$N(1895)\ 1/2^-$

$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$ 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

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

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

$-2\times$IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
80 to 140 (≈ 110) OUR ESTIMATE				
132 ± 30	ANISOVICH	17A	DPWA	Multichannel
100 ± 10	[1] ANISOVICH	17A	L+P	$\gamma p,\ \pi^- p \to K\Lambda$
$101 \pm 36 \pm 1$	[1,2] SVARC	14	L+P	$\pi N \to \pi N$
• • • 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 ± 45	BATINIC	10	DPWA	$\pi N \to N\pi,\ N\eta$
220	VRANA	00	DPWA	Multichannel
350 ± 100	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

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

N(1895) ELASTIC POLE RESIDUE

MODULUS |*r*|

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

[1] Fit to the amplitudes of HOEHLER 79.

PHASE *θ*

VALUE (°)	DOCUMENT ID		TECN	COMMENT
125±45	SOKHOYAN	15A	DPWA	Multichannel
−107±23±2	[1] SVARC	14	L+P	$\pi N \to \pi N$
0±90	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−164	BATINIC	10	DPWA	$\pi N \to N\pi, N\eta$

[1] Fit 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 $N\pi \to$ *N*(1895) $\to$ ΛK

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

[1] Statistical error only.

Normalized residue in $N\pi \to$ *N*(1895) $\to$ ΣK

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.06±0.02	40 ± 30	ANISOVICH	12A	DPWA	Multichannel

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

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.05±0.025	−100 ± 45	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \to$ *N*(1895) $\to$ *N*(1440)π

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
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	$\pi N \rightarrow \pi N$

[1] Statistical 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	$\pi N \rightarrow \pi N$

[1] Statistical error only.

N(1895) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	2–18 %
Γ_2	$N\eta$	15–40 %
Γ_3	$N\eta'$	10–40 %
Γ_4	$N\omega$	16–40 %
Γ_5	ΛK	13–23 %
Γ_6	ΣK	6–20 %
Γ_7	$N\pi\pi$	
Γ_8	$\Delta(1232)\pi$	

Γ_9 $\Delta(1232)\pi$, D-wave	3–11 %	
Γ_{10} $N\rho$		
Γ_{11} $N\rho$, $S=1/2$, S-wave	seen	
Γ_{12} $N\rho$, $S=3/2$, D-wave	3–12 %	
Γ_{13} $\Lambda K^*(892)$	4–9 %	
Γ_{14} $N\sigma$	seen	
Γ_{15} $N(1440)\pi$	1–4 %	
Γ_{16} $p\gamma$, helicity=1/2	0.01–0.06 %	
Γ_{17} $n\gamma$, helicity=1/2	0.003–0.05 %	

N(1895) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ Γ_1/Γ

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

[1] Statistical error only.

$\Gamma(N\eta)/\Gamma_{total}$ Γ_2/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
15 to 40 ($\approx$ 25) OUR ESTIMATE				
37$\pm$ 9	[1] HUNT	19	DPWA	Multichannel
10$\pm$ 5	ANISOVICH	17C	DPWA	Multichannel
20$\pm$ 6	[2] KASHEVAROV	17	DPWA	$\gamma p \to \eta p, \eta' p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
21$\pm$ 6	ANISOVICH	12A	DPWA	Multichannel
40$\pm$ 4	[1] SHRESTHA	12A	DPWA	Multichannel
22$\pm$10	BATINIC	10	DPWA	$\pi N \to N\pi, N\eta$
41$\pm$ 4	VRANA	00	DPWA	Multichannel

[1] Statistical error only.
[2] Assuming $A_{1/2} = -0.030$ GeV$^{-1/2}$.

$\Gamma(N\eta')/\Gamma_{total}$ Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.10 to 0.40 ($\approx$ 0.20) OUR ESTIMATE				
0.13$\pm$0.05	ANISOVICH	17C	DPWA	Multichannel
0.38$\pm$0.20	[1] KASHEVAROV	17	DPWA	$\gamma p \to \eta p, \eta' p$

[1] Assuming $A_{1/2} = -0.030$ GeV$^{-1/2}$.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
28±12	DENISENKO	16	DPWA	Multichannel

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

VALUE (%)		DOCUMENT ID		TECN	COMMENT
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.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
13±7	ANISOVICH	12A	DPWA	Multichannel

$\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{total}$ Γ_9/Γ

VALUE (%)		DOCUMENT ID		TECN	COMMENT
<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.

$\Gamma(N\rho, S=1/2, S\text{-wave})/\Gamma_{total}$ Γ_{11}/Γ

VALUE (%)		DOCUMENT ID		TECN	COMMENT
<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.

$\Gamma(N\rho, S=3/2, D\text{-wave})/\Gamma_{total}$ Γ_{12}/Γ

VALUE (%)		DOCUMENT ID		TECN	COMMENT
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.

$\Gamma(\Lambda K^*(892))/\Gamma_{total}$ Γ_{13}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.063±0.025	ANISOVICH	17B	DPWA	Multichannel

$\Gamma(N\sigma)/\Gamma_{total}$ $\qquad\qquad\Gamma_{14}/\Gamma$

VALUE (%)		DOCUMENT ID		TECN	COMMENT
<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

[1] Statistical error only.

$\Gamma(N(1440)\pi)/\Gamma_{total}$ $\qquad\qquad\Gamma_{15}/\Gamma$

VALUE (%)		DOCUMENT ID		TECN	COMMENT
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

[1] Statistical error only.

$N(1895)$ PHOTON DECAY AMPLITUDES AT THE POLE

$N(1895) \to p\gamma$, helicity-1/2 amplitude $A_{1/2}$

MODULUS (GeV$^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
−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

$N(1895) \to p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV$^{-1/2}$)		DOCUMENT ID		TECN	COMMENT
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

[1] Statistical error only.

$N(1895) \to n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV$^{-1/2}$)		DOCUMENT ID		TECN	COMMENT
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

HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
ANISOVICH	17A	PRL 119 062004	A.V. Anisovich *et al.*	
ANISOVICH	17B	PL B771 142	A.V. Anisovich *et al.*	
ANISOVICH	17C	PL B772 247	A.V. Anisovich *et al.*	
KASHEVAROV	17	PRL 118 212001	V.L. Kashevarov *et al.*	(A2/MAMI Collab.)
DENISENKO	16	PL B755 97	I. Denisenko *et al.*	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan *et al.*	(CBELSA/TAPS Collab.)
SVARC	14	PR C89 045205	A. Svarc *et al.*	(RBI Zagreb, UNI Tuzla)
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich *et al.*	
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich *et al.*	(BONN, PNPI)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
BATINIC	10	PR C82 038203	M. Batinic *et al.*	(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 *et al.*	(CMU, LBL) IJP
Also		PR D20 2839	R.E. Cutkosky *et al.*	(CMU, LBL)
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP