$N(2220)$ H_{19}

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

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 ($\approx$ 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	$\pi N \to \pi N$
$\bullet\bullet\bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet\bullet\bullet$				
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 ($\approx$ 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	$\pi N \to \pi N$
$\bullet\bullet\bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet\bullet\bullet$				
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 ($\approx$ 2170) OUR ESTIMATE				
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	$\pi N \to \pi N$
$\bullet\bullet\bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet\bullet\bullet$				
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

$-2\times$IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
400 to 560 ($\approx$ 480) OUR ESTIMATE				
372	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
400	[1] HOEHLER	93	ARGD	$\pi N \to \pi N$
480$\pm$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
33	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
40	HOEHLER	93	ARGD	$\pi N \to \pi N$
45$\pm$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
-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	$N\pi$	10–20 %
Γ_2	$N\eta$	
Γ_3	ΛK	

N(2220) BRANCHING RATIOS

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.1 to 0.2 OUR ESTIMATE				
0.246 ± 0.001	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$
0.15 ± 0.03	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
0.18 ± 0.015	HOEHLER	79	IPWA	$\pi N \to \pi N$
0.12 ± 0.04	HENDRY	78	MPWA	$\pi N \to \pi N$

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

0.200 ± 0.006	ARNDT	04	DPWA	$\pi N \to \pi N, \eta N$
0.26	ARNDT	95	DPWA	$\pi N \to N\pi$

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

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

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.

N(2220) REFERENCES

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

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)