$N(2120)$ $3/2^-$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$ Status: ∗∗∗

Before the 2012 *Review*, all the evidence for a $J^P = 3/2^-$ state with a mass above 1800 MeV was filed under a two-star $N(2080)$. There is now evidence from ANISOVICH 12A for two $3/2^-$ states in this region, so we have split the older data (according to mass) between a three-star $N(1875)$ and a two-star $N(2120)$.

$N(2120)$ POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
2050 to 2150 (≈ 2100) OUR ESTIMATE				
2115±40	SOKHOYAN	15A	DPWA	Multichannel
2094± 7±11	SVARC	14	L+P	$\pi N \rightarrow \pi N$
2050±70	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2115±40	GUTZ	14	DPWA	Multichannel
2110±50	ANISOVICH	12A	DPWA	Multichannel

−2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
200 to 360 (≈ 280) OUR ESTIMATE				
345±35	SOKHOYAN	15A	DPWA	Multichannel
296±15±4	SVARC	14	L+P	$\pi N \rightarrow \pi N$
200±80	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)
• • • We do not use the following data for averages, fits, limits, etc. • • •				
345±35	GUTZ	14	DPWA	Multichannel
340±45	ANISOVICH	12A	DPWA	Multichannel

$N(2120)$ ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
10 to 30 (≈ 20) OUR ESTIMATE				
11± 6	SOKHOYAN	15A	DPWA	Multichannel
13± 1±1	SVARC	14	L+P	$\pi N \rightarrow \pi N$
30±20	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11± 6	GUTZ	14	DPWA	Multichannel
13± 3	ANISOVICH	12A	DPWA	Multichannel

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
−40 to 20 (≈ −10) OUR ESTIMATE				
−30± 20	SOKHOYAN	15A	DPWA	Multichannel
− 2± 4±9	SVARC	14	L+P	$\pi N \rightarrow \pi N$
0±100	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$ (higher m)
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−30± 20	GUTZ	14	DPWA	Multichannel
−20± 10	ANISOVICH	12A	DPWA	Multichannel

N(2120) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \rightarrow N(2120) \rightarrow \Lambda K$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.03±0.01	100 ± 30	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2120) \rightarrow \Sigma K$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.02±0.015	−50 ± 40	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2120) \rightarrow N(1535)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.15±0.08	−90 ± 40	GUTZ	14	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2120) \rightarrow \Delta(1232)\pi$, S-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.25±0.10	undefined	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2120) \rightarrow \Delta(1232)\pi$, D-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.15±0.06	−35 ± 30	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2120) \rightarrow N\sigma$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.09±0.05	−80 ± 50	SOKHOYAN	15A	DPWA	Multichannel

N(2120) BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
2060 to 2160 (≈ 2120) OUR ESTIMATE				
2120±45	SOKHOYAN	15A	DPWA	Multichannel
2060±80	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
2081±20	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2120±35	GUTZ	14	DPWA	Multichannel
2150±60	ANISOVICH	12A	DPWA	Multichannel

$N(2120)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
260 to 360 (≈ 300) OUR ESTIMATE				
340±35	SOKHOYAN	15A	DPWA	Multichannel
300±100	CUTKOSKY	80	IPWA	$\pi N \to \pi N$ (higher m)
265±40	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
340±35	GUTZ	14	DPWA	Multichannel
330±45	ANISOVICH	12A	DPWA	Multichannel

$N(2120)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	5–15 %
Γ_2	$N\eta'$	2–6 %
Γ_3	$N\omega$	4–20 %
Γ_4	$N\pi\pi$	50–95 %
Γ_5	$\Delta(1232)\pi$	40–90 %
Γ_6	$\Delta(1232)\pi$, S-wave	30–70 %
Γ_7	$\Delta(1232)\pi$, D-wave	8–32 %
Γ_8	$\Lambda K^*(892)$	< 0.2 %
Γ_9	$N\sigma$	7–15 %
Γ_{10}	$N(1535)\pi$	7–23 %
Γ_{11}	$p\gamma$	0.16–2.1 %
Γ_{12}	$p\gamma$, helicity=1/2	0.07–0.80 %
Γ_{13}	$p\gamma$, helicity=3/2	0.09–1.3 %
Γ_{14}	$n\gamma$	0.04–0.72 %
Γ_{15}	$n\gamma$, helicity=1/2	0.04–0.60 %
Γ_{16}	$n\gamma$, helicity=3/2	0.001–0.12 %

$N(2120)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ — Γ_1/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5 to 15 (≈ 10) OUR ESTIMATE				
5±3	SOKHOYAN	15A	DPWA	Multichannel
14±7	CUTKOSKY	80	IPWA	$\pi N \to \pi N$ (higher m)
6±2	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5±3	GUTZ	14	DPWA	Multichannel
6±2	ANISOVICH	12A	DPWA	Multichannel

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.04±0.02	ANISOVICH	17C	DPWA	Multichannel

$\Gamma(N\omega)/\Gamma_{total}$ Γ_3/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
12±8	DENISENKO	16	DPWA	Multichannel

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

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
50±20	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{total}$ Γ_7/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
20±12	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(\Lambda K^*(892))/\Gamma_{total}$ Γ_8/Γ

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.002	ANISOVICH	17B	DPWA	Multichannel

$\Gamma(N\sigma)/\Gamma_{total}$ Γ_9/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
11±4	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(N(1535)\pi)/\Gamma_{total}$ Γ_{10}/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
15±8	GUTZ	14	DPWA	Multichannel

N(2120) PHOTON DECAY AMPLITUDES AT THE POLE

N(2120) → $p\gamma$, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.130±0.045	−40 ± 25	SOKHOYAN	15A	DPWA	Multichannel

N(2120) → $p\gamma$, helicity-3/2 amplitude $A_{3/2}$

MODULUS ($GeV^{-1/2}$)	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.160±0.060	−30 ± 15	SOKHOYAN	15A	DPWA	Multichannel

N(2120) BREIT-WIGNER PHOTON DECAY AMPLITUDES

N(2120) → $p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.130±0.050	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.130±0.050	GUTZ	14	DPWA	Multichannel

N(2120) → $p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.160±0.065	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.160±0.065	GUTZ	14	DPWA	Multichannel

$N(2120) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.110 ± 0.045	ANISOVICH	13B	DPWA	Multichannel

$N(2120) \rightarrow n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.040 ± 0.030	ANISOVICH	13B	DPWA	Multichannel

N(2120) REFERENCES

ANISOVICH	17B	PL B771 142	A.V. Anisovich *et al.*	
ANISOVICH	17C	PL B772 247	A.V. Anisovich *et al.*	
DENISENKO	16	PL B755 97	I. Denisenko *et al.*	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan *et al.*	(CBELSA/TAPS Collab.)
GUTZ	14	EPJ A50 74	E. Gutz *et al.*	(CBELSA/TAPS Collab.)
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)
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky *et al.*	(CMU, LBL)
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT)