

$N(1895) \ 1/2^-$ $I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$ Status: ****

Before our 2012 *Review*, this state appeared in our Listings as the $N(2090)$. Any structure in the S_{11} wave above 1800 MeV is listed here. A few early results that are now obsolete have been omitted.

 $N(1895)$ POLE POSITION**REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1890 to 1930 (\approx 1910) OUR ESTIMATE			
1907 \pm 10	AFZAL	20	DPWA Multichannel
1895 \pm 15	ANISOVICH	17A	DPWA Multichannel
1906 \pm 17	¹ ANISOVICH	17A	L+P $\gamma p, \pi^- p \rightarrow K \Lambda$
1917 \pm 19 \pm 1	² SVARC	14	L+P $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1956	HUNT	19	DPWA Multichannel
1907 \pm 10	ANISOVICH	17C	DPWA Multichannel
1907 \pm 10	SOKHOYAN	15A	DPWA Multichannel
1900 \pm 15	ANISOVICH	12A	DPWA Multichannel
1797 \pm 26	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1795	VRANA	00	DPWA Multichannel
2150 \pm 70	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

¹ Statistical error only.² Fit to the amplitudes of HOEHLER 79.**–2×IMAGINARY PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
80 to 140 (\approx 110) OUR ESTIMATE			
100 ⁺ _– 40 10	AFZAL	20	DPWA Multichannel
132 \pm 30	ANISOVICH	17A	DPWA Multichannel
100 \pm 10	¹ ANISOVICH	17A	L+P $\gamma p, \pi^- p \rightarrow K \Lambda$
101 \pm 36 \pm 1	^{1,2} SVARC	14	L+P $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
449	HUNT	19	DPWA Multichannel
100 ⁺ _– 40 10	ANISOVICH	17C	DPWA Multichannel
100 ⁺ _– 40 15	SOKHOYAN	15A	DPWA Multichannel
90 ⁺ _– 30 15	ANISOVICH	12A	DPWA Multichannel
420 \pm 45	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
220	VRANA	00	DPWA Multichannel
350 \pm 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

¹ Statistical error only.² Fit to the amplitudes of HOEHLER 79.

$N(1895)$ ELASTIC POLE RESIDUE**MODULUS $|r|$**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1 to 5 (≈ 3) OUR ESTIMATE			
3 ± 2	SOKHOYAN	15A	DPWA Multichannel
3.1 ± 1.4	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1 ± 1	ANISOVICH	12A	DPWA Multichannel
60	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
40 ± 20	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

¹Fit to the amplitudes of HOEHLER 79.**PHASE θ**

<u>VALUE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
125 ± 45	SOKHOYAN	15A	DPWA Multichannel
$-107 \pm 23 \pm 2$	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
0 ± 90	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-164	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$

¹Fit to the amplitudes of HOEHLER 79. **$N(1895)$ INELASTIC POLE RESIDUE**The "normalized residue" is the residue divided by $\Gamma_{pole}/2$.**Normalized residue in $N\pi \rightarrow N(1895) \rightarrow \Lambda K$**

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.09 ± 0.03	8 ± 30	ANISOVICH	17A	DPWA Multichannel
0.06 ± 0.02	87 ± 27	¹ ANISOVICH	17A	L+P $\gamma p, \pi^- p \rightarrow K\Lambda$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.05 ± 0.02	-90 ± 30	ANISOVICH	12A	DPWA Multichannel

¹Statistical error only.**Normalized residue in $N\pi \rightarrow N(1895) \rightarrow \Sigma K$**

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.06 ± 0.02	40 ± 30	ANISOVICH	12A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1895) \rightarrow \Delta(1232)\pi$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.05 ± 0.025	-100 ± 45	SOKHOYAN	15A	DPWA Multichannel

Normalized residue in $N\pi \rightarrow N(1895) \rightarrow N(1440)\pi$

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.05 ± 0.025	-100 ± 45	SOKHOYAN	15A	DPWA Multichannel

$N(1895)$ BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1870 to 1920 (≈ 1895) OUR ESTIMATE			
2000 ± 29	¹ HUNT	19	DPWA Multichannel
1890^{+9}_{-23}	KASHEVAROV	17	DPWA $\gamma p \rightarrow \eta p, \eta' p$
1905 ± 12	SOKHOYAN	15A	DPWA Multichannel
1880 ± 20	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1895 ± 15	ANISOVICH	12A	DPWA Multichannel
1910 ± 15	¹ SHRESTHA	12A	DPWA Multichannel
1812 ± 25	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
1822 ± 43	VRANA	00	DPWA Multichannel
2180 ± 80	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

¹Statistical error only. **$N(1895)$ BREIT-WIGNER WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
80 to 200 (≈ 120) OUR ESTIMATE			
466 ± 72	¹ HUNT	19	DPWA Multichannel
150 ± 57	KASHEVAROV	17	DPWA $\gamma p \rightarrow \eta p, \eta' p$
100^{+30}_{-10}	SOKHOYAN	15A	DPWA Multichannel
95 ± 30	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
90^{+30}_{-15}	ANISOVICH	12A	DPWA Multichannel
502 ± 47	¹ SHRESTHA	12A	DPWA Multichannel
405 ± 40	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
248 ± 185	VRANA	00	DPWA Multichannel
350 ± 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

¹Statistical error only. **$N(1895)$ DECAY MODES**

Mode	Fraction (Γ_j/Γ)
Γ_1 $N\pi$	2–18 %
Γ_2 $N\eta$	15–45 %
Γ_3 $N\eta'$	10–40 %
Γ_4 $N\omega$	16–40 %
Γ_5 ΛK	3–23 %
Γ_6 ΣK	6–20 %
Γ_7 $N\pi\pi$	17–74 %
Γ_8 $\Delta(1232)\pi, D\text{-wave}$	3–11 %

Γ_9	$N\rho$	14–50 %
Γ_{10}	$N\rho, S=1/2, S\text{-wave}$	<18 %
Γ_{11}	$N\rho, S=3/2, D\text{-wave}$	14–32 %
Γ_{12}	$N\sigma$	<13 %
Γ_{13}	$N(1440)\pi$	2–12 %
Γ_{14}	$\Lambda K^*(892)$	4–9 %
Γ_{15}	$p\gamma, \text{helicity}=1/2$	0.01–0.06 %
Γ_{16}	$n\gamma, \text{helicity}=1/2$	0.003–0.05 %

$N(1895)$ BRANCHING RATIOS

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
2–18 % OUR ESTIMATE			
8 ± 4	¹ HUNT	19	DPWA Multichannel
2.5±1.5	SOKHOYAN	15A	DPWA Multichannel
9 ± 5	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2 ± 1	ANISOVICH	12A	DPWA Multichannel
17 ± 2	¹ SHRESTHA	12A	DPWA Multichannel
32 ± 6	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
17 ± 3	VRANA	00	DPWA Multichannel
18 ± 8	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

¹Statistical error only.

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
15–45 % OUR ESTIMATE			
10 ± 5	MUELLER	20	DPWA Multichannel
37 ± 9	¹ HUNT	19	DPWA Multichannel
10 ± 5	ANISOVICH	17C	DPWA Multichannel
20 ± 6	² KASHEVAROV	17	DPWA $\gamma p \rightarrow \eta p, \eta' p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
21 ± 6	ANISOVICH	12A	DPWA Multichannel
40 ± 4	¹ SHRESTHA	12A	DPWA Multichannel
22 ± 10	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
41 ± 4	VRANA	00	DPWA Multichannel

¹Statistical error only.

²Assuming $A_{1/2} = -0.030 \text{ GeV}^{-1/2}$.

$\Gamma(N\eta')/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
10–40 % OUR ESTIMATE			
13 ± 5	ANISOVICH	17C	DPWA Multichannel
38 ± 20	¹ KASHEVAROV	17	DPWA $\gamma p \rightarrow \eta p, \eta' p$

¹Assuming $A_{1/2} = -0.030 \text{ GeV}^{-1/2}$.

$\Gamma(N\omega)/\Gamma_{\text{total}}$ Γ_4/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
16-40 % OUR ESTIMATE			
28 ± 12	DENISENKO	16	DPWA Multichannel

 $\Gamma(\Lambda K)/\Gamma_{\text{total}}$ Γ_5/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3-23 % OUR ESTIMATE			
7 ± 4	¹ HUNT	19	DPWA Multichannel
18 ± 5	ANISOVICH	12A	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.8 ± 0.8	¹ SHRESTHA	12A	DPWA Multichannel
¹ Statistical error only.			

 $\Gamma(\Sigma K)/\Gamma_{\text{total}}$ Γ_6/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
6-20 % OUR ESTIMATE			
13 ± 7	ANISOVICH	12A	DPWA Multichannel

 $\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{\text{total}}$ Γ_8/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3-11 % OUR ESTIMATE			
< 10	¹ HUNT	19	DPWA Multichannel
7 ± 4	SOKHOYAN	15A	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
7 ± 3	¹ SHRESTHA	12A	DPWA Multichannel
1 ± 1	VRANA	00	DPWA Multichannel
¹ Statistical error only.			

 $\Gamma(N\rho, S=1/2, S\text{-wave})/\Gamma_{\text{total}}$ Γ_{10}/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
< 18 % OUR ESTIMATE			
< 18	¹ HUNT	19	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 2	¹ SHRESTHA	12A	DPWA Multichannel
36 ± 1	VRANA	00	DPWA Multichannel
¹ Statistical error only.			

 $\Gamma(N\rho, S=3/2, D\text{-wave})/\Gamma_{\text{total}}$ Γ_{11}/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
14-32 % OUR ESTIMATE			
23 ± 9	¹ HUNT	19	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9 ± 3	¹ SHRESTHA	12A	DPWA Multichannel
1 ± 1	VRANA	00	DPWA Multichannel
¹ Statistical error only.			

$\Gamma(N\sigma)/\Gamma_{\text{total}}$ Γ_{12}/Γ
VALUE (%) DOCUMENT ID TECN COMMENT

<13 % OUR ESTIMATE

<13	¹ HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 2	¹ SHRESTHA	12A	DPWA	Multichannel
2 ± 1	VRANA	00	DPWA	Multichannel

¹Statistical error only.

$\Gamma(N(1440)\pi)/\Gamma_{\text{total}}$ Γ_{13}/Γ
VALUE (%) DOCUMENT ID TECN COMMENT

2-12 % OUR ESTIMATE

7 ± 5	¹ HUNT	19	DPWA	Multichannel
2.5 ± 1.5	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
24 ± 4	¹ SHRESTHA	12A	DPWA	Multichannel
2 ± 1	VRANA	00	DPWA	Multichannel

¹Statistical error only.

$\Gamma(\Lambda K^*(892))/\Gamma_{\text{total}}$ Γ_{14}/Γ
VALUE (%) DOCUMENT ID TECN COMMENT

4-9 % OUR ESTIMATE

6.3 ± 2.5	ANISOVICH	17B	DPWA	Multichannel
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 $N(1895)$ PHOTON DECAY AMPLITUDES AT THE POLE **$N(1895) \rightarrow p\gamma$, 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>
-0.015 ± 0.006	-35 ± 35	ANISOVICH	17C	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.015 ± 0.006	145 ± 35	SOKHOYAN	15A	DPWA Multichannel

 $N(1895)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES **$N(1895) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$**

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.017 ± 0.005	¹ HUNT	19	DPWA Multichannel
-0.016 ± 0.006	SOKHOYAN	15A	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.012 ± 0.006	¹ SHRESTHA	12A	DPWA Multichannel

¹Statistical error only. **$N(1895) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$**

<u>VALUE ($\text{GeV}^{-1/2}$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.002 ± 0.013	¹ HUNT	19	DPWA Multichannel
0.013 ± 0.006	ANISOVICH	13B	DPWA Multichannel

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

0.003±0.007 ¹ SHRESTHA 12A DPWA Multichannel

¹ Statistical error only.

N(1895) REFERENCES

AFZAL	20	PRL 125 152002	F. Afzal <i>et al.</i>	(CBELSA/TAPS Collab.)
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	
ANISOVICH	17A	PRL 119 062004	A.V. Anisovich <i>et al.</i>	
ANISOVICH	17B	PL B771 142	A.V. Anisovich <i>et al.</i>	
ANISOVICH	17C	PL B772 247	A.V. Anisovich <i>et al.</i>	
KASHEVAROV	17	PRL 118 212001	V.L. Kashevarov <i>et al.</i>	(A2/MAMI Collab.)
DENISENKO	16	PL B755 97	I. Denisenko <i>et al.</i>	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan <i>et al.</i>	(CBELSA/TAPS Collab.)
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>	
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)
BATINIC	10	PR C82 038203	M. Batinic <i>et al.</i>	(ZAGR)
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)
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP