

$\Delta(1930) 5/2^-$  $I(J^P) = \frac{3}{2}(\frac{5}{2}^-)$  Status: \*\*\*

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

 **$\Delta(1930)$  POLE POSITION****REAL PART**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>1840 to 1920 (<math>\approx 1880</math>) OUR ESTIMATE</b>			
$1848 \pm 9 \pm 19$	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
$1890 \pm 50$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1836	ROENCHEN	15A	DPWA Multichannel
1882	SHRESTHA	12A	DPWA Multichannel
2001	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1883	VRANA	00	DPWA Multichannel
1850	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>230 to 330 (<math>\approx 280</math>) OUR ESTIMATE</b>			
$321 \pm 17 \pm 7$	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
$260 \pm 60$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
724	ROENCHEN	15A	DPWA Multichannel
187	SHRESTHA	12A	DPWA Multichannel
387	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
250	VRANA	00	DPWA Multichannel
180	HOEHLER	93	SPED $\pi N \rightarrow \pi N$

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

 **$\Delta(1930)$  ELASTIC POLE RESIDUE****MODULUS  $|r|$** 

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>8 to 20 (<math>\approx 14</math>) OUR ESTIMATE</b>			
$9 \pm 1 \pm 1$	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
$18 \pm 6$	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
34	ROENCHEN	15A	DPWA Multichannel
7	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
20	HOEHLER	93	SPED $\pi N \rightarrow \pi N$

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

**PHASE  $\theta$** 

VALUE ( $^{\circ}$ )	DOCUMENT ID	TECN	COMMENT
<b>– 40 to –10 (<math>\approx</math> –30) OUR ESTIMATE</b>			
– 37 $\pm$ 3 $\pm$ 7	<sup>1</sup> SVARC	14	L+P $\pi N \rightarrow \pi N$
– 20 $\pm$ 40	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
– 155	ROENCHEN	15A	DPWA Multichannel
– 12	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
<sup>1</sup> Fit to the amplitudes of HOEHLER 79.			

 **$\Delta(1930)$  INELASTIC POLE RESIDUE**

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

**Normalized residue in  $N\pi \rightarrow \Delta(1930) \rightarrow \Sigma K$** 

MODULUS	PHASE ( $^{\circ}$ )	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.043	–0.5	ROENCHEN	15A	DPWA Multichannel

**Normalized residue in  $N\pi \rightarrow \Delta(1930) \rightarrow \Delta\pi, D$ -wave**

MODULUS	PHASE ( $^{\circ}$ )	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.15	30	ROENCHEN	15A	DPWA Multichannel

**Normalized residue in  $N\pi \rightarrow \Delta(1930) \rightarrow \Delta\pi, G$ -wave**

MODULUS	PHASE ( $^{\circ}$ )	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.009	121	ROENCHEN	15A	DPWA Multichannel

 **$\Delta(1930)$  BREIT-WIGNER MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>1900 to 2000 (<math>\approx</math> 1950) OUR ESTIMATE</b>			
1930 $\pm$ 12	<sup>1</sup> SHRESTHA	12A	DPWA Multichannel
2233 $\pm$ 53	<sup>1</sup> ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1940 $\pm$ 30	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
1901 $\pm$ 15	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1932 $\pm$ 100	VRANA	00	DPWA Multichannel
<sup>1</sup> Statistical error only.			

 **$\Delta(1930)$  BREIT-WIGNER WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>200 to 400 (<math>\approx</math> 300) OUR ESTIMATE</b>			
235 $\pm$ 39	<sup>1</sup> SHRESTHA	12A	DPWA Multichannel
773 $\pm$ 187	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
320 $\pm$ 60	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
195 $\pm$ 60	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
316 $\pm$ 237	VRANA	00	DPWA Multichannel

<sup>1</sup>Statistical error only. **$\Delta(1930)$  DECAY MODES**

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

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\pi$	5–15 %
$\Gamma_2$ $N\gamma$	0.0–0.01 %
$\Gamma_3$ $N\gamma$ , helicity=1/2	0.0–0.005 %
$\Gamma_4$ $N\gamma$ , helicity=3/2	0.0–0.004 %

 **$\Delta(1930)$  BRANCHING RATIOS**

$\Gamma(N\pi)/\Gamma_{\text{total}}$					$\Gamma_1/\Gamma$
VALUE (%)	DOCUMENT ID	TECN	COMMENT		
<b>5 to 15 (<math>\approx 10</math>) OUR ESTIMATE</b>					
$7.9 \pm 0.4$	<sup>1</sup> SHRESTHA	12A	DPWA	Multichannel	
$8.1 \pm 1.2$	<sup>1</sup> ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$	
$14 \pm 4$	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$	
$4 \pm 3$	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$9 \pm 8$	VRANA	00	DPWA	Multichannel	
<sup>1</sup> Statistical error only.					

 **$\Delta(1930)$  PHOTON DECAY AMPLITUDES AT THE POLE** **$\Delta(1930) \rightarrow N\gamma$ , helicity-1/2 amplitude  $A_{1/2}$** 

MODULUS ( $\text{GeV}^{-1/2}$ )	PHASE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$0.130^{+0.073}_{-0.096}$	$-50^{+77}_{-26}$	ROENCHEN	14	DPWA
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.270$	33	ROENCHEN	15A	DPWA Multichannel

 **$\Delta(1930) \rightarrow N\gamma$ , helicity-3/2 amplitude  $A_{3/2}$** 

MODULUS ( $\text{GeV}^{-1/2}$ )	PHASE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$-0.056^{+0.003}_{-0.151}$	$168^{+72}_{-76}$	ROENCHEN	14	DPWA
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.153	81	ROENCHEN	15A	DPWA Multichannel

 **$\Delta(1930)$  BREIT-WIGNER PHOTON DECAY AMPLITUDES** **$\Delta(1930) \rightarrow N\gamma$ , helicity-1/2 amplitude  $A_{1/2}$** 

VALUE ( $\text{GeV}^{-1/2}$ )	DOCUMENT ID	TECN	COMMENT
$-0.007 \pm 0.010$	<sup>1</sup> ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.011 \pm 0.003$	<sup>1</sup> SHRESTHA	12A	DPWA Multichannel
<sup>1</sup> Statistical error only.			

## $\Delta(1930) \rightarrow N\gamma$ , helicity-3/2 amplitude $A_{3/2}$

VALUE (GeV <sup>-1/2</sup> )	DOCUMENT ID	TECN	COMMENT
0.005±0.010	<sup>1</sup> ARNDT	96	IPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.002±0.002	<sup>1</sup> SHRESTHA	12A	DPWA Multichannel
<sup>1</sup> Statistical error only.			

## $\Delta(1930)$ 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)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman, T.-S.H. Lee	(PITT, ANL)
ARNDT	96	PR C53 430	R.A. Arndt, I.I. Strakovsky, R.L. Workman	(VPI)
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