

$N(2060) 5/2^-$

$$I(J^P) = \frac{1}{2}(\frac{5}{2}^-) \text{ Status: } **$$

OMITTED FROM SUMMARY TABLE

Before our 2012 *Review*, this state appeared in our Listings as the $N(2200)$.

The latest GWU analysis (ARNDT 06) finds no evidence for this resonance.

$N(2060)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
≈ 2060 OUR ESTIMATE			
2060 ± 15	ANISOVICH	12A	DPWA Multichannel
1900	BELL	83	DPWA $\pi^- p \rightarrow \Lambda K^0$
2180 ± 80	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
1920	SAXON	80	DPWA $\pi^- p \rightarrow \Lambda K^0$
2228 ± 30	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2116 ± 21	SHRESTHA	12A	DPWA Multichannel
2217 ± 27	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$

$N(2060)$ BREIT-WIGNER WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
375 ± 25	ANISOVICH	12A	DPWA Multichannel
130	BELL	83	DPWA $\pi^- p \rightarrow \Lambda K^0$
400 ± 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
220	SAXON	80	DPWA $\pi^- p \rightarrow \Lambda K^0$
310 ± 50	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
307 ± 112	SHRESTHA	12A	DPWA Multichannel
481 ± 17	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$

$N(2060)$ POLE POSITION

REAL PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2040 ± 15	ANISOVICH	12A	DPWA Multichannel
2100 ± 60	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2064	SHRESTHA	12A	DPWA Multichannel
2144 ± 31	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$

– 2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
390 ± 25	ANISOVICH 12A	DPWA	Multichannel
360 ± 80	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
267	SHRESTHA 12A	DPWA	Multichannel
438 ± 13	BATINIC 10	DPWA	$\pi N \rightarrow N\pi, N\eta$

N(2060) ELASTIC POLE RESIDUE

MODULUS $|r|$

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
19 ± 5	ANISOVICH 12A	DPWA	Multichannel
20 ± 10	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
26	BATINIC 10	DPWA	$\pi N \rightarrow N\pi, N\eta$

PHASE θ

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
– 125 ± 20	ANISOVICH 12A	DPWA	Multichannel
– 90 ± 50	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
– 71	BATINIC 10	DPWA	$\pi N \rightarrow N\pi, N\eta$

N(2060) INELASTIC POLE RESIDUE

The “normalized residue” is the residue divided by $\Gamma_{pole}/2$.

Normalized residue in $N\pi \rightarrow N(2060) \rightarrow N\eta$

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
5 ± 3	40 ± 25	ANISOVICH 12A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2060) \rightarrow \Lambda K$

<u>MODULUS (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1 ± 0.5	ANISOVICH 12A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2060) \rightarrow \Sigma K$

<u>MODULUS (%)</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
4 ± 2	– 70 ± 30	ANISOVICH 12A	DPWA	Multichannel

N(2060) DECAY MODES

Mode
Γ_1 $N\pi$
Γ_2 $N\eta$
Γ_3 ΛK
Γ_4 ΣK
Γ_5 $N\pi\pi$
Γ_6 $\Delta\pi$
Γ_7 $\Delta(1232)\pi$, <i>D-wave</i>
Γ_8 $N\rho$
Γ_9 $N\rho$, $S=1/2$
Γ_{10} $N\rho$, $S=3/2$, <i>D-wave</i>
Γ_{11} $p\gamma$
Γ_{12} $p\gamma$, helicity=1/2
Γ_{13} $p\gamma$, helicity=3/2
Γ_{14} $n\gamma$
Γ_{15} $n\gamma$, helicity=1/2
Γ_{16} $n\gamma$, helicity=3/2

N(2060) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	Γ_1/Γ
8±2	ANISOVICH	12A	DPWA Multichannel	
10±3	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$	
7±2	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
9±2	SHRESTHA	12A	DPWA Multichannel	
13±4	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$	
$\Gamma(N\eta)/\Gamma_{\text{total}}$				
<i>VALUE (%)</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	Γ_2/Γ
4 ±2	ANISOVICH	12A	DPWA Multichannel	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<1	SHRESTHA	12A	DPWA Multichannel	
0.2±1.0	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$	
$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(2060) \rightarrow N\eta$				
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$
0.066	BAKER	79	DPWA $\pi^- p \rightarrow n\eta$	

$(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\pi \rightarrow N(2060) \rightarrow \Lambda K$				$(\Gamma_1 \Gamma_3)^{1/2} / \Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
-0.03	BELL	83	DPWA	$\pi^- p \rightarrow \Lambda K^0$
-0.05	SAXON	80	DPWA	$\pi^- p \rightarrow \Lambda K^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.00 ± 0.03	SHRESTHA	12A	DPWA	Multichannel

$\Gamma(\Sigma K) / \Gamma_{\text{total}}$				Γ_4 / Γ
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
3 ± 2	ANISOVICH	12A	DPWA	Multichannel

$\Gamma(\Delta(1232)\pi, D\text{-wave}) / \Gamma_{\text{total}}$				Γ_7 / Γ
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
40 ± 13	SHRESTHA	12A	DPWA	Multichannel

$\Gamma(N\rho, S=1/2) / \Gamma_{\text{total}}$				Γ_9 / Γ
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
21 ± 15	SHRESTHA	12A	DPWA	Multichannel

$\Gamma(N\rho, S=3/2, D\text{-wave}) / \Gamma_{\text{total}}$				Γ_{10} / Γ
VALUE (%)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 9	SHRESTHA	12A	DPWA	Multichannel

$N(2060)$ PHOTON DECAY AMPLITUDES

Papers on γN amplitudes predating 1981 may be found in our 2006 edition, Journal of Physics, G **33** 1 (2006).

$N(2060) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT	
0.065 ± 0.012	¹ ANISOVICH	12A	DPWA	Phase = $(15 \pm 8)^\circ$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.018 ± 0.004	SHRESTHA	12A	DPWA	Multichannel

$N(2060) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT	
0.055^{+15}_{-35}	¹ ANISOVICH	12A	DPWA	Phase = $(15 \pm 10)^\circ$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.010 ± 0.004	SHRESTHA	12A	DPWA	Multichannel

$N(2060) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.012 ± 0.017	SHRESTHA	12A	DPWA	Multichannel

$N(2060) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-0.023 ± 0.023	SHRESTHA	12A	DPWA Multichannel

$N(2060)$ FOOTNOTES

¹This ANISOVICH 12A value is the complex helicity amplitude at the pole position.

$N(2060)$ 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)
BATINIC	10	PR C82 038203	M. Batinic <i>et al.</i>	(ZAGR)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
BELL	83	NP B222 389	K.W. Bell <i>et al.</i>	(RL) IJP
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
Also		PR D20 2839	R.E. Cutkosky <i>et al.</i>	(CMU, LBL)
SAXON	80	NP B162 522	D.H. Saxon <i>et al.</i>	(RHEL, BRIS) IJP
BAKER	79	NP B156 93	R.D. Baker <i>et al.</i>	(RHEL) IJP
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP