$N(1860)\ 5/2^+$

$I(J^P) = \frac{1}{2}(\frac{5}{2}^+)$ 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(1860) BREIT-WIGNER MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1820 to 1960 (≈ 1860) OUR ESTIMATE				
$1860\ ^{+120}_{-\ 60}$	ANISOVICH	12A	DPWA	Multichannel
1817.7	ARNDT	06	DPWA	$\pi N \to \pi N,\ \eta N$
1882 ± 10	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1900 ± 7	SHRESTHA	12A	DPWA	Multichannel
1814	ARNDT	95	DPWA	$\pi N \to N\pi$
1903 ± 87	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$

N(1860) BREIT-WIGNER WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
$270\ ^{+140}_{-\ 50}$	ANISOVICH	12A	DPWA	Multichannel
117.6	ARNDT	06	DPWA	$\pi N \to \pi N,\ \eta N$
95 ± 20	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
219 ± 23	SHRESTHA	12A	DPWA	Multichannel
176	ARNDT	95	DPWA	$\pi N \to N\pi$
490 ±310	MANLEY	92	IPWA	$\pi N \to \pi N$ & $N\pi\pi$

N(1860) POLE POSITION

REAL PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1834± 19±6	[1] SVARC	14	MLS	$\pi N \to \pi N$
$1830^{+120}_{-\ 60}$	ANISOVICH	12A	DPWA	Multichannel
1807	ARNDT	06	DPWA	$\pi N \to \pi N,\ \eta N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1863	SHRESTHA	12A	DPWA	Multichannel

−2×IMAGINARY PART

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
122± 34±7	[1]	SVARC	14	MLS	$\pi N \rightarrow \pi N$
$250^{+150}_{-\ 50}$		ANISOVICH	12A	DPWA	Multichannel
109		ARNDT	06	DPWA	$\pi N \rightarrow \pi N$, ηN
• • • We do not use the following data for averages, fits, limits, etc. • • •					
189		SHRESTHA	12A	DPWA	Multichannel

N(1860) ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
4± 1±1	[1]	SVARC	14	MLS	$\pi N \rightarrow \pi N$
50±20		ANISOVICH	12A	DPWA	Multichannel
60		ARNDT	06	DPWA	$\pi N \rightarrow \pi N$, ηN

PHASE θ

VALUE (°)		*DOCUMENT ID*		*TECN*	*COMMENT*
−39±18±9	[1]	SVARC	14	MLS	$\pi N \rightarrow \pi N$
−80±40		ANISOVICH	12A	DPWA	Multichannel
−67		ARNDT	06	DPWA	$\pi N \rightarrow \pi N$, ηN

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	$N(\pi\pi)^{I=0}_{S-wave}$
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

$\Gamma(N\pi)/\Gamma_{total}$ Γ_1/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
20 ±6	ANISOVICH	12A	DPWA	Multichannel
12.7	ARNDT	06	DPWA	$\pi N \rightarrow \pi N$, ηN
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	$\pi N \rightarrow \pi N$ & $N\pi\pi$

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

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

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ 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*-wave$)/\Gamma_{total}$ 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

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ 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	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ 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	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$\Gamma(N(\pi\pi)^{I=0}_{S-wave})/\Gamma_{total}$ 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

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	[2] ANISOVICH 12A	DPWA	Phase = (120 ± 50)°
• • • 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	[2] ANISOVICH 12A	DPWA	Phase = (−80 ± 60)°
• • • 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
0.021 ± 0.013	ANISOVICH 13B	DPWA	Multichannel
• • • 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
0.034 ± 0.017	ANISOVICH 13B	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •			
−0.009 ± 0.005	SHRESTHA 12A	DPWA	Multichannel

N(1860) FOOTNOTES

[1] Fit to the amplitudes of HOEHLER 79.
[2] This ANISOVICH 12A value is the complex helicity amplitude at the pole position.

N(1860) REFERENCES

SVARC	14	PR C89 045205	A. Svarc *et al.*	
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich *et al.*	
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich *et al.*	(BONN, PNPI)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
ARNDT	06	PR C74 045205	R.A. Arndt *et al.*	(GWU)
ARNDT	95	PR C52 2120	R.A. Arndt *et al.*	(VPI, BRCO)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KSA)
Also		PR D30 904	D.M. Manley *et al.*	(VPI)
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT)