$N(2060) 5/2^{-}$

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

DPWA $\pi N \rightarrow N \pi$, $N \eta$

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OMITTED FROM SUMMARY TABLE

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

N(2060) POLE POSITION

DEA	I P	A DT
KEP	NL P	ARI

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
2030 ± 15	SOKHOYAN	15A	DPWA	Multichannel
$2119\!\pm\!11\!\pm\!1$	¹ SVARC	14	L+P	$\pi N \rightarrow \pi N$
2100 ± 60	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
• • • We do not use the following	g data for averages	s, fits,	limits, e	tc. • • •
2040 ± 15	ANISOVICH	12A	DPWA	Multichannel
2064	SHRESTHA	12A	DPWA	Multichannel
2144 ± 31	BATINIC	10	DPWA	π N \rightarrow N π , N η
-2×IMAGINARY PART				
-2×IMAGINARY PART VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
-	SOKHOYAN	15A		<u>COMMENT</u> Multichannel
VALUE (MeV)	-	15A 14	DPWA	
VALUE (MeV) 400 ± 35	SOKHOYAN	14	DPWA L+P	Multichannel
VALUE (MeV) 400 ± 35 370 ± 20 ± 5	SOKHOYAN ¹ SVARC CUTKOSKY	14 80	DPWA L+P IPWA	Multichannel $\pi N \rightarrow \pi N$ $\pi N \rightarrow \pi N$
VALUE (MeV) 400±35 370±20±5 360±80	SOKHOYAN ¹ SVARC CUTKOSKY	14 80 s, fits,	DPWA L+P IPWA limits, e	Multichannel $\pi N \rightarrow \pi N$ $\pi N \rightarrow \pi N$

N(2060) ELASTIC POLE RESIDUE

DOCUMENT ID TECN COMMENT

BATINIC

MODULUS |r|

VALUE (MeV)

 $438\!\pm\!13$

$25\pm$ 8 $19\pm$ 1 ± 1 20 ± 10 • • • We do not use the following	SOKHOYAN 1 SVARC CUTKOSKY data for averages	14 80	L+P IPWA	Multichannel $\pi N \rightarrow \pi N$ $\pi N \rightarrow \pi N$ etc. $\bullet \bullet \bullet$
19± 5	ANISOVICH			Multichannel
26	BATINIC	10	DPWA	$\pi N \rightarrow N \pi, N \eta$
PHASE θ VALUE (°)	DOCUMENT ID		TECN	COMMENT
VALUE ()	DOCUMENT ID		TECN	COMMENT
-130 ± 20	SOKHOYAN	15A		Multichannel
			DPWA	
-130 ± 20	SOKHOYAN	14	DPWA L+P	Multichannel
-130±20 - 94± 5±1	SOKHOYAN SVARC CUTKOSKY	14 80	DPWA L+P IPWA	$\begin{array}{ll} Multichannel \\ \pi N \to \pi N \\ \pi N \to \pi N \end{array}$
-130 ± 20 $-94\pm5\pm1$ -90 ± 50	SOKHOYAN SVARC CUTKOSKY	14 80 s, fits,	DPWA L+P IPWA limits, 6	$\begin{array}{ll} Multichannel \\ \pi N \to \pi N \\ \pi N \to \pi N \end{array}$

N(2060) INELASTIC POLE RESIDUE

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

THE	normanzea residue	is the residue divided by	pole/2.	
Normalized	residue in $N\pi$ $ ightarrow$	$N(2060) \rightarrow N\eta$		
		DOCUMENT ID	TECN	COMMENT
$0.05\!\pm\!0.03$	40 ± 25	ANISOVICH 12	a DPWA	Multichannel
Normalized	residue in $N\pi ightarrow$	$N(2060) \rightarrow \Lambda K$		
MODULUS		DOCUMENT ID		
0.01 ± 0.005		ANISOVICH 12	a DPWA	Multichannel
Normalized	residue in $N\pi$ $ ightarrow$	$N(2060) \rightarrow \Sigma K$		
MODULUS	PHASE (°)	DOCUMENT ID ANISOVICH 12	TECN	COMMENT
$0.04 \!\pm\! 0.02$	-70 ± 30	ANISOVICH 12	a DPWA	Multichannel
Normalized	residue in $N\pi ightarrow$	$N(2060) \rightarrow \Delta(123)$	2)π, <i>D</i> -v	vave
		DOCUMENT ID		
		SOKHOYAN 15		
Normalized	residue in $N\pi ightarrow$	$N(2060) \rightarrow N\sigma$		
MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
$0.12\!\pm\!0.06$	80 ± 40	SOKHOYAN 15	a DPWA	Multichannel
Normalized	residue in $N\pi ightarrow$	$N(2060) \rightarrow N(144)$	$0)\pi$	
MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
$0.17 \!\pm\! 0.09$	-60 ± 35	DOCUMENT ID SOKHOYAN 15	a DPWA	Multichannel
Normalized	residue in $N\pi$ $ ightarrow$	$N(2060) \rightarrow N(152)$	0)π, <i>P</i> -w	<i>a</i> ve
		DOCUMENT ID		
		SOKHOYAN 15		
	N(2060) BREIT-WIGNER M	IASS	
	(=500	•		
VALUE (MeV)		DOCUMENT ID		
2045 ± 15		SOKHOYAN 15A		
2180±80		CUTKOSKY 80 HOEHLER 79	IPWA πI	$V \rightarrow \pi N$
2228 ± 30		HUEHLER /9	IPVVA πI	${ t V} ightarrow \pi { t / V}$

N(2060) BREIT-WIGNER WIDTH

ANISOVICH

SHRESTHA

BATINIC

12A DPWA Multichannel

12A DPWA Multichannel

10 DPWA $\pi N \rightarrow N \pi$, $N \eta$

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

 2060 ± 15

 $2116 \pm 21 \\ 2217 \pm 27$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
420± 30	SOKHOYAN	15A	DPWA	Multichannel
400 ± 100	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
310± 50	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$

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

375± 25	ANISOVICH	12A	DPWA Multichannel
307 ± 112	SHRESTHA	12A	DPWA Multichannel
481± 17	BATINIC	10	DPWA $\pi N \rightarrow N \pi$, $N \eta$

N(2060) DECAY MODES

	Mode	Fraction (Γ_j/Γ)
$\overline{\Gamma_1}$	$N\pi$	7–12 %
Γ_2	$N\eta$	2–6 %
Γ ₃	N ω	
Γ_4	ΛK	seen
Γ_5	ΣK	1–5 %
Γ_6	$N\pi\pi$	
Γ_7	$\Delta(1232)\pi$	
Γ ₈	${\it \Delta}(1232)\pi$, ${\it D}$ -wave	4–10 %
Γ_9	$N \rho$	
Γ_{10}	$N \rho$, $S=1/2$, P -wave	seen
Γ_{11}	$N\sigma$	3–9 %
Γ_{12}	$N(1440)\pi$	4–14 %
Γ_{13}	$N(1520)\pi$, $ extit{P}$ -wave	9–21 %
Γ_{14}	$N(1680)\pi$, $\it S$ -wave	8–22 %
Γ_{15}	$oldsymbol{ ho}\gamma$	0.03-0.19 %
Γ_{16}	$p\gamma$, helicity $=1/2$	0.02–0.08 %
Γ_{17}	$p\gamma$, helicity=3/2	0.01–0.10 %
Γ_{18}	$n\gamma$	0.003–0.07 %
Γ_{19}	$n\gamma$, helicity=1/2	0.001-0.02 %
Γ ₂₀	$n\gamma$, helicity=3/2	0.002-0.05 %

N(2060) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$					Γ_1/Γ
VALUE (%)	DOCUMENT ID		TECN	COMMENT	
11 ± 2	SOKHOYAN	15A	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 d 	ata for averages	s, fits,	limits, e	etc. • • •	
8±2	ANISOVICH	12A	DPWA	Multichannel	
9 ± 2	SHRESTHA	12A	DPWA	Multichannel	
13 ± 4	BATINIC	10	DPWA	$\pi N \rightarrow N \pi, N \eta$	
$\Gamma(N\eta)/\Gamma_{total}$					Γ_2/Γ
VALUE (%)	DOCUMENT ID		TECN	COMMENT	
4 ±2	ANISOVICH	12A	DPWA	Multichannel	
• • • We do not use the following d	ata for averages	s, fits,	limits, e	etc. • • •	
<1	SHRESTHA	12A	DPWA	Multichannel	
0.2 ± 1.0	BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$	

$\Gamma(N\omega)/\Gamma_{total}$					Г ₃ /Г
VALUE (%)	DOCUMENT ID		TECN	COMMENT	
4 ± 3	DENISENKO	16	DPWA	Multichannel	
$\Gamma(\Sigma K)/\Gamma_{total}$					Γ_5/Γ
VALUE (%)	DOCUMENT ID			COMMENT	
3±2	ANISOVICH	12A	DPWA	Multichannel	
$\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{\text{total}}$	DOCUMENT ID		TECN	COMMENT	Γ_8/Γ
7+ 3	SOKHOYAN			Multichannel	
• • • We do not use the following of		-			
40 ± 13	SHRESTHA			Multichannel	
40±13	SHIKESTHA	12A	DEWA	withthamler	
$\Gamma(N\rho, S=1/2, P-wave)/\Gamma_{total}$					Γ_{10}/Γ
VALUE (%)	DOCUMENT ID		TECN	COMMENT	
• • • We do not use the following	data for averages	s, fits,	limits, e	etc. • • •	
21 ± 15	SHRESTHA	12A	DPWA	Multichannel	
$\Gamma(N\sigma)/\Gamma_{\text{total}}$ VALUE (%)	DOCUMENT ID		TECN	COMMENT	Γ_{11}/Γ
6±3	SOKHOYAN			Multichannel	
$\Gamma(N(1440)\pi)/\Gamma_{\text{total}}$	DOCUMENT ID			COMMENT	Γ ₁₂ /Γ
9±5	SOKHOYAN	15A	DPWA	Multichannel	
$\Gamma(N(1520)\pi, P\text{-wave})/\Gamma_{\text{total}}$ $\frac{VALUE\ (\%)}{15\pm 6}$	DOCUMENT ID		TECN DPWA	<u>COMMENT</u> Multichannel	Γ ₁₃ /Γ
$\Gamma(N(1680)\pi$, S-wave)/ Γ_{total}	DOCUMENT ID		TECN	COMMENT	Γ ₁₄ /Γ
15±7	SOKHOYAN	15 _^			
N(2060) PHOTON D					
$N(2060) \rightarrow p\gamma$, helicity-1/2 a					
	,		Tr	COMMENT	
$\frac{MODULUS (GeV^{-1/2})}{0.064 \pm 0.010} \frac{PHASE (^{\circ})}{12 \pm 8}$	DOCUMEN DOCUMEN	AN	154 DI	DIA/A Multichen	
			15A DI	YVA Wuitichan	nei
$N(2060) \rightarrow p\gamma$, helicity-3/2 a	,				
$\underline{MODULUS\ (GeV^{-1/2})}$ $\underline{PHASE\ (^{\circ}\)}$	<u>DOCUMEN</u>	T ID	TE	COMMENT	
$\frac{\textit{MODULUS (GeV}^{-1/2})}{0.060 \pm 0.020} \frac{\textit{PHASE (}^{\circ}\textit{)}}{13 \pm 10}$	SOKHOY	AN	15A DI	PWA Multichan	nel

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N(2060) BREIT-WIGNER PHOTON DECAY AMPLITUDES

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

$VALUE~({ m GeV}^{-1/2})$	DOCUMENT ID		TECN	COMMENT
0.062 ± 0.010	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following of	lata for averages,	fits,	limits, e	tc. • • •
0.018 ± 0.004	SHRESTHA	12A	DPWA	Multichannel

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

$VALUE (GeV^{-1/2})$	DOCUMENT ID		TECN	COMMENT
0.062 ± 0.020	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following of	lata for averages,	fits,	limits, e	tc. • • •
0.010 ± 0.004	SHRESTHA	12A	DPWA	Multichannel

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

$VALUE (GeV^{-1/2})$	DOCUMENT ID		TECN	COMMENT
$0.025\!\pm\!0.011$	ANISOVICH	13 B	DPWA	Multichannel
• • • We do not use the following of	lata for averages	, fits,	limits, e	tc. • • •
-0.012 ± 0.017	SHRESTHA	12A	DPWA	Multichannel

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

$VALUE$ (GeV $^{-1/2}$)	DOCUMENT ID	TECN	COMMENT				
$-0.037\!\pm\!0.017$	ANISOVICH 1	3B DPWA	Multichannel				
ullet $ullet$ We do not use the following data for averages, fits, limits, etc. $ullet$ $ullet$							
-0.023 ± 0.023	SHRESTHA 1	2A DPWA	Multichannel				

N(2060) FOOTNOTES

N(2060) REFERENCES

DENISENKO SOKHOYAN SVARC ANISOVICH ANISOVICH SHRESTHA BATINIC	16 15A 14 13B 12A 12A 10	PL B755 97 EPJ A51 95 PR C89 045205 EPJ A49 67 EPJ A48 15 PR C86 055203 PR C82 038203	I. Denisenko <i>et al.</i> V. Sokhoyan <i>et al.</i> A. Svarc <i>et al.</i> A.V. Anisovich <i>et al.</i> A.V. Anisovich <i>et al.</i> M. Shrestha, D.M. Manley M. Batinic <i>et al.</i>	(CBELSA/TAPS Collab.) (BONN, PNPI) (KSU) (ZAGR)
CUTKOSKY Also HOEHLER Also	80 79	Toronto Conf. 19 PR D20 2839 PDAT 12-1 Toronto Conf. 3	R.E. Cutkosky <i>et al.</i> R.E. Cutkosky <i>et al.</i> G. Hohler <i>et al.</i> R. Koch	(CMU, LBL) IJP (CMU, LBL) (KARLT) IJP (KARLT) IJP

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 $^{^{1}}$ Fit to the amplitudes of HOEHLER 79.