

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

OMITTED FROM SUMMARY TABLE

Most of the results published before 1975 are now obsolete and have been omitted. They may be found in our 1982 edition, *Physics Letters* **111B** 1 (1982). Some further obsolete results published before 1984 were last included in our 2006 edition, *Journal of Physics* **G33** 1 (2006).

The various analyses do not agree very well with one another.

The latest GWU analysis (ARNDT 06) finds no evidence for this resonance.

 $N(1990)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
≈ 1990 OUR ESTIMATE			
2060 \pm 65	ANISOVICH	12A	DPWA Multichannel
1970 \pm 50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
2005 \pm 150	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
1999	BARBOUR	78	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1990 \pm 45	SHRESTHA	12A	DPWA Multichannel
2311 \pm 16	VRANA	00	DPWA Multichannel
2086 \pm 28	MANLEY	92	IPWA $\pi N \rightarrow \pi N$ & $N\pi\pi$

 $N(1990)$ BREIT-WIGNER WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
240 \pm 50	ANISOVICH	12A	DPWA Multichannel
350 \pm 120	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
350 \pm 100	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
216	BARBOUR	78	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
203 \pm 161	SHRESTHA	12A	DPWA Multichannel
205 \pm 72	VRANA	00	DPWA Multichannel
535 \pm 120	MANLEY	92	IPWA $\pi N \rightarrow \pi N$ & $N\pi\pi$

 $N(1990)$ POLE POSITION**REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2030 \pm 65	ANISOVICH	12A	DPWA Multichannel
1900 \pm 30	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1941	SHRESTHA	12A	DPWA Multichannel
2301	VRANA	00	DPWA Multichannel
not seen	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

–2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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. ● ● ●			
130	SHRESTHA 12A	DPWA	Multichannel
202	VRANA 00	DPWA	Multichannel
not seen	ARNDT 91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90

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

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2±1	ANISOVICH 12A	DPWA	Multichannel
9±3	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$

PHASE θ

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
125±65	ANISOVICH 12A	DPWA	Multichannel
– 60±30	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$

N(1990) DECAY MODES

Mode
Γ_1 $N\pi$
Γ_2 $N\eta$
Γ_3 ΛK
Γ_4 ΣK
Γ_5 $N\pi\pi$
Γ_6 $p\gamma$, helicity=1/2
Γ_7 $p\gamma$, helicity=3/2
Γ_8 $n\gamma$, helicity=1/2
Γ_9 $n\gamma$, helicity=3/2

N(1990) BRANCHING RATIOS

<u>$\Gamma(N\pi)/\Gamma_{\text{total}}$</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	<u>Γ_1/Γ</u>
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	SHRESTHA 12A	DPWA	Multichannel	
22±11	VRANA 00	DPWA	Multichannel	
6±2	MANLEY 92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$	

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1990) \rightarrow N\eta$				$(\Gamma_1 \Gamma_2)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
-0.043	BAKER	79	DPWA	$\pi^- p \rightarrow n\eta$

$\Gamma(N\eta) / \Gamma_{\text{total}}$				Γ_2 / Γ
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
0±1	VRANA	00	DPWA	Multichannel

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1990) \rightarrow \Lambda K$				$(\Gamma_1 \Gamma_3)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
+0.01	BELL	83	DPWA	$\pi^- p \rightarrow \Lambda K^0$
not seen	SAXON	80	DPWA	$\pi^- p \rightarrow \Lambda K^0$
-0.021±0.033	DEVENISH	74B		Fixed- <i>t</i> dispersion rel.

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

-0.010±0.003	SHRESTHA	12A	DPWA	Multichannel
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$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1990) \rightarrow \Sigma K$				$(\Gamma_1 \Gamma_4)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
0.010 to 0.023	¹ DEANS	75	DPWA	$\pi N \rightarrow \Sigma K$
0.06	LANGBEIN	73	IPWA	$\pi N \rightarrow \Sigma K$ (sol. 1)

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(1990) \rightarrow N\pi\pi$				$(\Gamma_1 \Gamma_5)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	LONGACRE	75	IPWA	$\pi N \rightarrow N\pi\pi$

$N(1990)$ PHOTON DECAY AMPLITUDES

Papers on γN amplitudes predating 1981 may be found in our 2006 edition, *Journal of Physics* **G33** 1 (2006).

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

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT	
0.042±0.014	² ANISOVICH	12A	DPWA	Phase = $(-30 \pm 20)^\circ$
0.030±0.029	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.040	BARBOUR	78	DPWA	$\gamma N \rightarrow \pi N$

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

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT	
0.058±0.012	² ANISOVICH	12A	DPWA	Phase = $(-35 \pm 25)^\circ$
0.086±0.060	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
+0.004	BARBOUR	78	DPWA	$\gamma N \rightarrow \pi N$

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

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
-0.045 ± 0.020	ANISOVICH	13B	DPWA Multichannel
-0.001	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-0.069	BARBOUR	78	DPWA $\gamma N \rightarrow \pi N$

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

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
-0.052 ± 0.027	ANISOVICH	13B	DPWA Multichannel
-0.178	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-0.072	BARBOUR	78	DPWA $\gamma N \rightarrow \pi N$

$N(1990)$ FOOTNOTES

¹ The range given for DEANS 75 is from the four best solutions.

² This ANISOVICH 12A value is the complex helicity amplitude at the pole position.

$N(1990)$ REFERENCES

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

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)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman., T.-S.H. Lee	(PITT+)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KSA) IJP
Also		PR D30 904	D.M. Manley <i>et al.</i>	(VPI)
ARNDT	91	PR D43 2131	R.A. Arndt <i>et al.</i>	(VPI, TELE) IJP
BELL	83	NP B222 389	K.W. Bell <i>et al.</i>	(RL) IJP
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HEL, CIT, CERN)
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)
Also		NP B197 365	K. Fujii <i>et al.</i>	(NAGO)
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
SAXON	80	NP B162 522	D.H. Saxon <i>et al.</i>	(RHEL, BRIS) IJP
BAKER	79	NP B156 93	R.D. Baker <i>et al.</i>	(RHEL) IJP
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP
BARBOUR	78	NP B141 253	I.M. Barbour, R.L. Crawford, N.H. Parsons	(GLAS)
DEANS	75	NP B96 90	S.R. Deans <i>et al.</i>	(SFLA, ALAH) IJP
LONGACRE	75	PL 55B 415	R.S. Longacre <i>et al.</i>	(LBL, SLAC) IJP
DEVENISH	74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+)
LANGBEIN	73	NP B53 251	W. Langbein, F. Wagner	(MUNI) IJP