

$N(2220) H_{19}$

$$I(J^P) = \frac{1}{2}(\frac{9}{2}^+) \text{ Status: } ****$$

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

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

$N(2220)$ BREIT-WIGNER WIDTH

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

$N(2220)$ POLE POSITION

REAL PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2130 to 2200 (\approx 2170) OUR ESTIMATE			
2199	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
2135	¹ HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
2160 \pm 80	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2209	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
2203	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
2253	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

– 2×IMAGINARY PART

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

N(2220) ELASTIC POLE RESIDUE

MODULUS $|r|$

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

PHASE θ

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

N(2220) DECAY MODES

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

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\pi$	10–20 %
Γ_2 $N\eta$	
Γ_3 ΛK	

N(2220) 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				
0.246 ± 0.001	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
0.15 ± 0.03	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
0.18 ± 0.015	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$
0.12 ± 0.04	HENDRY	78	MPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.200 ± 0.006	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
0.26	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$

$(\Gamma_i \Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(2220) \rightarrow \Lambda K$				$(\Gamma_1 \Gamma_3)^{1/2}/\Gamma$
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
not required	BELL	83	DPWA	$\pi^- p \rightarrow \Lambda K^0$
not seen	SAXON	80	DPWA	$\pi^- p \rightarrow \Lambda K^0$

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.
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N(2220) REFERENCES

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

ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
ARNDT	04	PR C69 035213	R.A. Arndt <i>et al.</i>	(GWU, TRIU)
ARNDT	95	PR C52 2120	R.A. Arndt <i>et al.</i>	(VPI, BRCO)
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)
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
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELSE, CIT, CERN)
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
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(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)