

$N(1675) 5/2^-$ $I(J^P) = \frac{1}{2}(\frac{5}{2}^-)$ Status: ****

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

 $N(1675)$ POLE POSITION**REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1655 to 1665 (≈ 1660) OUR ESTIMATE			
1655 \pm 4	SOKHOYAN	15A	DPWA Multichannel
1654 \pm 2	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
1660 \pm 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1646	HUNT	19	DPWA Multichannel
1646	ROENCHEN	15A	DPWA Multichannel
1640	SHKLYAR	13	DPWA Multichannel
1654 \pm 4	ANISOVICH	12A	DPWA Multichannel
1658 \pm 9	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1657	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1674	VRANA	00	DPWA Multichannel
1656	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$

¹Fit to the amplitudes of HOEHLER 79.

-2xIMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
125 to 150 (≈ 135) OUR ESTIMATE			
147 \pm 5	SOKHOYAN	15A	DPWA Multichannel
125 \pm 3 \pm 1	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
140 \pm 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
146	HUNT	19	DPWA Multichannel
125	ROENCHEN	15A	DPWA Multichannel
108	SHKLYAR	13	DPWA Multichannel
151 \pm 5	ANISOVICH	12A	DPWA Multichannel
137 \pm 7	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
139	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
120	VRANA	00	DPWA Multichannel
126	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$

¹Fit to the amplitudes of HOEHLER 79.

 $N(1675)$ ELASTIC POLE RESIDUE**MODULUS $|r|$**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
23 to 33 (≈ 28) OUR ESTIMATE			
28 \pm 1	SOKHOYAN	15A	DPWA Multichannel
23 \pm 1	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
31 \pm 5	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

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

24	ROENCHEN	15A	DPWA	Multichannel
20	SHKLYAR	13	DPWA	Multichannel
28 ± 1	ANISOVICH	12A	DPWA	Multichannel
25	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
27	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
23	HOEHLER	93	ARGD	$\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

PHASE θ

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
−30 to −20 (≈ −25) OUR ESTIMATE			
−24 ± 4	SOKHOYAN	15A	DPWA Multichannel
−25 ± 2	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
−30 ± 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

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

−22	ROENCHEN	15A	DPWA	Multichannel
−49	SHKLYAR	13	DPWA	Multichannel
−26 ± 4	ANISOVICH	12A	DPWA	Multichannel
−16	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
−21	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
−22	HOEHLER	93	ARGD	$\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

N(1675) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow \Delta\pi, D\text{-wave}$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.33 ± 0.04	90 ± 15	SOKHOYAN	15A	DPWA Multichannel
0.33 ± 0.05	82 ± 10	ANISOVICH	12A	DPWA Multichannel

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

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow N\eta$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.044	−43	ROENCHEN	15A	DPWA Multichannel

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

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow \Lambda K$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.001	100	ROENCHEN	15A	DPWA Multichannel

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

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow \Sigma K$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.031	−175	ROENCHEN	15A	DPWA Multichannel

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

Normalized residue in $N\pi \rightarrow N(1675) \rightarrow N\sigma$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.13±0.03	125 ± 20	SOKHOYAN	15A DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.15±0.04	132 ± 18	ANISOVICH	12A DPWA	Multichannel

 $N(1675)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1665 to 1680 (≈ 1675) OUR ESTIMATE			
1669 ± 2	¹ HUNT	19 DPWA	Multichannel
1663 ± 4	SOKHOYAN	15A DPWA	Multichannel
1666 ± 2	¹ SHKLYAR	13 DPWA	Multichannel
1674.1± 0.2	¹ ARNDT	06 DPWA	$\pi N \rightarrow \pi N, \eta N$
1675 ± 10	CUTKOSKY	80 IPWA	$\pi N \rightarrow \pi N$
1679 ± 8	HOEHLER	79 IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1664 ± 5	ANISOVICH	12A DPWA	Multichannel
1679 ± 1	¹ SHRESTHA	12A DPWA	Multichannel
1679 ± 9	BATINIC	10 DPWA	$\pi N \rightarrow N\pi, N\eta$
1685 ± 4	VRANA	00 DPWA	Multichannel

¹Statistical error only. **$N(1675)$ BREIT-WIGNER WIDTH**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
130 to 160 (≈ 145) OUR ESTIMATE			
161 ± 8	¹ HUNT	19 DPWA	Multichannel
146 ± 6	SOKHOYAN	15A DPWA	Multichannel
148 ± 1	¹ SHKLYAR	13 DPWA	Multichannel
146.5± 1.0	¹ ARNDT	06 DPWA	$\pi N \rightarrow \pi N, \eta N$
160 ± 20	CUTKOSKY	80 IPWA	$\pi N \rightarrow \pi N$
120 ± 15	HOEHLER	79 IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
152 ± 7	ANISOVICH	12A DPWA	Multichannel
145 ± 4	¹ SHRESTHA	12A DPWA	Multichannel
152 ± 8	BATINIC	10 DPWA	$\pi N \rightarrow N\pi, N\eta$
131 ± 10	VRANA	00 DPWA	Multichannel

¹Statistical error only. **$N(1675)$ DECAY MODES**

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

<u>Mode</u>	<u>Fraction (Γ_j/Γ)</u>
Γ_1 $N\pi$	38–42 %
Γ_2 $N\eta$	< 1 %

Γ_3	ΛK	<0.04 %
Γ_4	$N\pi\pi$	25–45 %
Γ_5	$\Delta(1232)\pi$, <i>D-wave</i>	23–37 %
Γ_6	$N\rho$	0.1–0.9 %
Γ_7	$N\rho$, $S=1/2$	<0.2 %
Γ_8	$N\rho$, $S=3/2$, <i>D-wave</i>	0.1–0.7 %
Γ_9	$N\sigma$	3–7 %
Γ_{10}	$p\gamma$	0–0.02 %
Γ_{11}	$p\gamma$, helicity=1/2	0–0.01 %
Γ_{12}	$p\gamma$, helicity=3/2	0–0.01 %
Γ_{13}	$n\gamma$	0–0.15 %
Γ_{14}	$n\gamma$, helicity=1/2	0–0.05 %
Γ_{15}	$n\gamma$, helicity=3/2	0–0.10 %

$N(1675)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
38 to 42 (≈ 40) OUR ESTIMATE			
33 ± 1	¹ HUNT	19	DPWA Multichannel
41 ± 2	SOKHOYAN	15A	DPWA Multichannel
41 ± 1	¹ SHKLYAR	13	DPWA Multichannel
39.3 ± 0.1	¹ ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
38 ± 5	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
38 ± 3	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
40 ± 3	ANISOVICH	12A	DPWA Multichannel
38.6 ± 0.6	¹ SHRESTHA	12A	DPWA Multichannel
35 ± 4	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
35 ± 1	VRANA	00	DPWA Multichannel

¹Statistical error only.

$\Gamma(N\eta)/\Gamma_{\text{total}}$ Γ_2/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.5 ± 0.5	MUELLER	20	DPWA Multichannel
2.0 ± 0.3	¹ HUNT	19	DPWA Multichannel
<1	SHKLYAR	13	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
<1	¹ SHRESTHA	12A	DPWA Multichannel
0.1 ± 0.1	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
3 ± 3	THOMA	08	DPWA Multichannel
0 ± 1	VRANA	00	DPWA Multichannel

¹Statistical error only.

$\Gamma(\Lambda K)/\Gamma_{\text{total}}$ Γ_3/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<0.04 % OUR ESTIMATE			
<0.04	¹ HUNT	19	DPWA Multichannel

¹Statistical error only.

$\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
58.3±0.2	¹ HUNT 19	DPWA	Multichannel
30 ±7	SOKHOYAN 15A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
33 ±8	ANISOVICH 12A	DPWA	Multichannel
46 ±1	¹ SHRESTHA 12A	DPWA	Multichannel
63 ±2	VRANA 00	DPWA	Multichannel

¹ Statistical error only. $\Gamma(N\rho, S=1/2)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
<0.2 % OUR ESTIMATE			
<0.2	¹ HUNT 19	DPWA	Multichannel

¹ Statistical error only. $\Gamma(N\rho, S=3/2, D\text{-wave})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
0.1–0.7 % OUR ESTIMATE			
0.4±0.3	¹ HUNT 19	DPWA	Multichannel

¹ Statistical error only. $\Gamma(N\sigma)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
5±2	SOKHOYAN 15A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
7±3	ANISOVICH 12A	DPWA	Multichannel

 $N(1675)$ PHOTON DECAY AMPLITUDES AT THE POLE **$N(1675) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$**

MODULUS ($\text{GeV}^{-1/2}$)	PHASE ($^\circ$)	DOCUMENT ID	TECN	COMMENT
0.022±0.003	−12 ± 7	SOKHOYAN 15A	DPWA	Multichannel
0.022 ^{+0.004} _{−0.007}	49 ⁺⁵ _{−2}	ROENCHEN 14	DPWA	

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

0.032	36	ROENCHEN 15A	DPWA	Multichannel
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 $N(1675) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

MODULUS ($\text{GeV}^{-1/2}$)	PHASE ($^\circ$)	DOCUMENT ID	TECN	COMMENT
0.028±0.006	−17 ± 6	SOKHOYAN 15A	DPWA	Multichannel
0.036 ^{+0.004} _{−0.005}	−30 ± 4	ROENCHEN 14	DPWA	

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

0.051	−9.3	ROENCHEN 15A	DPWA	Multichannel
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$N(1675)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES **$N(1675) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$**

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.010 to 0.025 (≈ 0.018) OUR ESTIMATE			
0.026 \pm 0.002	¹ HUNT	19	DPWA Multichannel
0.022 \pm 0.003	SOKHOYAN	15A	DPWA Multichannel
0.009 \pm 0.001	¹ SHKLYAR	13	DPWA Multichannel
0.013 \pm 0.001	¹ WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
0.018 \pm 0.002	¹ DUGGER	07	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.024 \pm 0.003	ANISOVICH	12A	DPWA Multichannel
0.011 \pm 0.001	¹ SHRESTHA	12A	DPWA Multichannel
0.015	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$

¹Statistical error only. **$N(1675) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$**

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.015 to 0.030 (≈ 0.022) OUR ESTIMATE			
0.005 \pm 0.002	¹ HUNT	19	DPWA Multichannel
0.027 \pm 0.006	SOKHOYAN	15A	DPWA Multichannel
0.021 \pm 0.001	¹ SHKLYAR	13	DPWA Multichannel
0.016 \pm 0.001	¹ WORKMAN	12A	DPWA $\gamma N \rightarrow N\pi$
0.021 \pm 0.001	¹ DUGGER	07	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.025 \pm 0.007	ANISOVICH	12A	DPWA Multichannel
0.020 \pm 0.001	¹ SHRESTHA	12A	DPWA Multichannel
0.022	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$

¹Statistical error only. **$N(1675) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$**

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.065 to -0.055 (≈ -0.060) OUR ESTIMATE			
-0.069 \pm 0.005	¹ HUNT	19	DPWA Multichannel
-0.060 \pm 0.007	ANISOVICH	13B	DPWA Multichannel
-0.058 \pm 0.002	¹ CHEN	12A	DPWA $\gamma N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-0.040 \pm 0.004	¹ SHRESTHA	12A	DPWA Multichannel
-0.062	DRECHSEL	07	DPWA $\gamma N \rightarrow \pi N$

¹Statistical error only. **$N(1675) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$**

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.095 to -0.075 (≈ -0.085) OUR ESTIMATE			
-0.031 \pm 0.005	¹ HUNT	19	DPWA Multichannel
-0.088 \pm 0.010	ANISOVICH	13B	DPWA Multichannel
-0.080 \pm 0.005	¹ CHEN	12A	DPWA $\gamma N \rightarrow \pi N$

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

–0.068±0.004 ¹ SHRESTHA 12A DPWA Multichannel
–0.084 DRECHSEL 07 DPWA $\gamma N \rightarrow \pi N$

¹Statistical error only.

N(1675) REFERENCES

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

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>	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan <i>et al.</i>	(CBELSA/TAPS Collab.)
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	13B	EPJ A49 67	A.V. Anisovich <i>et al.</i>	
SHKLYAR	13	PR C87 015201	V. Shklyar, H. Lenske, U. Mosel	(GIES)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
CHEN	12A	PR C86 015206	W. Chen <i>et al.</i>	(DUKE, GWU, MSST, ITEP+)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
WORKMAN	12A	PR C86 015202	R. Workman <i>et al.</i>	(GWU)
BATINIC	10	PR C82 038203	M. Batinic <i>et al.</i>	(ZAGR)
THOMA	08	PL B659 87	U. Thoma <i>et al.</i>	(CB-ELSA Collab.)
DRECHSEL	07	EPJ A34 69	D. Drechsel, S.S. Kamalov, L. Tiator	(MAINZ, JINR)
DUGGER	07	PR C76 025211	M. Dugger <i>et al.</i>	(JLab CLAS Collab.)
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)
HOEHLER	93	πN 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