHEN	12A	DPWA $\gamma N \rightarrow \pi N$
-0.033±0.013	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
-0.023±0.005	FUJII	81	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-0.059±0.002	SHRESTHA	12A	DPWA Multichannel
-0.038	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$
-0.040±0.015	ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
-0.048±0.002	LI	93	IPWA $\gamma N \rightarrow \pi N$

$N(1680)$ DECAY MODES

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

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\pi$	65–70 %
Γ_2 $N\eta$	$(0 \pm 7) \times 10^{-3}$
Γ_3 ΛK	
Γ_4 ΣK	
Γ_5 $N\pi\pi$	30–40 %
Γ_6 $\Delta\pi$	5–15 %
Γ_7 $\Delta(1232)\pi$, <i>P</i> -wave	(10 ± 5) %
Γ_8 $\Delta(1232)\pi$, <i>F</i> -wave	0–12 %
Γ_9 $N\rho$	3–15 %
Γ_{10} $N\rho$, $S=1/2$, <i>F</i> -wave	
Γ_{11} $N\rho$, $S=3/2$, <i>P</i> -wave	<12;%
Γ_{12} $N\rho$, $S=3/2$, <i>F</i> -wave	1–5 %
Γ_{13} $N(\pi\pi)_{S\text{-wave}}^{I=0}$	(11 ± 5) %
Γ_{14} $p\gamma$	0.21–0.32 %
Γ_{15} $p\gamma$, helicity=1/2	0.001–0.011 %
Γ_{16} $p\gamma$, helicity=3/2	0.20–0.32 %
Γ_{17} $n\gamma$	0.021–0.046 %
Γ_{18} $n\gamma$, helicity=1/2	0.004–0.029 %
Γ_{19} $n\gamma$, helicity=3/2	0.01–0.024 %

$N(1680)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE (%)	DOCUMENT ID	TECN	COMMENT		
65 to 70 OUR ESTIMATE					
68 ± 1	SHKLYAR	13	DPWA	Multichannel	
64 ± 5	ANISOVICH	12A	DPWA	Multichannel	
70.1 ± 0.1	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$	
62 ± 5	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$	
65 ± 2	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

68.0 ± 0.5	SHRESTHA	12A	DPWA	Multichannel
66 ± 8	ANISOVICH	10	DPWA	Multichannel
67 ± 3	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
72 ± 15	THOMA	08	DPWA	Multichannel
67.0 ± 0.4	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
69 ± 2	VRANA	00	DPWA	Multichannel
68	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
70 ± 3	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \& N\pi\pi$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1680) \rightarrow N\eta$ $(\Gamma_1 \Gamma_2)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	BAKER	79	DPWA	$\pi^- p \rightarrow n\eta$
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$\Gamma(N\eta) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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0.0 ± 0.7 OUR AVERAGE

0 ± 1	SHKLYAR	13	DPWA	Multichannel
0 ± 1	VRANA	00	DPWA	Multichannel

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.0 ± 0.3	SHRESTHA	12A	DPWA	Multichannel
0.4 ± 0.2	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
<1	THOMA	08	DPWA	Multichannel
0.15 ^{+0.35} _{-0.10}	TIATOR	99	DPWA	$\gamma p \rightarrow p\eta$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1680) \rightarrow \Lambda K$ $(\Gamma_1 \Gamma_3)^{1/2} / \Gamma$

Coupling to ΛK not required in the analyses of SAXON 80 or BELL 83.

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

-0.01	SHRESTHA	12A	DPWA	Multichannel
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Note: Signs of couplings from $\pi N \rightarrow N\pi\pi$ 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 $\Delta(1232)\pi$.

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1680) \rightarrow \Delta(1232)\pi, P\text{-wave}$ $(\Gamma_1 \Gamma_7)^{1/2} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
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-0.31 to -0.21 OUR ESTIMATE

-0.27	^{1,5} LONGACRE	77	IPWA	$\pi N \rightarrow N\pi\pi$
-0.25	² LONGACRE	75	IPWA	$\pi N \rightarrow N\pi\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

-0.26 ± 0.04	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \& N\pi\pi$
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$\Gamma(\Delta(1232)\pi, P\text{-wave})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
10 ±5 OUR ESTIMATE			
5 ±3	ANISOVICH	12A	DPWA Multichannel
14 ±3	VRANA	00	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.5±0.9	SHRESTHA	12A	DPWA Multichannel
8 ±3	THOMA	08	DPWA Multichannel

 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(1680) \rightarrow \Delta(1232)\pi, F\text{-wave}$ $(\Gamma_1\Gamma_8)^{1/2}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
+0.03 to +0.11 OUR ESTIMATE			
+0.07	^{1,5} LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
+0.08	² LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
+0.07±0.03	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
0 to 12 (≈ 5) OUR ESTIMATE			
10 ±3	ANISOVICH	12A	DPWA Multichannel
1 ±1	VRANA	00	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.0±0.1	SHRESTHA	12A	DPWA Multichannel
4 ±3	THOMA	08	DPWA Multichannel

 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(1680) \rightarrow N\rho, S=3/2, P\text{-wave}$ $(\Gamma_1\Gamma_{11})^{1/2}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.30 to -0.10 OUR ESTIMATE			
-0.23	^{1,5} LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
-0.30	² LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-0.20±0.05	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

 $\Gamma(N\rho, S=3/2, P\text{-wave})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
5 ±1	VRANA	00	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
7.4±0.7	SHRESTHA	12A	DPWA Multichannel

 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(1680) \rightarrow N\rho, S=3/2, F\text{-wave}$ $(\Gamma_1\Gamma_{12})^{1/2}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.18 to -0.10 OUR ESTIMATE			
-0.15	^{1,5} LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-0.13±0.03	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

$\Gamma(N\rho, S=3/2, F\text{-wave})/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
3 ±1	VRANA	00	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.4±0.3	SHRESTHA	12A	DPWA Multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(1680) \rightarrow N(\pi\pi)_{S\text{-wave}}^{I=0}$ $(\Gamma_1\Gamma_{13})^{1/2}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
+0.25 to +0.35 OUR ESTIMATE			
+0.31	^{1,5} LONGACRE	77	IPWA $\pi N \rightarrow N\pi\pi$
+0.30	² LONGACRE	75	IPWA $\pi N \rightarrow N\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
+0.29±0.04	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

$\Gamma(N(\pi\pi)_{S\text{-wave}}^{I=0})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
11 ±5 OUR ESTIMATE			
14 ±7	ANISOVICH	12A	DPWA Multichannel
9 ±1	VRANA	00	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9.4±0.8	SHRESTHA	12A	DPWA Multichannel
11 ±5	THOMA	08	DPWA Multichannel

N(1680) FOOTNOTES

- 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.
- ² From method II of LONGACRE 75: eyeball fits with Breit-Wigner circles to the T-matrix amplitudes.
- ³ 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.
- ⁴ 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.
- ⁵ LONGACRE 77 considers this coupling to be well determined.

N(1680) REFERENCES

For early references, see *Physics Letters* **111B** 1 (1982). For very early references, see *Reviews of Modern Physics* **37** 633 (1965).

SHKLYAR	13	PR C87 015201	V. Shklyar, H. Lenseke, U. Mosel	(GIES)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
CHEN	12A	PR C86 015206	W. Chen <i>et al.</i>	(DUKE, GWU, MSST, ITEP+)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
WORKMAN	12A	PR C86 015202	R. Workman <i>et al.</i>	(GWU)
ANISOVICH	10	EPJ A44 203	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
BATINIC	10	PR C82 038203	M. Batinic <i>et al.</i>	(ZAGR)
THOMA	08	PL B659 87	U. Thoma <i>et al.</i>	(CB-ELSA Collab.)
DRECHSEL	07	EPJ A34 69	D. Drechsel, S.S. Kamalov, L. Tiator	(MAINZ, JINR)
DUGGER	07	PR C76 025211	M. Dugger <i>et al.</i>	(Jefferson Lab CLAS Collab.)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)

PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
ARNDT	04	PR C69 035213	R.A. Arndt <i>et al.</i>	(GWU, TRIU)
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman,, T.-S.H. Lee	(PITT+)
TIATOR	99	PR C60 035210	L. Tiator <i>et al.</i>	
ARNDT	96	PR C53 430	R.A. Arndt, I.I. Strakovsky, R.L. Workman	(VPI)
ARNDT	95	PR C52 2120	R.A. Arndt <i>et al.</i>	(VPI, BRCO)
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)
LI	93	PR C47 2759	Z.J. Li <i>et al.</i>	(VPI)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KSA) IJP
Also		PR D30 904	D.M. Manley <i>et al.</i>	(VPI)
ARNDT	91	PR D43 2131	R.A. Arndt <i>et al.</i>	(VPI, TELE) IJP
BELL	83	NP B222 389	K.W. Bell <i>et al.</i>	(RL) IJP
CRAWFORD	83	NP B211 1	R.L. Crawford, W.T. Morton	(GLAS)
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELSE, CIT, CERN)
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)
Also		NP B197 365	K. Fujii <i>et al.</i>	(NAGO)
FUJII	81	NP B187 53	K. Fujii <i>et al.</i>	(NAGO, OSAK)
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
Also		PR D20 2839	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
SAXON	80	NP B162 522	D.H. Saxon <i>et al.</i>	(RHEL, BRIS) IJP
BAKER	79	NP B156 93	R.D. Baker <i>et al.</i>	(RHEL) IJP
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP
LONGACRE	78	PR D17 1795	R.S. Longacre <i>et al.</i>	(LBL, SLAC)
LONGACRE	77	NP B122 493	R.S. Longacre, J. Dolbeau	(SACL) IJP
Also		NP B108 365	J. Dolbeau <i>et al.</i>	(SACL) IJP
LONGACRE	75	PL 55B 415	R.S. Longacre <i>et al.</i>	(LBL, SLAC) IJP