$N(1900)\ 3/2^+$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$ Status: ****

N(1900) POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1900 to 1940 (≈ 1920) OUR ESTIMATE				
1905 ± 2	ROENCHEN	22	DPWA	Multichannel
1945 ± 35	ANISOVICH	17A	DPWA	Multichannel
1928 ± 18 ± 2	[1] SVARC	14	L+P	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1856	HUNT	19	DPWA	Multichannel
1912 ± 30	[2] ANISOVICH	17A	L+P	$\gamma p, \pi^- p \to K\Lambda$
1910 ± 30	SOKHOYAN	15A	DPWA	Multichannel
1910 ± 30	GUTZ	14	DPWA	Multichannel
1910	SHKLYAR	13	DPWA	Multichannel
1900 ± 30	ANISOVICH	12A	DPWA	Multichannel

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

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
90 to 160 (≈ 130) OUR ESTIMATE				
93 ± 2	ROENCHEN	22	DPWA	Multichannel
135^{+70}_{-30}	ANISOVICH	17A	DPWA	Multichannel
152 ± 40 ± 9	[1] SVARC	14	L+P	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
241	HUNT	19	DPWA	Multichannel
166 ± 30	[2] ANISOVICH	17A	L+P	$\gamma p, \pi^- p \to K\Lambda$
280 ± 50	SOKHOYAN	15A	DPWA	Multichannel
280 ± 50	GUTZ	14	DPWA	Multichannel
173	SHKLYAR	13	DPWA	Multichannel
200^{+100}_{-60}	ANISOVICH	12A	DPWA	Multichannel

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

N(1900) ELASTIC POLE RESIDUE

MODULUS |r|

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
2 to 6 (≈ 4) OUR ESTIMATE				
1.6 ± 0.2	ROENCHEN	22	DPWA	Multichannel
4 ±2	SOKHOYAN	15A	DPWA	Multichannel
4 ±1 ±1	[1] SVARC	14	L+P	$\pi N \to \pi N$

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

4	±2	GUTZ	14	DPWA	Multichannel
10		SHKLYAR	13	DPWA	Multichannel
3	±2	ANISOVICH	12A	DPWA	Multichannel

[1] Fit to the amplitudes of HOEHLER 79.

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
−40 to 20 (≈ − 10) OUR ESTIMATE				
44±11	ROENCHEN	22	DPWA	Multichannel
−10±40	SOKHOYAN	15A	DPWA	Multichannel
−29±15±2	[1] SVARC	14	L+P	$\pi N \to \pi N$

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

−10±40	GUTZ	14	DPWA	Multichannel
−64	SHKLYAR	13	DPWA	Multichannel
10±35	ANISOVICH	12A	DPWA	Multichannel

[1] Fit to the amplitudes of HOEHLER 79.

N(1900) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \to N(1900) \to N\eta$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.010±0.002	55 ± 15	ROENCHEN	22	DPWA	Multichannel
0.05 ±0.02	70 ± 60	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to N(1900) \to \Lambda K$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.029±0.003	5.4 ± 9.3	ROENCHEN	22	DPWA	Multichannel
0.03 ±0.02	90 ± 40	ANISOVICH	17A	DPWA	Multichannel

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

0.07 ±0.03	135 ± 25	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to N(1900) \to \Sigma K$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.013±0.002	−40 ± 9	ROENCHEN	22	DPWA	Multichannel
0.04 ±0.02	110 ± 30	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to N(1900) \to N(1535)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.04±0.01	170 ± 30	GUTZ	14	DPWA	Multichannel

Normalized residue in $N\pi \to N(1900) \to \Delta(1232)\pi$, *P*-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.07±0.04	−65 ± 30	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \to N(1900) \to \Delta(1232)\pi$, *F*-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.10±0.05	80 ± 30	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(1900) \rightarrow N(1520)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.07±0.04	−105 ± 35	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(1900) \rightarrow N\sigma$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.03±0.02	−110 ± 35	SOKHOYAN	15A	DPWA	Multichannel

N(1900) BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1890 to 1950 (≈ 1920) OUR ESTIMATE				
1911± 6	[1] HUNT	19	DPWA	Multichannel
1910±30	SOKHOYAN	15A	DPWA	Multichannel
1998± 3	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1910±30	GUTZ	14	DPWA	Multichannel
1905±30	ANISOVICH	12A	DPWA	Multichannel
1900± 8	[1] SHRESTHA	12A	DPWA	Multichannel
1951±53	PENNER	02C	DPWA	Multichannel

[1] Statistical error only.

N(1900) BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
100 to 320 (≈ 200) OUR ESTIMATE				
292± 16	[1] HUNT	19	DPWA	Multichannel
270± 50	SOKHOYAN	15A	DPWA	Multichannel
359± 10	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
270± 50	GUTZ	14	DPWA	Multichannel
$250^{+120}_{-\ 50}$	ANISOVICH	12A	DPWA	Multichannel
101± 15	[1] SHRESTHA	12A	DPWA	Multichannel
622± 42	PENNER	02C	DPWA	Multichannel

[1] Statistical error only.

N(1900) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	1–20 %
Γ_2	$N\eta$	2–14 %
Γ_3	$N\eta'$	4–8 %
Γ_4	$N\omega$	7–13 %
Γ_5	ΛK	2–20 %
Γ_6	ΣK	3–7 %
Γ_7	$N\pi\pi$	>56 %
Γ_8	$\Delta(1232)\pi$	30–70 %

Γ_9	$\Delta(1232)\pi$, P-wave	9–25 %
Γ_{10}	$\Delta(1232)\pi$, F-wave	21–45 %
Γ_{11}	$N\rho$, S=1/2	25–40 %
Γ_{12}	$N\sigma$	1–7 %
Γ_{13}	$N(1520)\pi$	7–23 %
Γ_{14}	$N(1535)\pi$	4–10 %
Γ_{15}	$\Lambda K^*(892)$	$<$ 0.2 %
Γ_{16}	$p\gamma$	0.001–0.025 %
Γ_{17}	$p\gamma$, helicity=1/2	0.001–0.021 %
Γ_{18}	$p\gamma$, helicity=3/2	<0.003 %
Γ_{19}	$n\gamma$	<0.040 %
Γ_{20}	$n\gamma$, helicity=1/2	<0.007 %
Γ_{21}	$n\gamma$, helicity=3/2	<0.033 %

$N(1900)$ BRANCHING RATIOS

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1–20 % OUR ESTIMATE				
1.9±0.1	[1] HUNT	19	DPWA	Multichannel
3 ±2	SOKHOYAN	15A	DPWA	Multichannel
25 ±1	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3 ±2	GUTZ	14	DPWA	Multichannel
3 ±2	ANISOVICH	12A	DPWA	Multichannel
7 ±4	[1] SHRESTHA	12A	DPWA	Multichannel
16 ±2	PENNER	02C	DPWA	Multichannel

[1] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
2 ±2	MUELLER	20	DPWA	Multichannel
1.3±0.5	[1] HUNT	19	DPWA	Multichannel
2 ±2	[1] SHKLYAR	13	DPWA	Multichannel
10 ±4	ANISOVICH	12A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<$ 1	[1] SHRESTHA	12A	DPWA	Multichannel
14 ±5	PENNER	02C	DPWA	Multichannel

[1] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4–8 % OUR ESTIMATE				
6±2	ANISOVICH	17C	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
15±8	DENISENKO	16	DPWA	Multichannel
10±3	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
39±9	PENNER	02C	DPWA	Multichannel

[1] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
13.7±0.3	[1] HUNT	19	DPWA	Multichannel
16 ±5	ANISOVICH	12A	DPWA	Multichannel
2.4±0.3	[1] SHKLYAR	05	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
14 ±5	[1] SHRESTHA	12A	DPWA	Multichannel
5 to 15	NIKONOV	08	DPWA	Multichannel
0.1±0.1	PENNER	02C	DPWA	Multichannel

[1] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5±2	ANISOVICH	12A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1±1	PENNER	02C	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
17±8	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(\Delta(1232)\pi, F\text{-wave})/\Gamma_{total}$ Γ_{10}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
33±12	SOKHOYAN	15A	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
25–40 % OUR ESTIMATE				
32±7	[1] HUNT	19	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(N\sigma)/\Gamma_{total}$ Γ_{12}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4±3	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(N(1520)\pi)/\Gamma_{total}$ Γ_{13}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
15±8	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(N(1535)\pi)/\Gamma_{total}$ Γ_{14}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
7±3	GUTZ	14	DPWA	Multichannel

$\Gamma(\Lambda K^*(892))/\Gamma_{total}$ Γ_{15}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
< 0.2 % OUR ESTIMATE				
<0.2	ANISOVICH	17B	DPWA	Multichannel

N(1900) PHOTON DECAY AMPLITUDES AT THE POLE

N(1900) → pγ, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.0091±0.0014	80 ± 12	ROENCHEN	22	DPWA	Multichannel
0.026 ±0.014	60 ± 35	SOKHOYAN	15A	DPWA	Multichannel

N(1900) → pγ, helicity-3/2 amplitude $A_{3/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
−0.0077±0.0017	−42 ± 12	ROENCHEN	22	DPWA	Multichannel
−0.070 ±0.030	70 ± 50	SOKHOYAN	15A	DPWA	Multichannel

N(1900) → nγ, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
−0.098±0.020	−13 ± 20	ANISOVICH	17E	DPWA	Multichannel

N(1900) → nγ, helicity-3/2 amplitude $A_{3/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.074±0.015	5 ± 15	ANISOVICH	17E	DPWA	Multichannel

N(1900) BREIT-WIGNER PHOTON DECAY AMPLITUDES

N(1900) → pγ, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.040±0.004	[1] HUNT	19	DPWA	Multichannel
0.024±0.014	SOKHOYAN	15A	DPWA	Multichannel
−0.008±0.001	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.024±0.014	GUTZ	14	DPWA	Multichannel
0.026±0.015	ANISOVICH	12A	DPWA	Multichannel
0.041±0.008	[1] SHRESTHA	12A	DPWA	Multichannel
−0.017	PENNER	02D	DPWA	Multichannel

[1] Statistical error only.

N(1900) → pγ, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
−0.094±0.007	[1] HUNT	19	DPWA	Multichannel
−0.067±0.030	SOKHOYAN	15A	DPWA	Multichannel
< 0.001	SHKLYAR	13	DPWA	Multichannel

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

−0.067±0.030	GUTZ	14	DPWA	Multichannel
−0.065±0.030	ANISOVICH	12A	DPWA	Multichannel
−0.004±0.006	[1] SHRESTHA	12A	DPWA	Multichannel
0.031	PENNER	02D	DPWA	Multichannel

[1] Statistical error only.

$N(1900) \to n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.007±0.014	[1] HUNT	19	DPWA	Multichannel
−0.102±0.020	ANISOVICH	17E	DPWA	Multichannel

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

0.000±0.030	ANISOVICH	13B	DPWA	Multichannel
−0.010±0.004	[1] SHRESTHA	12A	DPWA	Multichannel
−0.016	PENNER	02D	DPWA	Multichannel

[1] Statistical error only.

$N(1900) \to n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.007±0.011	[1] HUNT	19	DPWA	Multichannel
0.073±0.015	ANISOVICH	17E	DPWA	Multichannel

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

−0.060±0.045	ANISOVICH	13B	DPWA	Multichannel
−0.011±0.007	[1] SHRESTHA	12A	DPWA	Multichannel
−0.002	PENNER	02D	DPWA	Multichannel

[1] Statistical error only.

$N(1900)$ REFERENCES

ROENCHEN	22	EPJ A58 229	D. Roenchen *et al.*	(JULI, GWU, BONN+)
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.*	
ANISOVICH	17E	PR C96 055202	A.V. Anisovich *et al.*	(BONN, PNPI, JLAB+)
DENISENKO	16	PL B755 97	I. Denisenko *et al.*	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan *et al.*	(CBELSA/TAPS Collab.)
GUTZ	14	EPJ A50 74	E. Gutz *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.*	
SHKLYAR	13	PR C87 015201	V. Shklyar, H. Lenske, U. Mosel	(GIES)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich *et al.*	(BONN, PNPI)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
NIKONOV	08	PL B662 245	V.A. Nikonov *et al.*	(Bonn, Gatchina)
SHKLYAR	05	PR C72 015210	V. Shklyar, H. Lenske, U. Mosel	(GIES)
PENNER	02C	PR C66 055211	G. Penner, U. Mosel	(GIES)
PENNER	02D	PR C66 055212	G. Penner, U. Mosel	(GIES)
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT)