

$N(2190) G_{17}$

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

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			
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. ● ● ●			
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>
350 to 550 (≈ 450) OUR ESTIMATE			
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. ● ● ●			
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>
1950 to 2150 (≈ 2050) OUR ESTIMATE			
2030	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
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. ● ● ●			
2060	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

– 2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
350 to 550 (≈ 450) OUR ESTIMATE			
460	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
482	¹ HOEHLER	93	SPED $\pi N \rightarrow \pi N$
400±160	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
464	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

N(2190) ELASTIC POLE RESIDUE

MODULUS $|r|$

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

PHASE θ

VALUE (°)	DOCUMENT ID	TECN	COMMENT
– 23	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
– 30±50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
– 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 $N\eta$	
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			
0.22±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. ● ● ●			
0.23	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>
● ● ● 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 $N\pi \rightarrow N(2190) \rightarrow \Sigma K$ $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

<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. ● ● ●			
0.014 to 0.019	² DEANS	75	DPWA $\pi N \rightarrow \Sigma K$

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.25±0.03	MANLEY	92	IPWA $\pi N \rightarrow \pi N \ \& \ N\pi\pi$

N(2190) PHOTON DECAY AMPLITUDES

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

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● 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 $A_{3/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • 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 $A_{1/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • 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 $A_{3/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • 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 $\gamma N \rightarrow \pi N$

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

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $p\gamma \rightarrow N(2190) \rightarrow \Lambda K^+$ (E_{4-} amplitude)

<u>VALUE (units 10⁻³)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>
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• • • 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)

<u>VALUE (degrees)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>
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• • • 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)

<u>VALUE (units 10⁻³)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>
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• • • 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	95	PR C52 2120	+Strakovsky, Workman, Pavan	(VPI, BRCO)
BATINIC	95	PR C51 2310	+Slaus, Svarc, Nefkens	(BOSK, UCLA)
Also	98	PR C57 1004 (erratum)	M. Batinic+	
HOEHLER	93	π N Newsletter 9 1		(KARL)
MANLEY	92	PR D45 4002	+Saleski	(KENT) IJP
Also	84	PR D30 904	Manley, Arndt, Goradia, Teplitz	(VPI)
ARNDT	91	PR D43 2131	+Li, Roper, Workman, Ford	(VPI, TELE) IJP
WORKMAN	90	PR C42 781		(VPI)
TANABE	89	PR C39 741	+Kohno, Bennhold	(MANZ)
Also	89	NC 102A 193	Kohno, Tanabe, Bennhold	(MANZ)
BELL	83	NP B222 389	+Blissett, Broome, Daley, Hart, Lintern+	(RL) IJP
PDG	82	PL 111B	Roos, Porter, Aguilar-Benitez+	(HELS, CIT, CERN)
CRAWFORD	80	Toronto Conf. 107		(GLAS)
CUTKOSKY	80	Toronto Conf. 19	+Forsyth, Babcock, Kelly, Hendrick	(CMU, LBL) IJP
Also	79	PR D20 2839	Cutkosky, Forsyth, Hendrick, Kelly	(CMU, LBL) IJP
SAXON	80	NP B162 522	+Baker, Bell, Blissett, Bloodworth+	(RHEL, BRIS) IJP
BAKER	79	NP B156 93	+Brown, Clark, Davies, Depagter, Evans+	(RHEL) IJP
HOEHLER	79	PDAT 12-1	+Kaiser, Koch, Pietarinen	(KARLT) IJP
Also	80	Toronto Conf. 3	Koch	(KARLT) IJP
BARBOUR	78	NP B141 253	+Crawford, Parsons	(GLAS)
HENDRY	78	PRL 41 222		(IND, LBL) IJP
Also	81	ANP 136 1	Hendry	(IND)
WINNIK	77	NP B128 66	+Toaff, Revel, Goldberg, Berny	(HAIF) I
DEANS	75	NP B96 90	+Mitchell, Montgomery+	(SFLA, ALAH) IJP