$N(2220)\ 9/2^+$

$I(J^P) = \frac{1}{2}(\frac{9}{2}^+)$ 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 1980 were last included in our 2006 edition, Journal of Physics, G **33** 1 (2006).

N(2220) BREIT-WIGNER MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2200 to 2300 (≈ 2250) OUR ESTIMATE				
2316.3± 2.9	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
2230 ± 80	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
2205 ± 10	HOEHLER	79	IPWA	$\pi N \to \pi N$
2300 ±100	HENDRY	78	MPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2270 ± 11	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
2258	ARNDT	95	DPWA	$\pi N \to N\pi$

N(2220) BREIT-WIGNER WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
350 to 500 (≈ 400) OUR ESTIMATE				
633± 17	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
500±150	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
365± 30	HOEHLER	79	IPWA	$\pi N \to \pi N$
450±150	HENDRY	78	MPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
366± 42	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
334	ARNDT	95	DPWA	$\pi N \to N\pi$

N(2220) POLE POSITION

REAL PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2130 to 2200 (≈ 2170) OUR ESTIMATE				
2150±35	ANISOVICH	12A	DPWA	Multichannel
2199	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
2135	[1] HOEHLER	93	ARGD	$\pi N \to \pi N$
2160±80	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2209	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
2203	ARNDT	95	DPWA	$\pi N \to N\pi$
2253	ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
400 to 560 (≈ 480) OUR ESTIMATE				
440± 40	ANISOVICH	12A	DPWA	Multichannel
372	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
400	[2] HOEHLER	93	ARGD	$\pi N \to \pi N$
480±100	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
564	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
536	ARNDT	95	DPWA	$\pi N \to N\pi$
640	ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

N(2220) ELASTIC POLE RESIDUE

MODULUS |r|

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
60±12	ANISOVICH	12A	DPWA	Multichannel
33	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
40	HOEHLER	93	ARGD	$\pi N \to \pi N$
45±20	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
96	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
68	ARNDT	95	DPWA	$\pi N \to N\pi$
85	ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
−58±12	ANISOVICH	12A	DPWA	Multichannel
−33	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
−50	HOEHLER	93	ARGD	$\pi N \to \pi N$
−45±25	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−71	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
−43	ARNDT	95	DPWA	$\pi N \to N\pi$
−62	ARNDT	91	DPWA	$\pi N \to \pi N$ Soln SM90

N(2220) DECAY MODES

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

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	15–25 %
Γ_2	$N\eta$	
Γ_3	ΛK	

N(2220) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ Γ_1/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
15 to 25 OUR ESTIMATE				
24 ±5	ANISOVICH	12A	DPWA	Multichannel
24.6±0.1	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
15 ±3	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
18.0±1.5	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$
12 ±4	HENDRY	78	MPWA	$\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
20.0±0.6	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
26	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \rightarrow N(2220) \rightarrow \Lambda K$ $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
not required	BELL	83	DPWA	$\pi^- p \rightarrow \Lambda K^0$
not seen	SAXON	80	DPWA	$\pi^- p \rightarrow \Lambda K^0$

N(2220) PHOTON DECAY AMPLITUDES

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

$N(2220) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
<0.01	[3] ANISOVICH	12A	DPWA	Multichannel

$N(2220) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
<0.01	[3] ANISOVICH	12A	DPWA	Multichannel

N(2220) 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] 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.

[3] This ANISOVICH 12A value is the complex helicity amplitude at the pole position.

N(2220) REFERENCES

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

ANISOVICH	12A	EPJ A48 15	A.V. Anisovich *et al.*	(BONN, PNPI)
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)
ARNDT	95	PR C52 2120	R.A. Arndt *et al.*	(VPI, BRCO)
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)
ARNDT	91	PR D43 2131	R.A. Arndt *et al.*	(VPI, TELE) IJP
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)