$N(2190)\ 7/2^-$

$I(J^P) = \frac{1}{2}(\frac{7}{2}^-)$ Status: ****

Older and obsolete values are listed and referenced in the 2014 edition, Chinese Physics **C38** 070001 (2014).

N(2190) POLE POSITION

REAL PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1950 to 2150 (≈ 2050) OUR ESTIMATE				
2130±35	SARANTSEV	25	DPWA	Multichannel
1965± 6	ROENCHEN	22	DPWA	Multichannel
2140±20	AFZAL	20	DPWA	Multichannel
2079± 4±9	[1] SVARC	14	L+P	$\pi N \to \pi N$
2100±50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2162	HUNT	19	DPWA	Multichannel
2074	ROENCHEN	15A	DPWA	Multichannel
2150±25	SOKHOYAN	15A	DPWA	Multichannel
2063±32	BATINIC	10	DPWA	$\pi N \to N\pi,\ N\eta$
2070	ARNDT	06	DPWA	$\pi N \to \pi N,\ \eta N$
2107	VRANA	00	DPWA	Multichannel
2042	HOEHLER	93	SPED	$\pi N \to \pi N$

[1] Fit to the amplitudes of HOEHLER 79.

−2×IMAGINARY PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
300 to 500 (≈ 400) OUR ESTIMATE				
370± 45	SARANTSEV	25	DPWA	Multichannel
287± 33	ROENCHEN	22	DPWA	Multichannel
$420^{+120}_{-\ 40}$	AFZAL	20	DPWA	Multichannel
509± 7±16	[1] SVARC	14	L+P	$\pi N \to \pi N$
400±160	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
407	HUNT	19	DPWA	Multichannel
327	ROENCHEN	15A	DPWA	Multichannel
325± 25	SOKHOYAN	15A	DPWA	Multichannel
330±101	BATINIC	10	DPWA	$\pi N \to N\pi,\ N\eta$
520	ARNDT	06	DPWA	$\pi N \to \pi N,\ \eta N$
380	VRANA	00	DPWA	Multichannel
482	HOEHLER	93	SPED	$\pi N \to \pi N$

[1] Fit to the amplitudes of HOEHLER 79.

N(2190) ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
20 to 60 (≈ 40) OUR ESTIMATE				
18± 4	ROENCHEN	22	DPWA	Multichannel
30± 4	SOKHOYAN	15A	DPWA	Multichannel
54± 1±3	[1] SVARC	14	L+P	$\pi N \to \pi N$
25±10	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
35	ROENCHEN	15A	DPWA	Multichannel
30± 5	ANISOVICH	12A	DPWA	Multichannel
34	BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
72	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
45	HOEHLER	93	SPED	$\pi N \to \pi N$

[1] Fit to the amplitudes of HOEHLER 79.

PHASE θ

VALUE (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
−30 to 30 (≈ 0) OUR ESTIMATE				
−45±14	ROENCHEN	22	DPWA	Multichannel
28±10	SOKHOYAN	15A	DPWA	Multichannel
−18± 1±3	[1] SVARC	14	L+P	$\pi N \to \pi N$
−30±50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−40	ROENCHEN	15A	DPWA	Multichannel
30±10	ANISOVICH	12A	DPWA	Multichannel
−19	BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
−32	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN

[1] Fit to the amplitudes of HOEHLER 79.

N(2190) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \to N(2190) \to \Lambda K$

MODULUS	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.026±0.007	−78 ± 15	ROENCHEN	22	DPWA	Multichannel
0.03 ±0.01	20 ± 15	ANISOVICH	12A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.005	−51	ROENCHEN	15A	DPWA	Multichannel

Normalized residue in $N\pi \to N(2190) \to \Sigma K$

MODULUS	*PHASE* (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
0.005±0.001	−92 ± 16	ROENCHEN	22	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.013	−69	ROENCHEN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2190) \rightarrow N\eta$

MODULUS	*PHASE (°)*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.021±0.005	−65 ± 15	ROENCHEN	22	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.016	129	ROENCHEN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2190) \rightarrow \Delta(1232)\pi$, D-wave

MODULUS	*PHASE (°)*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.27±0.04	−165 ± 20	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \rightarrow N(2190) \rightarrow N\sigma$

MODULUS	*PHASE (°)*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.13±0.05	50 ± 15	SOKHOYAN	15A	DPWA	Multichannel

$N(2190)$ BREIT-WIGNER MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
2140 to 2220 (≈ 2180) OUR ESTIMATE				
2170 ±25	SARANTSEV	25	DPWA	Multichannel
2222 ±15	[1] HUNT	19	DPWA	Multichannel
2152.4± 1.4	[1] ARNDT	06	DPWA	$\pi N \rightarrow \pi N$, ηN
2200 ±70	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
2140 ±12	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2205 ±18	SOKHOYAN	15A	DPWA	Multichannel
2150 ±26	[1] SHRESTHA	12A	DPWA	Multichannel
2125 ±61	BATINIC	10	DPWA	$\pi N \rightarrow N\pi$, $N\eta$
2168 ±18	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$N(2190)$ BREIT-WIGNER WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
300 to 500 (≈ 400) OUR ESTIMATE				
420± 45	SARANTSEV	25	DPWA	Multichannel
442± 40	[1] HUNT	19	DPWA	Multichannel
484± 13	[1] ARNDT	06	DPWA	$\pi N \rightarrow \pi N$, ηN
500±150	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
390± 30	HOEHLER	79	IPWA	$\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
355± 30	SOKHOYAN	15A	DPWA	Multichannel
500± 74	[1] SHRESTHA	12A	DPWA	Multichannel
381±160	BATINIC	10	DPWA	$\pi N \rightarrow N\pi$, $N\eta$
453±101	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

N(2190) DECAY MODES

The following branching fractions are our estimates, not fits or averages.

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	10–20 %
Γ_2	$N\eta$	1–5 %
Γ_3	$N\omega$	8–20 %
Γ_4	ΛK	0.2–0.8 %
Γ_5	$N\pi\pi$	22–51 %
Γ_6	$\Delta\pi$	(4.0±2.0) %
Γ_7	$\Delta(1232)\pi$, *D*-wave	19–31 %
Γ_8	$N\rho$	(8 ±7) %
Γ_9	$N\rho$, S=3/2, *D*-wave	<11 %
Γ_{10}	$N\sigma$	3–9 %
Γ_{11}	$\Lambda K^*(892)$	0.2–0.8 %
Γ_{12}	$p\gamma$	<0.08 %
Γ_{13}	$p\gamma$, helicity=1/2	<0.06 %
Γ_{14}	$p\gamma$, helicity=3/2	<0.02 %
Γ_{15}	$n\gamma$	<0.04 %
Γ_{16}	$n\gamma$, helicity=1/2	<0.01 %
Γ_{17}	$n\gamma$, helicity=3/2	<0.03 %

N(2190) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
10–20 % OUR ESTIMATE				
15 ± 3	SEIFEN	25	DPWA	Multichannel
22.9± 0.6	[1] HUNT	19	DPWA	Multichannel
23.8± 0.1	[1] ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
12 ± 6	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
14 ± 2	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
16 ± 2	SOKHOYAN	15A	DPWA	Multichannel
20 ± 1	[1] SHRESTHA	12A	DPWA	Multichannel
18 ±12	BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
20 ± 4	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

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

VALUE (%)	*DOCUMENT ID*		*TECN*	*COMMENT*
1–5 % OUR ESTIMATE				
4 ±2	MUELLER	20	DPWA	Multichannel
2.7±2.2	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2 ±1	[1] SHRESTHA	12A	DPWA	Multichannel

0.1±0.3	BATINIC	10	DPWA	$\pi N \to N\pi, N\eta$
0 ±1	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
8–20 % OUR ESTIMATE				
14±6	DENISENKO	16	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	WILLIAMS	09	IPWA	$\gamma p \to p\omega$

$\Gamma(\Lambda K)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0.2–0.8 % OUR ESTIMATE				
0.6±0.1	[1] HUNT	19	DPWA	Multichannel
0.5±0.3	ANISOVICH	12A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1	[1] SHRESTHA	12A	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(\Delta\pi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4±2	SARANTSEV	25	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
19–31 % OUR ESTIMATE				
4±2	SEIFEN	25	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
25±6	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(N\rho)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
8±7	SARANTSEV	25	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
<11 % OUR ESTIMATE				
8± 7	SARANTSEV	25	DPWA	Multichannel
<11	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
29±28	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(N\sigma)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
3–9 % OUR ESTIMATE				
6±3	SEIFEN	25	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6±3	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(\Lambda K^*(892))/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0.2–0.8 % OUR ESTIMATE				
0.5±0.3	ANISOVICH	17B	DPWA	Multichannel

N(2190) PHOTON DECAY AMPLITUDES AT THE POLE

N(2190) → *pγ*, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.060±0.012	150 ± 25	SARANTSEV	25	DPWA	Multichannel
−0.015±0.004	111 ± 9	ROENCHEN	22	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−0.041	−21	ROENCHEN	15A	DPWA	Multichannel
0.068±0.005	−170 ± 12	SOKHOYAN	15A	DPWA	Multichannel

N(2190) → *pγ*, helicity-3/2 amplitude $A_{3/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.050±0.015	−10 ± 25	SARANTSEV	25	DPWA	Multichannel
0.062±0.011	179 ± 13	ROENCHEN	22	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.085	−22	ROENCHEN	15A	DPWA	Multichannel
0.025±0.010	22 ± 10	SOKHOYAN	15A	DPWA	Multichannel

N(2190) → *nγ*, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.030±0.007	5 ± 15	ANISOVICH	17E	DPWA	Multichannel

N(2190) → *nγ*, helicity-3/2 amplitude $A_{3/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
−0.023±0.008	13 ± 20	ANISOVICH	17E	DPWA	Multichannel

N(2190) BREIT-WIGNER PHOTON DECAY AMPLITUDES

N(2190) → *pγ*, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
−0.060±0.010	SARANTSEV	25	DPWA	Multichannel
0.001±0.002	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.071±0.006	SOKHOYAN	15A	DPWA	Multichannel

[1] Statistical error only.

N(2190) → *pγ*, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.051±0.006	SARANTSEV	25	DPWA	Multichannel
0.015±0.003	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.027±0.010	SOKHOYAN	15A	DPWA	Multichannel

[1] Statistical error only.

$N(2190) \to p\gamma$, ratio of helicity amplitudes $A_{3/2}/A_{1/2}$

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.17 ± 0.15	WILLIAMS	09	IPWA	$\gamma p \to p\omega$

$N(2190) \to n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
-0.01 ± 0.02	[1] HUNT	19	DPWA	Multichannel
0.030 ± 0.007	ANISOVICH	17E	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.015 ± 0.013	ANISOVICH	13B	DPWA	Multichannel

[1] Statistical error only.

$N(2190) \to n\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
-0.023 ± 0.022	[1] HUNT	19	DPWA	Multichannel
-0.023 ± 0.008	ANISOVICH	17E	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-0.034 ± 0.022	ANISOVICH	13B	DPWA	Multichannel

[1] Statistical error only.

N(2190) REFERENCES

For early references, see Physics Letters **111B** 1 (1982).

SARANTSEV	25	PR C112 015202	A.V. Sarantsev *et al.*	(Bonn-Gatchina Collab.)
SEIFEN	25	EPJ A61 173	T. Seifen *et al.*	(CBELSA/TAPS Collab.)
ROENCHEN	22	EPJ A58 229	D. Roenchen *et al.*	(JULI, GWU, BONN+)
AFZAL	20	PRL 125 152002	F. Afzal *et al.*	(CBELSA/TAPS Collab.)
MUELLER	20	PL B803 135323	J. Mueller *et al.*	(CBELSA/TAPS Collab.)
HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
ANISOVICH	17B	PL B771 142	A.V. Anisovich *et al.*	
ANISOVICH	17E	PR C96 055202	A.V. Anisovich *et al.*	(BONN, PNPI, JLAB+)
DENISENKO	16	PL B755 97	I. Denisenko *et al.*	
ROENCHEN	15A	EPJ A51 70	D. Roenchen *et al.*	
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan *et al.*	(CBELSA/TAPS Collab.)
PDG	14	CP C38 070001	K. Olive *et al.*	(PDG 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)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
BATINIC	10	PR C82 038203	M. Batinic *et al.*	(ZAGR)
WILLIAMS	09	PR C80 065209	M. Williams *et al.*	(JLab CLAS Collab.)
ARNDT	06	PR C74 045205	R.A. Arndt *et al.*	(GWU)
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman, T.-S.H. Lee	(PITT, ANL)
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky *et al.*	(CMU, LBL) IJP
Also		PR D20 2839	R.E. Cutkosky *et al.*	(CMU, LBL) IJP
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT) IJP
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP