

$N(2190) G_{17}$

$$I(J^P) = \frac{1}{2}(\frac{7}{2}^-) \text{ Status: } ****$$

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).

$N(2190)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2100 to 2200 (≈ 2190) OUR ESTIMATE			
2192.1 \pm 8.7	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
2127 \pm 9	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$
2200 \pm 70	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
2140 \pm 12	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
2140 \pm 40	HENDRY	78	MPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2168 \pm 18	VRANA	00	DPWA Multichannel
2131	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
2198 \pm 68	BATINIC	95	DPWA $\pi N \rightarrow N\pi, N\eta$
2098	CRAWFORD	80	DPWA $\gamma N \rightarrow \pi N$
2180	SAXON	80	DPWA $\pi^- p \rightarrow \Lambda K^0$
2140	BAKER	79	DPWA $\pi^- p \rightarrow n\eta$
2117	BARBOUR	78	DPWA $\gamma N \rightarrow \pi N$

$N(2190)$ BREIT-WIGNER WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
300 to 700 (≈ 500) OUR ESTIMATE			
726 \pm 62	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
550 \pm 50	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$
500 \pm 150	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
390 \pm 30	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
270 \pm 50	HENDRY	78	MPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
453 \pm 101	VRANA	00	DPWA Multichannel
476	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
805 \pm 140	BATINIC	95	DPWA $\pi N \rightarrow N\pi, N\eta$
238	CRAWFORD	80	DPWA $\gamma N \rightarrow \pi N$
80	SAXON	80	DPWA $\pi^- p \rightarrow \Lambda K^0$
319	BAKER	79	DPWA $\pi^- p \rightarrow n\eta$
220	BARBOUR	78	DPWA $\gamma N \rightarrow \pi N$

N(2190) POLE POSITION

REAL PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2050 to 2100 (\approx 2075) OUR ESTIMATE			
2076	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
2042	¹ HOEHLER	93	SPED $\pi N \rightarrow \pi N$
2100 \pm 50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2107	VRANA	00	DPWA Multichannel
2030	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
2060	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

– 2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
400 to 520 (\approx 450) OUR ESTIMATE			
502	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
482	¹ HOEHLER	93	SPED $\pi N \rightarrow \pi N$
400 \pm 160	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
380	VRANA	00	DPWA Multichannel
460	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
464	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

N(2190) ELASTIC POLE RESIDUE

MODULUS $|r|$

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
68	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
45	HOEHLER	93	SPED $\pi N \rightarrow \pi N$
25 \pm 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
46	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
54	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

PHASE θ

<u>VALUE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
– 32	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
– 30 \pm 50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
– 23	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
– 44	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

N(2190) DECAY MODES

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

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\pi$	10–20 %
Γ_2 $N\eta$	(0.0±1.0) %
Γ_3 ΛK	
Γ_4 ΣK	
Γ_5 $N\pi\pi$	
Γ_6 $N\rho$	
Γ_7 $N\rho, S=3/2, D\text{-wave}$	
Γ_8 $p\gamma, \text{ helicity}=1/2$	
Γ_9 $p\gamma, \text{ helicity}=3/2$	
Γ_{10} $n\gamma, \text{ helicity}=1/2$	
Γ_{11} $n\gamma, \text{ helicity}=3/2$	

N(2190) BRANCHING RATIOS

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.1 to 0.2 OUR ESTIMATE			
0.230±0.002	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
0.22 ±0.01	MANLEY	92	IPWA $\pi N \rightarrow \pi N \ \& \ N\pi\pi$
0.12 ±0.06	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
0.14 ±0.02	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
0.16 ±0.04	HENDRY	78	MPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.20 ±0.04	VRANA	00	DPWA Multichannel
0.23	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
0.19 ±0.05	BATINIC	95	DPWA $\pi N \rightarrow N\pi, N\eta$

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.00 ±0.01			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.001±0.003	BATINIC	95	DPWA $\pi N \rightarrow N\pi, N\eta$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(2190) \rightarrow N\eta$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
+0.052	BAKER	79	DPWA $\pi^- p \rightarrow n\eta$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(2190) \rightarrow \Lambda K$ $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.02	BELL	83	DPWA $\pi^- p \rightarrow \Lambda K^0$
-0.02	SAXON	80	DPWA $\pi^- p \rightarrow \Lambda K^0$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(2190) \rightarrow \Sigma K$ $(\Gamma_1 \Gamma_4)^{1/2} / \Gamma$
VALUE DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •
 0.014 to 0.019 ² DEANS 75 DPWA $\pi N \rightarrow \Sigma K$

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(2190) \rightarrow N\rho, S=3/2, D\text{-wave}$ $(\Gamma_1 \Gamma_7)^{1/2} / \Gamma$
VALUE DOCUMENT ID TECN COMMENT

−0.25 ± 0.03 MANLEY 92 IPWA $\pi N \rightarrow \pi N \ \& \ N\pi\pi$

$\Gamma(N\rho, S=3/2, D\text{-wave}) / \Gamma_{\text{total}}$ Γ_7 / Γ
VALUE DOCUMENT ID TECN COMMENT

0.29 ± 0.28 VRANA 00 DPWA Multichannel

$N(2190)$ PHOTON DECAY AMPLITUDES

$N(2190) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV^{-1/2}) DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •
 −0.055 CRAWFORD 80 DPWA $\gamma N \rightarrow \pi N$
 −0.030 BARBOUR 78 DPWA $\gamma N \rightarrow \pi N$

$N(2190) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE (GeV^{-1/2}) DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •
 0.081 CRAWFORD 80 DPWA $\gamma N \rightarrow \pi N$
 +0.180 BARBOUR 78 DPWA $\gamma N \rightarrow \pi N$

$N(2190) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV^{-1/2}) DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •
 −0.042 CRAWFORD 80 DPWA $\gamma N \rightarrow \pi N$
 −0.085 BARBOUR 78 DPWA $\gamma N \rightarrow \pi N$

$N(2190) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE (GeV^{-1/2}) DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •
 −0.126 CRAWFORD 80 DPWA $\gamma N \rightarrow \pi N$
 +0.007 BARBOUR 78 DPWA $\gamma N \rightarrow \pi N$

$N(2190) \ \gamma p \rightarrow \Lambda K^+$ AMPLITUDES

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $p\gamma \rightarrow N(2190) \rightarrow \Lambda K^+$ $(E_4\text{- amplitude})$

VALUE (units 10⁻³) DOCUMENT ID TECN

• • • We do not use the following data for averages, fits, limits, etc. • • •
 2.5 ± 1.0 WORKMAN 90 DPWA
 2.04 TANABE 89 DPWA

$p\gamma \rightarrow N(2190) \rightarrow \Lambda K^+$ phase angle θ (E_4- amplitude)

VALUE (degrees) DOCUMENT ID TECN

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

- 4 ± 9	WORKMAN	90	DPWA
- 27.5	TANABE	89	DPWA

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $p\gamma \rightarrow N(2190) \rightarrow \Lambda K^+$ (M_4- amplitude)

VALUE (units 10^{-3}) DOCUMENT ID TECN

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

- 7.0 ± 0.7	WORKMAN	90	DPWA
- 5.78	TANABE	89	DPWA

N(2190) FOOTNOTES

- ¹ 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.
- 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(2190) REFERENCES

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

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+)
ARNDT	95	PR C52 2120	R.A. Arndt <i>et al.</i>	(VPI, BRCO)
BATINIC	95	PR C51 2310	M. Batinic <i>et al.</i>	(BOSK, UCLA)
Also	98	PR C57 1004 (erratum)	M. Batinic <i>et al.</i>	
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KENT) IJP
Also	84	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
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 <i>et al.</i>	(RL) IJP
PDG	82	PL 111B	M. Roos <i>et al.</i>	(HELS, CIT, CERN)
CRAWFORD	80	Toronto Conf. 107	R.L. Crawford	(GLAS)
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
Also	79	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	80	Toronto Conf. 3	R. Koch	(KARLT) IJP
BARBOUR	78	NP B141 253	I.M. Barbour, R.L. Crawford, N.H. Parsons	(GLAS)
HENDRY	78	PRL 41 222	A.W. Hendry	(IND, LBL) IJP
Also	81	ANP 136 1	A.W. Hendry	(IND)
WINNIK	77	NP B128 66	M. Winnik <i>et al.</i>	(HAIF) I
DEANS	75	NP B96 90	S.R. Deans <i>et al.</i>	(SFLA, ALAH) IJP