$N(2190)\ 7/2^-$

$I(J^P) = \frac{1}{2}(\frac{7}{2}^-)$ 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, G **33** 1 (2006).

N(2190) BREIT-WIGNER MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2100 to 2200 (≈ 2190) OUR ESTIMATE				
2180 ±20	ANISOVICH	12A	DPWA	Multichannel
2152.4± 1.4	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
2127 ± 9	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N \pi \pi$
2200 ±70	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
2140 ±12	HOEHLER	79	IPWA	$\pi N \to \pi N$
2140 ±40	HENDRY	78	MPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2125 ±61	BATINIC	10	DPWA	$\pi N \to N \pi, N \eta$
2192.1± 8.7	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
2168 ±18	VRANA	00	DPWA	Multichannel
2131	ARNDT	95	DPWA	$\pi N \to N \pi$
2180	SAXON	80	DPWA	$\pi^- p \to \Lambda K^0$

N(2190) BREIT-WIGNER WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
300 to 700 (≈ 500) OUR ESTIMATE				
335± 40	ANISOVICH	12A	DPWA	Multichannel
484± 13	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
550± 50	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N \pi \pi$
500±150	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
390± 30	HOEHLER	79	IPWA	$\pi N \to \pi N$
270± 50	HENDRY	78	MPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
381±160	BATINIC	10	DPWA	$\pi N \to N \pi, N \eta$
726± 62	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
453±101	VRANA	00	DPWA	Multichannel
476	ARNDT	95	DPWA	$\pi N \to N \pi$
80	SAXON	80	DPWA	$\pi^- p \to \Lambda K^0$

$N(2190)$ POLE POSITION

REAL PART

VALUE (MeV)		DOCUMENT ID		TECN	COMMENT
2050 to 2100 (≈ 2075) OUR ESTIMATE					
2150±25		ANISOVICH	12A	DPWA	Multichannel
2070		ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
2042	[1]	HOEHLER	93	SPED	$\pi N \to \pi N$
2100±50		CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2063±32		BATINIC	10	DPWA	$\pi N \to N\pi, N\eta$
2076		ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
2107		VRANA	00	DPWA	Multichannel
2030		ARNDT	95	DPWA	$\pi N \to N\pi$
2060		ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

−2×IMAGINARY PART

VALUE (MeV)		DOCUMENT ID		TECN	COMMENT
400 to 520 (≈ 450) OUR ESTIMATE					
330± 30		ANISOVICH	12A	DPWA	Multichannel
520		ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
482	[1]	HOEHLER	93	SPED	$\pi N \to \pi N$
400±160		CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
330±101		BATINIC	10	DPWA	$\pi N \to N\pi, N\eta$
502		ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
380		VRANA	00	DPWA	Multichannel
460		ARNDT	95	DPWA	$\pi N \to N\pi$
464		ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

$N(2190)$ ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
30± 5	ANISOVICH	12A	DPWA	Multichannel
72	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
45	HOEHLER	93	SPED	$\pi N \to \pi N$
25±10	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
34	BATINIC	10	DPWA	$\pi N \to N\pi, N\eta$
68	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
46	ARNDT	95	DPWA	$\pi N \to N\pi$
54	ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
30±10	ANISOVICH	12A	DPWA	Multichannel
−32	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
−30±50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

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

−19	BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
−32	ARNDT	04	DPWA	$\pi N \to \pi N$, ηN
−23	ARNDT	95	DPWA	$\pi N \to N\pi$
−44	ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

N(2190) INELASTIC POLE RESIDUE

The "normalized residue" is the residue divided by Γ_{pole}.

Normalized residue in $N\pi \to N(2190) \to \Lambda K$

MODULUS (%)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
3±1	**20 ± 15**	ANISOVICH	12A	DPWA	Multichannel

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	$N\omega$	seen
Γ_4	ΛK	seen
Γ_5	ΣK	
Γ_6	$N\pi\pi$	seen
Γ_7	$N\rho$	seen
Γ_8	$p\gamma$	0.02–0.06 %
Γ_9	$p\gamma$, helicity=1/2	0.02–0.04 %
Γ_{10}	$p\gamma$, helicity=3/2	0.002–0.02 %

N(2190) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ — Γ_1/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
10 to 20 OUR ESTIMATE				
16 ± 2	ANISOVICH	12A	DPWA	Multichannel
23.8± 0.1	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
22 ± 1	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$
12 ± 6	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
14 ± 2	HOEHLER	79	IPWA	$\pi N \to \pi N$
16 ± 4	HENDRY	78	MPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
18 ±12	BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
23.0± 0.2	ARNDT	04	DPWA	$\pi N \to \pi N$, ηN
20 ± 4	VRANA	00	DPWA	Multichannel
23	ARNDT	95	DPWA	$\pi N \to N\pi$

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0 ±1	VRANA	00	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.1±0.3	BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
seen	WILLIAMS	09	IPWA	$\gamma p \to p\omega$

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0.5±0.3	ANISOVICH	12A	DPWA	Multichannel

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(2190) \to \Lambda K$ — $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.02	BELL	83	DPWA	$\pi^- p \to \Lambda K^0$
−0.02	SAXON	80	DPWA	$\pi^- p \to \Lambda K^0$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \to N(2190) \to N\rho$, S=3/2, D-wave — $(\Gamma_1\Gamma_0)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
−0.25±0.03	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$

$\Gamma(N\rho, S=3/2, D\text{-wave})/\Gamma_{total}$ — Γ_0/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
29±28	VRANA	00	DPWA	Multichannel

N(2190) PHOTON DECAY AMPLITUDES

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

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

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
−0.065±0.008	ANISOVICH	12A	DPWA	Multichannel

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

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.035±0.017	ANISOVICH	12A	DPWA	Multichannel

$N(2190) \to p\gamma$, ratio of helicity amplitudes $A_{3/2}/A_{1/2}$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.17±0.15	WILLIAMS	09	IPWA	$\gamma p \to p\omega$

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

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

$(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{total}$ 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.

N(2190) REFERENCES

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

ANISOVICH	12A	EPJ A48 15	A.V. Anisovich *et al.*	(BONN, PNPI)
BATINIC	10	PR C82 038203	M. Batinic *et al.*	(ZAGR)
WILLIAMS	09	PR C80 065209	M. Williams *et al.*	(CEBAF CLAS Collab.)
ARNDT	06	PR C74 045205	R.A. Arndt *et al.*	(GWU)
PDG	06	JPG 33 1	W.-M. Yao *et al.*	(PDG Collab.)
ARNDT	04	PR C69 035213	R.A. Arndt *et al.*	(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 *et al.*	(VPI, BRCO)
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KENT) IJP
Also		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		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 1	M. Roos *et al.*	(HELS, CIT, CERN)
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky *et al.*	(CMU, LBL) IJP
Also		PR D20 2839	R.E. Cutkosky *et al.*	(CMU, LBL) IJP
SAXON	80	NP B162 522	D.H. Saxon *et al.*	(RHEL, BRIS) IJP
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP
HENDRY	78	PRL 41 222	A.W. Hendry	(IND, LBL) IJP
Also		ANP 136 1	A.W. Hendry	(IND)