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

$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$ 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				
1907±10	AFZAL	20	DPWA	Multichannel
1895±15	ANISOVICH	17A	DPWA	Multichannel
1906±17	[1] ANISOVICH	17A	L+P	$\gamma p,\ \pi^- p \to\ K\Lambda$
1917±19±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×IMAGINARY PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
80 to 140 (≈ 110) OUR ESTIMATE				
$100^{+\ 40}_{-\ 10}$	AFZAL	20	DPWA	Multichannel
132± 30	ANISOVICH	17A	DPWA	Multichannel
100± 10	[1] ANISOVICH	17A	L+P	$\gamma p,\ \pi^- p \to\ K\Lambda$
101± 36±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 $N\pi \to N(1895) \to \Lambda K$

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 $N\pi \to N(1895) \to \Sigma K$

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 $N\pi \to N(1895) \to N(1440)\pi$

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	$\gamma p \to \eta p,\ \eta' p$
1905 ± 12	SOKHOYAN	15A	DPWA	Multichannel
1880 ± 20	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • 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	$\pi N \to N\pi,\ N\eta$
1822 ± 43	VRANA	00	DPWA	Multichannel
2180 ± 80	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

[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	$\gamma p \to \eta p,\ \eta' p$
100^{+30}_{-10}	SOKHOYAN	15A	DPWA	Multichannel
95 ± 30	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • 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	$\pi N \to N\pi,\ N\eta$
248 ± 185	VRANA	00	DPWA	Multichannel
350 ± 100	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

[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

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
2 to 18 (≈ 10) OUR ESTIMATE				
8 ±4	[1] HUNT	19	DPWA	Multichannel
2.5±1.5	SOKHOYAN	15A	DPWA	Multichannel
9 ±5	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • 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	$\pi N \to N\pi$, $N\eta$
17 ±3	VRANA	00	DPWA	Multichannel
18 ±8	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

[1] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
15 to 40 (≈ 25) 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	$\gamma p \to \eta p$, $\eta' p$
• • • 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	$\pi N \to N\pi$, $N\eta$
41± 4	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.10 to 0.40 (≈ 0.20) OUR ESTIMATE				
0.13±0.05	ANISOVICH	17C	DPWA	Multichannel
0.38±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-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-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-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

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

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.

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

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) → pγ, 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) → pγ, 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) → nγ, 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

AFZAL	20	PRL 125 152002	F. Afzal *et al.*	(CBELSA/TAPS Collab.)
MUELLER	20	PL B803 135323	J. Mueller *et al.*	(CBELSA/TAPS Collab.)
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