$N(2000)\ 5/2^+$

$I(J^P) = \frac{1}{2}(\frac{5}{2}^+)$ Status: **

OMITTED FROM SUMMARY TABLE

Before the 2012 *Review*, all the evidence for a $J^P = 5/2^+$ state with a mass above 1800 MeV was filed under a two-star $N(2000)$. There is now some evidence from ANISOVICH 12A for two $5/2^+$ states in this region, so we have split the older data (according to mass) between two two-star $5/2^+$ states, an $N(1860)$ and an $N(2000)$.

N(2000) POLE POSITION

REAL PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2030± 40	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1900	SHKLYAR	13	DPWA	Multichannel
2030±110	ANISOVICH	12A	DPWA	Multichannel

−2×IMAGINARY PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
380± 60	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
123	SHKLYAR	13	DPWA	Multichannel
480±100	ANISOVICH	12A	DPWA	Multichannel

N(2000) ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
18± 8	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11	SHKLYAR	13	DPWA	Multichannel
35^{+80}_{-15}	ANISOVICH	12A	DPWA	Multichannel

PHASE θ

VALUE (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
−150±40	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
− 6	SHKLYAR	13	DPWA	Multichannel
−100±40	ANISOVICH	12A	DPWA	Multichannel

N(2000) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \rightarrow N(2000) \rightarrow \Delta(1232)\pi$, *P*-wave

MODULUS	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.16±0.06	100 ± 50	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2000) \rightarrow \Delta(1232)\pi$, *F*-wave

MODULUS	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.20±0.10	−20 ± 45	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2000) \rightarrow N\sigma$

MODULUS	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.12±0.06	80 ± 40	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2000) \rightarrow N(1520)\pi$, *D*-wave

MODULUS	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.17±0.09	−60 ± 35	SOKHOYAN	15A	DPWA	Multichannel

N(2000) BREIT-WIGNER MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2060± 30	SOKHOYAN	15A	DPWA	Multichannel
1946± 4	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2090±120	ANISOVICH	12A	DPWA	Multichannel

[1] Statistical error only.

N(2000) BREIT-WIGNER WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
390± 55	SOKHOYAN	15A	DPWA	Multichannel
198± 2	[2] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
460±100	ANISOVICH	12A	DPWA	Multichannel

[2] Statistical error only.

N(2000) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	6–10 %
Γ_2	$N\eta$	<4 %
Γ_3	$N\omega$	<2 %
Γ_4	$N\pi\pi$	35–90 %
Γ_5	$\Delta(1232)\pi$	30–80 %
Γ_6	$\Delta(1232)\pi$, *P*-wave	12–32 %
Γ_7	$\Delta(1232)\pi$, *F*-wave	19–49 %
Γ_8	$\Lambda K^*(892)$	(2.2±1.0) %
Γ_9	$N\sigma$	5–15 %
Γ_{10}	$N(1520)\pi$, *D*-wave	11–31 %

Γ_{11}	$N(1680)\pi$, P-wave	17–25 %
Γ_{12}	$p\gamma$	0.01–0.08 %
Γ_{13}	$p\gamma$, helicity=1/2	0.003–0.031 %
Γ_{14}	$p\gamma$, helicity=3/2	0.008–0.048 %
Γ_{15}	$n\gamma$	0.002–0.07 %
Γ_{16}	$n\gamma$, helicity=1/2	<0.017 %
Γ_{17}	$n\gamma$, helicity=3/2	0.001–0.056 %

$N(2000)$ BRANCHING RATIOS

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
6 to 10 (≈ 8) OUR ESTIMATE				
8±4	SOKHOYAN	15A	DPWA	Multichannel
10±1	[3] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9±4	ANISOVICH	12A	DPWA	Multichannel

[3] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
2±2	[4] SHKLYAR	13	DPWA	Multichannel

[4] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
18±8	DENISENKO	16	DPWA	Multichannel
1±1	[5] SHKLYAR	13	DPWA	Multichannel

[5] Statistical error only.

$\Gamma(\Delta(1232)\pi, P\text{-wave})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
22±10	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(\Delta(1232)\pi, F\text{-wave})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
34±15	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(\Lambda K^*(892))/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.022±0.010	ANISOVICH	17B	DPWA	Multichannel

$\Gamma(N\sigma)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
10±5	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(N(1520)\pi, D\text{-wave})/\Gamma_{total}$ Γ_{10}/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
21 ± 10	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(N(1680)\pi, P\text{-wave})/\Gamma_{total}$ Γ_{11}/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
16 ± 9	SOKHOYAN	15A	DPWA	Multichannel

$N(2000)$ PHOTON DECAY AMPLITUDES AT THE POLE

$N(2000) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.033 ± 0.010	15 ± 25	SOKHOYAN	15A	DPWA	Multichannel

$N(2000) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

MODULUS ($GeV^{-1/2}$)	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.045 ± 0.008	-140 ± 25	SOKHOYAN	15A	DPWA	Multichannel

$N(2000)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES

$N(2000) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.031 ± 0.010	SOKHOYAN	15A	DPWA	Multichannel
0.011 ± 0.001	[6] SHKLYAR	13	DPWA	Multichannel

[6] Statistical error only.

$N(2000) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
-0.043 ± 0.008	SOKHOYAN	15A	DPWA	Multichannel
0.025 ± 0.001	[7] SHKLYAR	13	DPWA	Multichannel

[7] Statistical error only.

$N(2000) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
-0.018 ± 0.012	ANISOVICH	13B	DPWA	Multichannel

$N(2000) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
-0.035 ± 0.020	ANISOVICH	13B	DPWA	Multichannel

$N(2000)$ REFERENCES

ANISOVICH	17B	PL B771 142	A.V. Anisovich *et al.*	
DENISENKO	16	PL B755 97	I. Denisenko *et al.*	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan *et al.*	(CBELSA/TAPS Collab.)
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)