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

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

$N(1860)$ POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$1834\pm 19\pm 6$	[1] SVARC	14	L+P	$\pi N \to \pi N$
$1830^{+120}_{-\ 60}$	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	$\pi N \to \pi N,\ \eta N$

[1] Fit to the amplitudes of HOEHLER 79.

$-2\times$IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$122\pm 34\pm 7$	[2] SVARC	14	L+P	$\pi N \to \pi N$
$250^{+150}_{-\ 50}$	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	$\pi N \to \pi N,\ \eta N$

[2] Fit to the amplitudes of HOEHLER 79.

$N(1860)$ ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$4\pm 1\pm 1$	[3] SVARC	14	L+P	$\pi N \to \pi N$
50 ± 20	ANISOVICH	12A	DPWA	Multichannel

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

60	ARNDT	06	DPWA	$\pi N \to \pi N,\ \eta N$

[3] Fit to the amplitudes of HOEHLER 79.

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
$-39\pm 18\pm 9$	[4] SVARC	14	L+P	$\pi N \to \pi N$
-80 ± 40	ANISOVICH	12A	DPWA	Multichannel

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

-67		ARNDT	06	DPWA $\pi N \to \pi N, \eta N$

[4] Fit to the amplitudes of HOEHLER 79.

N(1860) BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1928 ± 21	[5] HUNT	19	DPWA	Multichannel
$1860 \begin{smallmatrix} +120 \\ -60 \end{smallmatrix}$	ANISOVICH	12A	DPWA	Multichannel
1882 ± 10	HOEHLER	79	IPWA	$\pi N \to \pi N$

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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1900 ± 7	[5] SHRESTHA	12A	DPWA	Multichannel
1817.7	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$

[5] Statistical error only.

N(1860) BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
376 ± 58	[6] HUNT	19	DPWA	Multichannel
$270 \begin{smallmatrix} +140 \\ -50 \end{smallmatrix}$	ANISOVICH	12A	DPWA	Multichannel
95 ± 20	HOEHLER	79	IPWA	$\pi N \to \pi N$

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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
219 ± 23	[6] SHRESTHA	12A	DPWA	Multichannel
117.6	ARNDT	06	DPWA	$\pi N \to \pi N, \eta N$

[6] Statistical error only.

N(1860) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	4–20 %
Γ_2	$N\eta$	0–6 %
Γ_3	ΛK	<0.01 %
Γ_4	$N\pi\pi$	>61 %
Γ_5	$\Delta\pi$	20–54 %
Γ_6	$\Delta\pi$, P-wave	4–16 %
Γ_7	$\Delta\pi$, F-wave	16–38 %
Γ_8	$N\rho$	<8.6 %
Γ_9	$N\rho$, $S=3/2$, P-wave	<8.5 %
Γ_{10}	$N\rho$, $S=3/2$, F-wave	<0.1 %
Γ_{11}	$N\sigma$	41–61 %
Γ_{12}	$p\gamma$	
Γ_{13}	$p\gamma$, helicity=1/2	seen
Γ_{14}	$p\gamma$, helicity=3/2	seen

Γ_{15}	$n\gamma$	0.0017–0.062 %
Γ_{16}	$n\gamma$, helicity=1/2	0.0003–0.019 %
Γ_{17}	$n\gamma$, helicity=3/2	0.0014–0.043 %

N(1860) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ Γ_1/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4–20 % OUR ESTIMATE				
8.0±0.1	[7] HUNT	19	DPWA	Multichannel
20 ±6	ANISOVICH	12A	DPWA	Multichannel
4 ±2	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
17 ±1	[7] SHRESTHA	12A	DPWA	Multichannel
12.7	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN

[7] Statistical error only.

$\Gamma(N\eta)/\Gamma_{total}$ Γ_2/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0–6 % OUR ESTIMATE				
0.11±0.09	[8] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4 ±2	[8] SHRESTHA	12A	DPWA	Multichannel

[8] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
<0.01 % OUR ESTIMATE				
<0.01	[9] HUNT	19	DPWA	Multichannel

[9] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4–16 % OUR ESTIMATE				
10±6	[10] HUNT	19	DPWA	Multichannel

[10] Statistical error only.

$\Gamma(\Delta\pi, F\text{-wave})/\Gamma_{total}$ Γ_7/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
16–38 % OUR ESTIMATE				
27±11	[11] HUNT	19	DPWA	Multichannel

[11] Statistical error only.

$\Gamma(N\rho, S=3/2, P\text{-wave})/\Gamma_{total}$ Γ_9/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
<8.5 % OUR ESTIMATE				
<8.5	[12] HUNT	19	DPWA	Multichannel

[12] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
<0.1 % OUR ESTIMATE				
<0.1	[13] HUNT	19	DPWA	Multichannel

[13] Statistical error only.

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

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

[14] Statistical error only.

N(1860) BREIT-WIGNER PHOTON DECAY AMPLITUDES

N(1860) → $p\gamma$, helicity-1/2 amplitude $A_{1/2}$

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

[15] Statistical error only.

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

VALUE	DOCUMENT ID		TECN	COMMENT
−0.032±0.034	[16] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.029±0.004	[16] SHRESTHA	12A	DPWA	Multichannel

[16] Statistical error only.

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

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.021±0.029	[17] 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	[17] SHRESTHA	12A	DPWA	Multichannel

[17] Statistical error only.

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

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.070±0.035	[18] 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	[18] SHRESTHA	12A	DPWA	Multichannel

[18] Statistical error only.

N(1860) REFERENCES

HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
SVARC	14	PR C89 045205	A. Svarc *et al.*	(RBI Zagreb, UNI Tuzla)
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)
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT)