

**$N(1860) 5/2^+$**  $I(J^P) = \frac{1}{2}(5/2^+)$  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  $N(2000)$ .

 **$N(1860)$  BREIT-WIGNER MASS**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>1820 to 1960 (<math>\approx 1860</math>) OUR ESTIMATE</b>			
1860 $\begin{smallmatrix} +120 \\ -60 \end{smallmatrix}$	ANISOVICH	12A	DPWA Multichannel
1817.7	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1882 $\pm 10$	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1900 $\pm 7$	SHRESTHA	12A	DPWA Multichannel
1814	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
1903 $\pm 87$	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

 **$N(1860)$  BREIT-WIGNER WIDTH**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
270 $\begin{smallmatrix} +140 \\ -50 \end{smallmatrix}$	ANISOVICH	12A	DPWA Multichannel
117.6	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
95 $\pm 20$	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
219 $\pm 23$	SHRESTHA	12A	DPWA Multichannel
176	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
490 $\pm 310$	MANLEY	92	IPWA $\pi N \rightarrow \pi N \& N\pi\pi$

 **$N(1860)$  POLE POSITION****REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1830 $\begin{smallmatrix} +120 \\ -60 \end{smallmatrix}$	ANISOVICH	12A	DPWA Multichannel
1807	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1863	SHRESTHA	12A	DPWA Multichannel

## – 2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$250^{+150}_{-50}$	ANISOVICH	12A	DPWA Multichannel
109	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
189	SHRESTHA	12A	DPWA Multichannel

## N(1860) ELASTIC POLE RESIDUE

### MODULUS $|r|$

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$50 \pm 20$	ANISOVICH	12A	DPWA Multichannel
60	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$

### PHASE $\theta$

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$-80 \pm 40$	ANISOVICH	12A	DPWA Multichannel
-67	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$

## N(1860) DECAY MODES

Mode
$\Gamma_1$ $N\pi$
$\Gamma_2$ $N\eta$
$\Gamma_3$ $\Lambda K$
$\Gamma_4$ $N\pi\pi$
$\Gamma_5$ $\Delta(1232)\pi$ , P-wave
$\Gamma_6$ $\Delta(1232)\pi$ , F-wave
$\Gamma_7$ $N\rho$ , $S=3/2$ , P-wave
$\Gamma_8$ $N\rho$ , $S=3/2$ , F-wave
$\Gamma_9$ $N(\pi\pi)_{S-wave}^{I=0}$
$\Gamma_{10}$ $p\gamma$
$\Gamma_{11}$ $p\gamma$ , helicity=1/2
$\Gamma_{12}$ $p\gamma$ , helicity=3/2
$\Gamma_{13}$ $n\gamma$
$\Gamma_{14}$ $n\gamma$ , helicity=1/2
$\Gamma_{15}$ $n\gamma$ , helicity=3/2

## N(1860) BRANCHING RATIOS

<u><math>\Gamma(N\pi)/\Gamma_{\text{total}}</math></u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	<u><math>\Gamma_1/\Gamma</math></u>
$20 \pm 6$	ANISOVICH	12A	DPWA Multichannel	
12.7	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$	
$4 \pm 2$	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$	

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

17 ± 1	SHRESTHA	12A	DPWA	Multichannel
10	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
8 ± 5	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \& N\pi\pi$

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

VALUE (%) DOCUMENT ID TECN COMMENT

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

4 ± 2	SHRESTHA	12A	DPWA	Multichannel
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**$\Gamma(\Lambda K)/\Gamma_{\text{total}}$   $\Gamma_3/\Gamma$**

VALUE (%) DOCUMENT ID TECN COMMENT

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

< 1	SHRESTHA	12A	DPWA	Multichannel
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**$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\pi \rightarrow N(1860) \rightarrow \Delta(1232)\pi$ , *P-wave*  $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

-0.03 ± 0.03	SHRESTHA	12A	DPWA	Multichannel
+0.10 ± 0.06	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \& N\pi\pi$

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

VALUE (%) DOCUMENT ID TECN COMMENT

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

< 1	SHRESTHA	12A	DPWA	Multichannel
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**$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\pi \rightarrow N(1860) \rightarrow N\rho, S=3/2$ , *P-wave*  $(\Gamma_1\Gamma_7)^{1/2}/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

-0.07 ± 0.03	SHRESTHA	12A	DPWA	Multichannel
-0.22 ± 0.08	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \& N\pi\pi$

**$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\pi \rightarrow N(1860) \rightarrow N\rho, S=3/2$ , *F-wave*  $(\Gamma_1\Gamma_8)^{1/2}/\Gamma$**

VALUE DOCUMENT ID TECN COMMENT

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

+0.11 ± 0.06	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \& N\pi\pi$
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**$\Gamma(N(\pi\pi)_{S=0}^{I=0})/\Gamma_{\text{total}}$   $\Gamma_9/\Gamma$**

VALUE (%) DOCUMENT ID TECN COMMENT

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

41 ± 6	SHRESTHA	12A	DPWA	Multichannel
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**$N(1860)$  PHOTON DECAY AMPLITUDES** **$N(1860) \rightarrow p\gamma$ , helicity-1/2 amplitude  $A_{1/2}$** 

<u>VALUE (GeV<sup>-1/2</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.020±0.012	<sup>1</sup> ANISOVICH	12A	DPWA Phase = (120 ± 50) <sup>o</sup>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-0.017±0.003	SHRESTHA	12A	DPWA Multichannel

 **$N(1860) \rightarrow p\gamma$ , helicity-3/2 amplitude  $A_{3/2}$** 

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.050±0.020	<sup>1</sup> ANISOVICH	12A	DPWA Phase = (-80 ± 60) <sup>o</sup>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.029±0.004	SHRESTHA	12A	DPWA Multichannel

 **$N(1860) \rightarrow n\gamma$ , helicity-1/2 amplitude  $A_{1/2}$** 

<u>VALUE (GeV<sup>-1/2</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.010±0.005	SHRESTHA	12A	DPWA Multichannel

 **$N(1860) \rightarrow n\gamma$ , helicity-3/2 amplitude  $A_{3/2}$** 

<u>VALUE (GeV<sup>-1/2</sup>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-0.009±0.005	SHRESTHA	12A	DPWA Multichannel

 **$N(1860)$  FOOTNOTES**

<sup>1</sup> This ANISOVICH 12A value is the complex helicity amplitude at the pole position.

 **$N(1860)$  REFERENCES**

ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
ARNDT	95	PR C52 2120	R.A. Arndt <i>et al.</i>	(VPI, BRCO)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KSA)
Also		PR D30 904	D.M. Manley <i>et al.</i>	(VPI)
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT)