

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

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

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$1834 \pm 19 \pm 6$	<sup>1</sup> SVARC 14	L+P	$\pi N \rightarrow \pi N$
$1830^{+120}_{-60}$	ANISOVICH 12A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1871	HUNT 19	DPWA	Multichannel
1807	ARNDT 06	DPWA	$\pi N \rightarrow \pi N, \eta N$

<sup>1</sup> Fit to the amplitudes of HOEHLER 79.**−2×IMAGINARY PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$122 \pm 34 \pm 7$	<sup>2</sup> SVARC 14	L+P	$\pi N \rightarrow \pi N$
$250^{+150}_{-50}$	ANISOVICH 12A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
337	HUNT 19	DPWA	Multichannel
109	ARNDT 06	DPWA	$\pi N \rightarrow \pi N, \eta N$

<sup>2</sup> Fit to the amplitudes of HOEHLER 79. **$N(1860)$  ELASTIC POLE RESIDUE****MODULUS  $|r|$** 

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$4 \pm 1 \pm 1$	<sup>3</sup> SVARC 14	L+P	$\pi N \rightarrow \pi N$
$50 \pm 20$	ANISOVICH 12A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
60	ARNDT 06	DPWA	$\pi N \rightarrow \pi N, \eta N$

<sup>3</sup> Fit to the amplitudes of HOEHLER 79.**PHASE  $\theta$** 

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$-39 \pm 18 \pm 9$	<sup>4</sup> SVARC 14	L+P	$\pi N \rightarrow \pi N$
$-80 \pm 40$	ANISOVICH 12A	DPWA	Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
−67	ARNDT 06	DPWA	$\pi N \rightarrow \pi N, \eta N$

<sup>4</sup> Fit to the amplitudes of HOEHLER 79.***N*(1860) BREIT-WIGNER MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1928 ± 21	<sup>5</sup> HUNT	19	DPWA Multichannel
1860 $\begin{smallmatrix} +120 \\ -60 \end{smallmatrix}$	ANISOVICH	12A	DPWA Multichannel
1882 ± 10	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1900 ± 7	<sup>5</sup> SHRESTHA	12A	DPWA Multichannel
1817.7	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$

<sup>5</sup> Statistical error only.***N*(1860) BREIT-WIGNER WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
376 ± 58	<sup>6</sup> HUNT	19	DPWA Multichannel
270 $\begin{smallmatrix} +140 \\ -50 \end{smallmatrix}$	ANISOVICH	12A	DPWA Multichannel
95 ± 20	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
219 ± 23	<sup>6</sup> SHRESTHA	12A	DPWA Multichannel
117.6	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$

<sup>6</sup> Statistical error only.***N*(1860) DECAY MODES**

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $N\pi$	4–20 %
$\Gamma_2$ $N\eta$	0–6 %
$\Gamma_3$ $\Lambda K$	<0.01 %
$\Gamma_4$ $N\pi\pi$	>61 %
$\Gamma_5$ $\Delta\pi$	20–54 %
$\Gamma_6$ $\Delta\pi$ , <i>P</i> -wave	4–16 %
$\Gamma_7$ $\Delta\pi$ , <i>F</i> -wave	16–38 %
$\Gamma_8$ $N\rho$	<8.6 %
$\Gamma_9$ $N\rho$ , $S=3/2$ , <i>P</i> -wave	<8.5 %
$\Gamma_{10}$ $N\rho$ , $S=3/2$ , <i>F</i> -wave	<0.1 %
$\Gamma_{11}$ $N\sigma$	41–61 %
$\Gamma_{12}$ $p\gamma$	
$\Gamma_{13}$ $p\gamma$ , helicity=1/2	seen
$\Gamma_{14}$ $p\gamma$ , helicity=3/2	seen
$\Gamma_{15}$ $n\gamma$	0.0017–0.062 %
$\Gamma_{16}$ $n\gamma$ , helicity=1/2	0.0003–0.019 %
$\Gamma_{17}$ $n\gamma$ , helicity=3/2	0.0014–0.043 %

**$N(1860)$  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>4–20 % OUR ESTIMATE</b>			
8.0±0.1	<sup>7</sup> HUNT	19	DPWA Multichannel
20 ±6	ANISOVICH	12A	DPWA Multichannel
4 ±2	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
17 ±1	<sup>7</sup> SHRESTHA	12A	DPWA Multichannel
12.7	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
<sup>7</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>
<b>0–6 % OUR ESTIMATE</b>			
0.11±0.09	<sup>8</sup> HUNT	19	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4 ±2	<sup>8</sup> SHRESTHA	12A	DPWA Multichannel
<sup>8</sup> Statistical error only.			

