

**$N(2000) 5/2^+$**  $I(J^P) = \frac{1}{2}(5/2^+)$  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**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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  $|r|$** 

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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  $\theta$** 

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
−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**

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.16 ± 0.06	100 ± 50	SOKHOYAN	15A	DPWA Multichannel

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

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.20 $\pm$ 0.10	-20 $\pm$ 45	SOKHOYAN	15A DPWA	Multichannel

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

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.12 $\pm$ 0.06	80 $\pm$ 40	SOKHOYAN	15A DPWA	Multichannel

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

<u>MODULUS</u>	<u>PHASE (<math>^\circ</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.17 $\pm$ 0.09	-60 $\pm$ 35	SOKHOYAN	15A DPWA	Multichannel

 **$N(2000)$  BREIT-WIGNER MASS**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2060 $\pm$ 30	SOKHOYAN	15A DPWA	Multichannel
1946 $\pm$ 4	<sup>1</sup> SHKLYAR	13 DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2090 $\pm$ 120	ANISOVICH	12A DPWA	Multichannel

<sup>1</sup>Statistical error only. **$N(2000)$  BREIT-WIGNER WIDTH**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
390 $\pm$ 55	SOKHOYAN	15A DPWA	Multichannel
198 $\pm$ 2	<sup>2</sup> SHKLYAR	13 DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
460 $\pm$ 100	ANISOVICH	12A DPWA	Multichannel

<sup>2</sup>Statistical error only. **$N(2000)$  DECAY MODES**

<u>Mode</u>	<u>Fraction (<math>\Gamma_j/\Gamma</math>)</u>
$\Gamma_1$ $N\pi$	6–10 %
$\Gamma_2$ $N\eta$	<4 %
$\Gamma_3$ $N\omega$	<2 %
$\Gamma_4$ $N\pi\pi$	35–90 %
$\Gamma_5$ $\Delta(1232)\pi$	30–80 %
$\Gamma_6$ $\Delta(1232)\pi$ , P-wave	12–32 %
$\Gamma_7$ $\Delta(1232)\pi$ , F-wave	19–49 %
$\Gamma_8$ $\Lambda K^*(892)$	(2.2 $\pm$ 1.0) %
$\Gamma_9$ $N\sigma$	5–15 %
$\Gamma_{10}$ $N(1520)\pi$ , D-wave	11–31 %

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

### $N(2000)$ BRANCHING RATIOS

#### $\Gamma(N\pi)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>6 to 10 (<math>\approx</math> 8) OUR ESTIMATE</b>			
$8 \pm 4$	SOKHOYAN	15A	DPWA Multichannel
$10 \pm 1$	<sup>3</sup> SHKLYAR	13	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$9 \pm 4$	ANISOVICH	12A	DPWA Multichannel
<sup>3</sup> Statistical error only.			

#### $\Gamma(N\eta)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$2 \pm 2$	<sup>4</sup> SHKLYAR	13	DPWA Multichannel
<sup>4</sup> Statistical error only.			

#### $\Gamma(N\omega)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$18 \pm 8$	DENISENKO	16	DPWA Multichannel
$1 \pm 1$	<sup>5</sup> SHKLYAR	13	DPWA Multichannel
<sup>5</sup> Statistical error only.			

#### $\Gamma(\Delta(1232)\pi, P\text{-wave})/\Gamma_{\text{total}}$ $\Gamma_6/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$22 \pm 10$	SOKHOYAN	15A	DPWA Multichannel

#### $\Gamma(\Delta(1232)\pi, F\text{-wave})/\Gamma_{\text{total}}$ $\Gamma_7/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$34 \pm 15$	SOKHOYAN	15A	DPWA Multichannel

#### $\Gamma(\Lambda K^*(892))/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.022 \pm 0.010</math></b>	ANISOVICH	17B	DPWA Multichannel

#### $\Gamma(N\sigma)/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$10 \pm 5$	SOKHOYAN	15A	DPWA Multichannel

$\Gamma(N(1520)\pi, D\text{-wave})/\Gamma_{\text{total}}$				$\Gamma_{10}/\Gamma$
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
$21 \pm 10$	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(N(1680)\pi, P\text{-wave})/\Gamma_{\text{total}}$				$\Gamma_{11}/\Gamma$
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
$16 \pm 9$	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 ( $\text{GeV}^{-1/2}$ )	PHASE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$0.033 \pm 0.010$	$15 \pm 25$	SOKHOYAN	15A	DPWA Multichannel

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

MODULUS ( $\text{GeV}^{-1/2}$ )	PHASE ( $^\circ$ )	DOCUMENT ID	TECN	COMMENT
$0.045 \pm 0.008$	$-140 \pm 25$	SOKHOYAN	15A	DPWA Multichannel

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

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

VALUE ( $\text{GeV}^{-1/2}$ )	DOCUMENT ID	TECN	COMMENT
$0.031 \pm 0.010$	SOKHOYAN	15A	DPWA Multichannel
$0.011 \pm 0.001$	<sup>6</sup> SHKLYAR	13	DPWA Multichannel

<sup>6</sup> Statistical error only.

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

VALUE ( $\text{GeV}^{-1/2}$ )	DOCUMENT ID	TECN	COMMENT
$-0.043 \pm 0.008$	SOKHOYAN	15A	DPWA Multichannel
$0.025 \pm 0.001$	<sup>7</sup> SHKLYAR	13	DPWA Multichannel

<sup>7</sup> Statistical error only.

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

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

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

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

### $N(2000)$ REFERENCES

ANISOVICH	17B	PL B771 142	A.V. Anisovich <i>et al.</i>
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.)
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich <i>et al.</i>
SHKLYAR	13	PR C87 015201	V. Shklyar, H. Lenske, U. Mosel (GIES)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i> (BONN, PNPI)