

**$N(2250) 9/2^-$**  $I(J^P) = \frac{1}{2}(\frac{9}{2}^-)$  Status: \*\*\*\*Older and obsolete values are listed and referenced in the 2014 edition, Chinese Physics **C38** 070001 (2014). **$N(2250)$  POLE POSITION****REAL PART**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>2100 to 2200 (<math>\approx</math> 2150) OUR ESTIMATE</b>			
2095 $\pm$ 10	ROENCHEN	22	DPWA Multichannel
2195 $\pm$ 45	AFZAL	20	DPWA Multichannel
2157 $\pm$ 3 $\pm$ 14	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
2195 $\pm$ 45	ANISOVICH	12A	DPWA Multichannel
2150 $\pm$ 50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2127	HUNT	19	DPWA Multichannel
2062	ROENCHEN	15A	DPWA Multichannel
2217	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
2187	HOEHLER	93	SPED $\pi N \rightarrow \pi N$

<sup>1</sup> Fit to the amplitudes of HOEHLER 79.**-2xIMAGINARY PART**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>350 to 500 (<math>\approx</math> 420) OUR ESTIMATE</b>			
422 $\pm$ 13	ROENCHEN	22	DPWA Multichannel
470 $\pm$ 50	AFZAL	20	DPWA Multichannel
412 $\pm$ 7 $\pm$ 44	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
470 $\pm$ 50	ANISOVICH	12A	DPWA Multichannel
360 $\pm$ 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
262	HUNT	19	DPWA Multichannel
403	ROENCHEN	15A	DPWA Multichannel
431	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
388	HOEHLER	93	SPED $\pi N \rightarrow \pi N$

<sup>1</sup> Fit to the amplitudes of HOEHLER 79. **$N(2250)$  ELASTIC POLE RESIDUE****MODULUS  $|r|$** 

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>15 to 30 (<math>\approx</math> 25) OUR ESTIMATE</b>			
14 $\pm$ 1	ROENCHEN	22	DPWA Multichannel
24 $\pm$ 1 $\pm$ 5	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
26 $\pm$ 5	ANISOVICH	12A	DPWA Multichannel
20 $\pm$ 6	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

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

8.2	ROENCHEN	15A	DPWA	Multichannel
21	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
21	HOEHLER	93	SPED	$\pi N \rightarrow \pi N$

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

### PHASE $\theta$

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>−60 to −20 (≈ −40) OUR ESTIMATE</b>			
−67 ± 9	ROENCHEN	22	DPWA Multichannel
−62 ± 1 ± 11	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
−38 ± 25	ANISOVICH	12A	DPWA Multichannel
−50 ± 20	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

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

−64	ROENCHEN	15A	DPWA	Multichannel
−20	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$

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

## N(2250) INELASTIC POLE RESIDUE

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

### Normalized residue in $N\pi \rightarrow N(2250) \rightarrow N\eta$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.018 ± 0.001	−89 ± 5	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.017	−89	ROENCHEN	15A	DPWA Multichannel

### Normalized residue in $N\pi \rightarrow N(2250) \rightarrow \Lambda K$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.003 ± 0.001	80 ± 5	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.006	−101	ROENCHEN	15A	DPWA Multichannel

### Normalized residue in $N\pi \rightarrow N(2250) \rightarrow \Sigma K$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.004 ± 0.002	−111 ± 5	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.002	70	ROENCHEN	15A	DPWA Multichannel

## N(2250) BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>2250 to 2320 (≈ 2280) OUR ESTIMATE</b>			
2200 ± 10	<sup>1</sup> HUNT	19	DPWA Multichannel
2280 ± 40	ANISOVICH	12A	DPWA Multichannel
2302 ± 6	<sup>1</sup> ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
2250 ± 80	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
2268 ± 15	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$

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

### ***N*(2250) BREIT-WIGNER WIDTH**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>300 to 600 (<math>\approx</math> 500) OUR ESTIMATE</b>			
343 $\pm$ 51	<sup>1</sup> HUNT	19	DPWA Multichannel
520 $\pm$ 50	ANISOVICH	12A	DPWA Multichannel
628 $\pm$ 28	<sup>1</sup> ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
480 $\pm$ 120	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
300 $\pm$ 40	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$

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

### ***N*(2250) DECAY MODES**

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

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\pi$	5–15 %
$\Gamma_2$ $N\eta$	<5 %
$\Gamma_3$ $\Lambda K$	1–3 %

### ***N*(2250) BRANCHING RATIOS**

<u><math>\Gamma(N\pi)/\Gamma_{\text{total}}</math></u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$\Gamma_1/\Gamma$
<b>5–15 % OUR ESTIMATE</b>				
8.5 $\pm$ 0.4	<sup>1</sup> HUNT	19	DPWA Multichannel	
12 $\pm$ 4	ANISOVICH	12A	DPWA Multichannel	
8.9 $\pm$ 0.1	<sup>1</sup> ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$	
10 $\pm$ 2	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$	
10 $\pm$ 2	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$	

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

<u><math>\Gamma(N\eta)/\Gamma_{\text{total}}</math></u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$\Gamma_2/\Gamma$
<b>&lt;5 % OUR ESTIMATE</b>				
<5	<sup>1</sup> HUNT	19	DPWA Multichannel	

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

<u><math>\Gamma(\Lambda K)/\Gamma_{\text{total}}</math></u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$\Gamma_3/\Gamma$
<b>1–3 % OUR ESTIMATE</b>				
2.0 $\pm$ 0.6	<sup>1</sup> HUNT	19	DPWA Multichannel	

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

## **$N(2250)$ PHOTON DECAY AMPLITUDES AT THE POLE**

### **$N(2250) \rightarrow p\gamma$ , helicity-1/2 amplitude $A_{1/2}$**

<u>MODULUS (<math>\text{GeV}^{-1/2}</math>)</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$-0.108 \pm 0.007$	$112 \pm 4$	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.026	-26	ROENCHEN	15A	DPWA Multichannel

### **$N(2250) \rightarrow p\gamma$ , helicity-3/2 amplitude $A_{3/2}$**

<u>MODULUS (<math>\text{GeV}^{-1/2}</math>)</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.050 \pm 0.011$	$69 \pm 8$	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.119	-42	ROENCHEN	15A	DPWA Multichannel

## **$N(2250)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES**

### **$N(2250) \rightarrow p\gamma$ , helicity-1/2 amplitude $A_{1/2}$**

<u>VALUE (<math>\text{GeV}^{-1/2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.0006 \pm 0.0037$	<sup>1</sup> HUNT	19	DPWA Multichannel
<sup>1</sup> Statistical error only.			

### **$N(2250) \rightarrow p\gamma$ , helicity-3/2 amplitude $A_{3/2}$**

<u>VALUE (<math>\text{GeV}^{-1/2}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.013 \pm 0.004$	<sup>1</sup> HUNT	19	DPWA Multichannel
<sup>1</sup> Statistical error only.			

## **$N(2250)$ REFERENCES**

ROENCHEN	22	EPJ A58 229	D. Roenchen <i>et al.</i>	(JULI, GWU, BONN+)
AFZAL	20	PRL 125 152002	F. Afzal <i>et al.</i>	(CBELSA/TAPS Collab.)
HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
ROENCHEN	15A	EPJ A51 70	D. Roenchen <i>et al.</i>	
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
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