 **$\Gamma(\Lambda K)/\Gamma_{\text{total}}$   $\Gamma_3/\Gamma$** 

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>&lt;0.01 % OUR ESTIMATE</b>			
<0.01	<sup>9</sup> HUNT	19	DPWA Multichannel
<sup>9</sup> Statistical error only.			

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>4–16 % OUR ESTIMATE</b>			
10±6	<sup>10</sup> HUNT	19	DPWA Multichannel
<sup>10</sup> Statistical error only.			

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>16–38 % OUR ESTIMATE</b>			
27±11	<sup>11</sup> HUNT	19	DPWA Multichannel
<sup>11</sup> Statistical error only.			

 **$\Gamma(N\rho, S=3/2, P\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_9/\Gamma$** 

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>&lt;8.5 % OUR ESTIMATE</b>			
<8.5	<sup>12</sup> HUNT	19	DPWA Multichannel
<sup>12</sup> Statistical error only.			

 **$\Gamma(N\rho, S=3/2, F\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_{10}/\Gamma$** 

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>&lt;0.1 % OUR ESTIMATE</b>			
<0.1	<sup>13</sup> HUNT	19	DPWA Multichannel
<sup>13</sup> Statistical error only.			

$\Gamma(N\sigma)/\Gamma_{\text{total}}$  $\Gamma_{11}/\Gamma$ 

VALUE (%)	DOCUMENT ID	TECN	COMMENT
<b>41–61 % OUR ESTIMATE</b>			
51 ± 10	<sup>14</sup> HUNT	19	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
41 ± 6	<sup>14</sup> SHRESTHA	12A	DPWA Multichannel
<sup>14</sup> Statistical error only.			

 **$N(1860)$  BREIT-WIGNER PHOTON DECAY AMPLITUDES** **$N(1860) \rightarrow \rho\gamma$ , helicity-1/2 amplitude  $A_{1/2}$** 

VALUE ( $\text{GeV}^{-1/2}$ )	DOCUMENT ID	TECN	COMMENT
−0.022 ± 0.020	<sup>15</sup> HUNT	19	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
−0.017 ± 0.003	<sup>15</sup> SHRESTHA	12A	DPWA Multichannel
<sup>15</sup> Statistical error only.			

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

VALUE	DOCUMENT ID	TECN	COMMENT
−0.032 ± 0.034	<sup>16</sup> HUNT	19	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.029 ± 0.004	<sup>16</sup> SHRESTHA	12A	DPWA Multichannel
<sup>16</sup> Statistical error only.			

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

VALUE ( $\text{GeV}^{-1/2}$ )	DOCUMENT ID	TECN	COMMENT
0.021 ± 0.029	<sup>17</sup> HUNT	19	DPWA Multichannel
0.021 ± 0.013	ANISOVICH	13B	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.010 ± 0.005	<sup>17</sup> SHRESTHA	12A	DPWA Multichannel
<sup>17</sup> Statistical error only.			

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

VALUE ( $\text{GeV}^{-1/2}$ )	DOCUMENT ID	TECN	COMMENT
0.070 ± 0.035	<sup>18</sup> HUNT	19	DPWA Multichannel
0.034 ± 0.017	ANISOVICH	13B	DPWA Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
−0.009 ± 0.005	<sup>18</sup> SHRESTHA	12A	DPWA Multichannel
<sup>18</sup> Statistical error only.			

 **$N(1860)$  REFERENCES**

HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
SVARC	14	PR C89 045205	A. Svarc <i>et al.</i>	(RBI Zagreb, UNI Tuzla)
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich <i>et al.</i>	
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)
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT)