

$N(1990) 7/2^+$ $I(J^P) = \frac{1}{2}(7^+)$ Status: **

OMITTED FROM SUMMARY TABLE

Older and obsolete values are listed and referenced in the 2014 edition, Chinese Physics **C38** 070001 (2014). **$N(1990)$ POLE POSITION****REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1861 ± 5	ROENCHEN 22	DPWA	Multichannel
2030 ± 65	ANISOVICH 12A	DPWA	Multichannel
1900 ± 30	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1913	HUNT 19	DPWA	Multichannel
1738	ROENCHEN 15A	DPWA	Multichannel
2301	VRANA 00	DPWA	Multichannel

– 2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
72 ± 3	ROENCHEN 22	DPWA	Multichannel
240 ± 60	ANISOVICH 12A	DPWA	Multichannel
260 ± 60	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
163	HUNT 19	DPWA	Multichannel
188	ROENCHEN 15A	DPWA	Multichannel
202	VRANA 00	DPWA	Multichannel

 $N(1990)$ ELASTIC POLE RESIDUE**MODULUS $|r|$**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.16 ± 0.01	ROENCHEN 22	DPWA	Multichannel
2 ± 1	ANISOVICH 12A	DPWA	Multichannel
9 ± 3	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
4.3	ROENCHEN 15A	DPWA	Multichannel

PHASE θ

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
– 119 ± 2	ROENCHEN 22	DPWA	Multichannel
125 ± 65	ANISOVICH 12A	DPWA	Multichannel
– 60 ± 30	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
– 70	ROENCHEN 15A	DPWA	Multichannel

$\Delta(1990)$ INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \rightarrow N(1990) \rightarrow N\eta$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.048\pm0.001	-43 \pm 2	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.013	-82	ROENCHEN	15A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1990) \rightarrow \Lambda K$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.004\pm0.001	133 \pm 2	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.022	-111	ROENCHEN	15A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1990) \rightarrow \Sigma K$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.010 \pm 0.002	-54 \pm 2	ROENCHEN	22	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.005	24	ROENCHEN	15A	DPWA Multichannel

$N(1990)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1950 to 2100 (\approx 2020) OUR ESTIMATE			
2028 \pm 19	¹ HUNT	19	DPWA Multichannel
2060 \pm 65	ANISOVICH	12A	DPWA Multichannel
1970 \pm 50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
2005 \pm 150	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1990 \pm 45	¹ SHRESTHA	12A	DPWA Multichannel
2311 \pm 16	VRANA	00	DPWA Multichannel

¹Statistical error only.

$N(1990)$ BREIT-WIGNER WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
200 to 400 (\approx 300) OUR ESTIMATE			
490 \pm 110	¹ HUNT	19	DPWA Multichannel
240 \pm 50	ANISOVICH	12A	DPWA Multichannel
350 \pm 120	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
350 \pm 100	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
203 \pm 161	¹ SHRESTHA	12A	DPWA Multichannel
205 \pm 72	VRANA	00	DPWA Multichannel

¹Statistical error only.

N(1990) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $N\pi$	2–6 %
Γ_2 $N\eta$	<3 %
Γ_3 ΛK	5.9–6.1 %
Γ_4 $p\gamma$	0.01–0.12%
Γ_5 $p\gamma$, helicity=1/2	0.003–0.042%
Γ_6 $p\gamma$, helicity=3/2	0.009–0.075 %
Γ_7 $n\gamma$	0.01–0.16 %
Γ_8 $n\gamma$, helicity=1/2	0.003–0.066 %
Γ_9 $n\gamma$, helicity=3/2	0.003–0.098 %

N(1990) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
2–6 % OUR ESTIMATE					
1.9 ± 0.4	¹ HUNT	19	DPWA	Multichannel	
2 ± 1	ANISOVICH	12A	DPWA	Multichannel	
6 ± 2	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$	
4 ± 2	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2 ± 1	¹ SHRESTHA	12A	DPWA	Multichannel	
22 ± 11	VRANA	00	DPWA	Multichannel	
¹ Statistical error only.					

$\Gamma(N\eta)/\Gamma_{\text{total}}$					Γ_2/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<3 % OUR ESTIMATE					
1 ± 1	MUELLER	20	DPWA	Multichannel	
1.7 ± 0.9	¹ HUNT	19	DPWA	Multichannel	
¹ Statistical error only.					

$\Gamma(\Lambda K)/\Gamma_{\text{total}}$					Γ_3/Γ
<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
5.9–6.1 % OUR ESTIMATE					
6.0 ± 0.1	¹ HUNT	19	DPWA	Multichannel	
¹ Statistical error only.					

N(1990) PHOTON DECAY AMPLITUDES AT THE POLE

N(1990) → pγ, helicity-1/2 amplitude $A_{1/2}$

<u>MODULUS ($\text{GeV}^{-1/2}$)</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
−0.030 ± 0.008	−135 ± 13	ROENCHEN	22	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.029	67	ROENCHEN	15A	DPWA	Multichannel

$N(1990) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>MODULUS ($\text{GeV}^{-1/2}$)</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.018 ± 0.006	53 ± 16	ROENCHEN	22	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.033	39	ROENCHEN	15A	DPWA Multichannel

$N(1990)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES

$N(1990) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.006 ± 0.003	¹ HUNT	19	DPWA Multichannel
0.040 ± 0.012	ANISOVICH	12A	DPWA Multichannel

¹Statistical error only.

$N(1990) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.055 ± 0.008	¹ HUNT	19	DPWA Multichannel
0.057 ± 0.012	ANISOVICH	12A	DPWA Multichannel

¹Statistical error only.

$N(1990) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.027 ± 0.024	¹ HUNT	19	DPWA Multichannel
-0.045 ± 0.020	ANISOVICH	13B	DPWA Multichannel

¹Statistical error only.

$N(1990) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.051 ± 0.020	¹ HUNT	19	DPWA Multichannel
-0.052 ± 0.027	ANISOVICH	13B	DPWA Multichannel

¹Statistical error only.

$N(1990)$ REFERENCES

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

ROENCHEN	22	EPJ A58 229	D. Roenchen <i>et al.</i>	(JULI, GWU, BONN+)
MUELLER	20	PL B803 135323	J. Mueller <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.)
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich <i>et al.</i>	
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman, T.-S.H. Lee	(PITT, ANL)
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