

$N(2220) \ 9/2^+$  $I(J^P) = \frac{1}{2}(\frac{9}{2}^+)$  Status: \*\*\*\*

Older and obsolete values are listed and referenced in the 2014 edition, Chinese Physics **C38** 070001 (2014).

 **$N(2220)$  POLE POSITION****REAL PART**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>2130 to 2200 (<math>\approx</math> 2170) OUR ESTIMATE</b>			
$2127 \pm 3 \pm 24$	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
$2150 \pm 35$	ANISOVICH	12A	DPWA Multichannel
$2160 \pm 80$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2171	ROENCHEN	15A	DPWA Multichannel
2199	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
2135	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$

<sup>1</sup>Fit to the amplitudes of HOEHLER 79.

**-2xIMAGINARY PART**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>360 to 480 (<math>\approx</math> 400) OUR ESTIMATE</b>			
$380 \pm 7 \pm 22$	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
$440 \pm 40$	ANISOVICH	12A	DPWA Multichannel
$480 \pm 100$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
593	ROENCHEN	15A	DPWA Multichannel
372	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
400	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$

<sup>1</sup>Fit to the amplitudes of HOEHLER 79.

 **$N(2220)$  ELASTIC POLE RESIDUE****MODULUS  $|r|$** 

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>35 to 60 (<math>\approx</math> 45) OUR ESTIMATE</b>			
$38 \pm 1 \pm 5$	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
$60 \pm 12$	ANISOVICH	12A	DPWA Multichannel
$45 \pm 20$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
62	ROENCHEN	15A	DPWA Multichannel
33	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
40	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$

<sup>1</sup>Fit to the amplitudes of HOEHLER 79.

**PHASE  $\theta$** 

<u>VALUE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>–60 to –30 (<math>\approx</math> –50) OUR ESTIMATE</b>			
–52 $\pm$ 1 $\pm$ 14	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
–58 $\pm$ 12	ANISOVICH	12A	DPWA Multichannel
–45 $\pm$ 25	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
–59	ROENCHEN	15A	DPWA Multichannel
–33	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
–50	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
<sup>1</sup> Fit to the amplitudes of HOEHLER 79.			

 **$N(2220)$  INELASTIC POLE RESIDUE**

The “normalized residue” is the residue divided by  $\Gamma_{pole}/2$ .

**Normalized residue in  $N\pi \rightarrow N(2220) \rightarrow N\eta$** 

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.004	–101	ROENCHEN	15A	DPWA Multichannel

**Normalized residue in  $N\pi \rightarrow N(2220) \rightarrow \Lambda K$** 

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.007	62	ROENCHEN	15A	DPWA Multichannel

**Normalized residue in  $N\pi \rightarrow N(2220) \rightarrow \Sigma K$** 

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.009	–128	ROENCHEN	15A	DPWA Multichannel

 **$N(2220)$  BREIT-WIGNER MASS**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2200 to 2300 (<math>\approx</math> 2250) OUR ESTIMATE</b>			
2316.3 $\pm$ 2.9	<sup>1</sup> 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 $\pi N \rightarrow \pi N$

<sup>1</sup>Statistical error only.

 **$N(2220)$  BREIT-WIGNER WIDTH**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>350 to 500 (<math>\approx</math> 400) OUR ESTIMATE</b>			
633 $\pm$ 17	<sup>1</sup> 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 $\pi N \rightarrow \pi N$

<sup>1</sup>Statistical error only.

**$N(2220)$  DECAY MODES**

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

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\pi$	15–30 %

 **$N(2220)$  BRANCHING RATIOS**

$\Gamma(N\pi)/\Gamma_{\text{total}}$					$\Gamma_1/\Gamma$
VALUE (%)	DOCUMENT ID	TECN	COMMENT		
<b>15 to 30 (<math>\approx 25</math>) OUR ESTIMATE</b>					
24 $\pm$ 5	ANISOVICH	12A	DPWA	Multichannel	
24.6 $\pm$ 0.1	<sup>1</sup> ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$	
15 $\pm$ 3	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$	
18.0 $\pm$ 1.5	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$	
<sup>1</sup> Statistical error only.					

 **$N(2220)$  PHOTON DECAY AMPLITUDES AT THE POLE** **$N(2220) \rightarrow p\gamma$ , helicity-1/2 amplitude  $A_{1/2}$** 

MODULUS ( $\text{GeV}^{-1/2}$ )	PHASE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$-0.233^{+0.084}_{-0.044}$	$-47^{+10}_{-6}$	ROENCHEN	14	DPWA
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.135	114	ROENCHEN	15A	DPWA Multichannel

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

MODULUS ( $\text{GeV}^{-1/2}$ )	PHASE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$0.162^{+0.041}_{-0.038}$	$-27^{+26}_{-13}$	ROENCHEN	14	DPWA
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.082	-41	ROENCHEN	15A	DPWA Multichannel

 **$N(2220)$  REFERENCES**For early references, see Physics Letters **111B** 1 (1982).

ROENCHEN	15A	EPJ A51 70	D. Roenchen <i>et al.</i>	
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
ROENCHEN	14	EPJ A50 101	D. Roenchen <i>et al.</i>	
Also		EPJ A51 63 (errat.)	D. Roenchen <i>et al.</i>	
SVARC	14	PR C89 045205	A. Svarc <i>et al.</i>	(RBI Zagreb, UNI Tuzla)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
HOEHLER	93	$\pi N$ Newsletter 9 1	G. Hohler	(KARL)
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
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP