

$N(1860) 5/2^+$ $I(J^P) = \frac{1}{2}(5/2^+)$ 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>
1820 to 1960 (≈ 1860) OUR ESTIMATE			
1860 $\begin{smallmatrix} +120 \\ -60 \end{smallmatrix}$	ANISOVICH	12A	DPWA Multichannel
1817.7	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
1882 ± 10	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1900 ± 7	SHRESTHA	12A	DPWA Multichannel
1814	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
1903 ± 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 ± 20	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
219 ± 23	SHRESTHA	12A	DPWA Multichannel
176	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
490 ± 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 ± 20	ANISOVICH	12A	DPWA Multichannel
60	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$

PHASE θ

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

N(1860) DECAY MODES

Mode
Γ_1 $N\pi$
Γ_2 $N\eta$
Γ_3 ΛK
Γ_4 $N\pi\pi$
Γ_5 $\Delta(1232)\pi$, P-wave
Γ_6 $\Delta(1232)\pi$, F-wave
Γ_7 $N\rho$, S=3/2, P-wave
Γ_8 $N\rho$, S=3/2, F-wave
Γ_9 $N(\pi\pi)_{S-wave}^{I=0}$
Γ_{10} $p\gamma$
Γ_{11} $p\gamma$, helicity=1/2
Γ_{12} $p\gamma$, helicity=3/2
Γ_{13} $n\gamma$
Γ_{14} $n\gamma$, helicity=1/2
Γ_{15} $n\gamma$, helicity=3/2

N(1860) BRANCHING RATIOS

<u>$\Gamma(N\pi)/\Gamma_{\text{total}}$</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	<u>Γ_1/Γ</u>
20 ± 6	ANISOVICH	12A	DPWA Multichannel	
12.7	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$	
4 ± 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	$\pi N \rightarrow \pi N \& N\pi\pi$

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

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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$\Gamma(\Lambda K)/\Gamma_{\text{total}}$ Γ_3/Γ

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	$\pi N \rightarrow \pi N \& N\pi\pi$

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

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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$\Gamma(N(\pi\pi)_{S=0}^{I=0})/\Gamma_{\text{total}}$ Γ_9/Γ

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) → pγ, helicity-1/2 amplitude A_{1/2}

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

N(1860) → pγ, helicity-3/2 amplitude A_{3/2}

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

N(1860) → nγ, helicity-1/2 amplitude A_{1/2}

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

N(1860) → nγ, helicity-3/2 amplitude A_{3/2}

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

N(1860) FOOTNOTES

¹ 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)