

$N(2190) \ 7/2^-$ $I(J^P) = \frac{1}{2}(7^-)$ Status: ****

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

 $N(2190)$ POLE POSITION**REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2050 to 2150 (\approx 2100) OUR ESTIMATE			
2150 \pm 25	SOKHOYAN	15A	DPWA Multichannel
2079 \pm 4 \pm 9	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
2100 \pm 50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2074	ROENCHEN	15A	DPWA Multichannel
2150 \pm 25	ANISOVICH	12A	DPWA Multichannel
2062	SHRESTHA	12A	DPWA Multichannel
2063 \pm 32	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
2070	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
2107	VRANA	00	DPWA Multichannel
2042	HOEHLER	93	SPED $\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

−2×IMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
300 to 500 (\approx 400) OUR ESTIMATE			
325 \pm 25	SOKHOYAN	15A	DPWA Multichannel
509 \pm 7 \pm 16	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
400 \pm 160	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
327	ROENCHEN	15A	DPWA Multichannel
330 \pm 30	ANISOVICH	12A	DPWA Multichannel
428	SHRESTHA	12A	DPWA Multichannel
330 \pm 101	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
520	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
380	VRANA	00	DPWA Multichannel
482	HOEHLER	93	SPED $\pi N \rightarrow \pi N$

¹ Fit to the amplitudes of HOEHLER 79.

 $N(2190)$ ELASTIC POLE RESIDUE**MODULUS $|r|$**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
25 to 70 (\approx 50) OUR ESTIMATE			
30 \pm 4	SOKHOYAN	15A	DPWA Multichannel
54 \pm 1 \pm 3	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
25 \pm 10	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

• • • 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	$\pi N \rightarrow N\pi, N\eta$
72	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$
45	HOEHLER	93	SPED	$\pi N \rightarrow \pi N$

¹Fit to the amplitudes of HOEHLER 79.

PHASE θ

<u>VALUE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
−30 to 30 (≈ 0) OUR ESTIMATE			
28 ± 10	SOKHOYAN	15A	DPWA Multichannel
−18 ± 1 ± 3	¹ SVARC	14	L+P $\pi N \rightarrow \pi N$
−30 ± 50	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

• • • 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	$\pi N \rightarrow N\pi, N\eta$
−32	ARNDT	06	DPWA	$\pi N \rightarrow \pi N, \eta N$

¹Fit 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 $N\pi \rightarrow N(2190) \rightarrow \Lambda K$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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 $N\pi \rightarrow N(2190) \rightarrow \Sigma K$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.013	−69	ROENCHEN	15A	DPWA Multichannel

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

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.016	129	ROENCHEN	15A	DPWA Multichannel

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

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

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

<u>MODULUS</u>	<u>PHASE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.13±0.05	50 ± 15	SOKHOYAN	15A DPWA	Multichannel

 $N(2190)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2140 to 2220 (\approx 2180) OUR ESTIMATE			
2205 ± 18	SOKHOYAN	15A DPWA	Multichannel
2150 ± 26	¹ SHRESTHA	12A DPWA	Multichannel
2152.4 ± 1.4	¹ ARNDT	06 DPWA	$\pi N \rightarrow \pi N, \eta N$
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. • • •			
2180 ± 20	ANISOVICH	12A DPWA	Multichannel
2125 ± 61	BATINIC	10 DPWA	$\pi N \rightarrow N\pi, N\eta$
2168 ± 18	VRANA	00 DPWA	Multichannel

¹Statistical error only. **$N(2190)$ BREIT-WIGNER WIDTH**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
300 to 500 (\approx 400) OUR ESTIMATE			
355 ± 30	SOKHOYAN	15A DPWA	Multichannel
500 ± 74	¹ SHRESTHA	12A DPWA	Multichannel
484 ± 13	¹ ARNDT	06 DPWA	$\pi N \rightarrow \pi N, \eta N$
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. • • •			
335 ± 40	ANISOVICH	12A DPWA	Multichannel
381 ± 160	BATINIC	10 DPWA	$\pi N \rightarrow N\pi, N\eta$
453 ± 101	VRANA	00 DPWA	Multichannel

¹Statistical error only. **$N(2190)$ DECAY MODES**

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

Mode	Fraction (Γ_j/Γ)
Γ_1 $N\pi$	10–20 %
Γ_2 $N\eta$	1–3 %
Γ_3 $N\omega$	8–20 %
Γ_4 ΛK	
Γ_5 $N\pi\pi$	
Γ_6 $\Delta(1232)\pi$	
Γ_7 $\Delta(1232)\pi, D\text{-wave}$	19–31 %
Γ_8 $N\rho$	

Γ_9	$N\rho, S=3/2, D\text{-wave}$	seen
Γ_{10}	$\Lambda K^*(892)$	0.2–0.8 %
Γ_{11}	$N\sigma$	3–9 %
Γ_{12}	$p\gamma$	0.014–0.077 %
Γ_{13}	$p\gamma, \text{helicity}=1/2$	
Γ_{14}	$p\gamma, \text{helicity}=3/2$	
Γ_{15}	$n\gamma$	<0.04 %
Γ_{16}	$n\gamma, \text{helicity}=1/2$	
Γ_{17}	$n\gamma, \text{helicity}=3/2$	<0.03 %

$N(2190)$ BRANCHING RATIOS

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
10 to 20 (≈ 15) OUR ESTIMATE			
16 \pm 2	SOKHOYAN	15A	DPWA Multichannel
20 \pm 1	¹ SHRESTHA	12A	DPWA Multichannel
23.8 \pm 0.1	¹ ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
12 \pm 6	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
14 \pm 2	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
16 \pm 2	ANISOVICH	12A	DPWA Multichannel
18 \pm 12	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
20 \pm 4	VRANA	00	DPWA Multichannel

¹Statistical error only.

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2 \pm 1	¹ SHRESTHA	12A	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.1 \pm 0.3	BATINIC	10	DPWA $\pi N \rightarrow N\pi, N\eta$
0 \pm 1	VRANA	00	DPWA Multichannel

¹Statistical error only.

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
14 \pm 6	DENISENKO	16	DPWA Multichannel
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
seen	WILLIAMS	09	IPWA $\gamma p \rightarrow p\omega$

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.5 \pm 0.3	ANISOVICH	12A	DPWA Multichannel
<1	SHRESTHA	12A	DPWA Multichannel

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
25 \pm 6	SOKHOYAN	15A	DPWA Multichannel

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

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

29 ± 28	VRANA	00	DPWA Multichannel
---------	-------	----	-------------------

 $\Gamma(\Lambda K^*(892))/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

0.005 ± 0.003	ANISOVICH	17B	DPWA Multichannel
---------------	-----------	-----	-------------------

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
-----------	-------------	------	---------

6 ± 3	SOKHOYAN	15A	DPWA Multichannel
-------	----------	-----	-------------------

 $N(2190)$ PHOTON DECAY AMPLITUDES AT THE POLE **$N(2190) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$**

MODULUS ($\text{GeV}^{-1/2}$)	PHASE ($^\circ$)	DOCUMENT ID	TECN	COMMENT
---------------------------------	--------------------	-------------	------	---------

0.068 ± 0.005	− 170 ± 12	SOKHOYAN	15A	DPWA Multichannel
---------------	------------	----------	-----	-------------------

− 0.083 $^{+0.007}_{-0.003}$	− 11 $^{+6}_{-2}$	ROENCHEN	14	DPWA
------------------------------	-------------------	----------	----	------

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

− 0.041	− 21	ROENCHEN	15A	DPWA Multichannel
---------	------	----------	-----	-------------------

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

MODULUS ($\text{GeV}^{-1/2}$)	PHASE ($^\circ$)	DOCUMENT ID	TECN	COMMENT
---------------------------------	--------------------	-------------	------	---------

0.025 ± 0.010	22 ± 10	SOKHOYAN	15A	DPWA Multichannel
---------------	---------	----------	-----	-------------------

0.095 $^{+0.013}_{-0.010}$	− 3 $^{+3}_{-5}$	ROENCHEN	14	DPWA
----------------------------	------------------	----------	----	------

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

0.085	− 22	ROENCHEN	15A	DPWA Multichannel
-------	------	----------	-----	-------------------

 $N(2190)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES **$N(2190) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$**

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
-------------------------------	-------------	------	---------

− 0.071 ± 0.006	SOKHOYAN	15A	DPWA Multichannel
-----------------	----------	-----	-------------------

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

− 0.065 ± 0.008	ANISOVICH	12A	DPWA Multichannel
-----------------	-----------	-----	-------------------

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

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
-------------------------------	-------------	------	---------

0.027 ± 0.010	SOKHOYAN	15A	DPWA Multichannel
---------------	----------	-----	-------------------

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

0.035 ± 0.017	ANISOVICH	12A	DPWA Multichannel
---------------	-----------	-----	-------------------

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
--------------	--------------------	-------------	----------------

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

-0.17 ± 0.15	WILLIAMS 09	IPWA	$\gamma p \rightarrow p\omega$
------------------	-------------	------	--------------------------------

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

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-----------------------------------	--------------------	-------------	----------------

-0.015 ± 0.013	ANISOVICH 13B	DPWA	Multichannel
--------------------	---------------	------	--------------

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

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-----------------------------------	--------------------	-------------	----------------

-0.034 ± 0.022	ANISOVICH 13B	DPWA	Multichannel
--------------------	---------------	------	--------------

 $N(2190)$ REFERENCES

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

ANISOVICH 17B	PL B771 142	A.V. Anisovich <i>et al.</i>	
DENISENKO 16	PL B755 97	I. Denisenko <i>et al.</i>	
ROENCHEN 15A	EPJ A51 70	D. Roenchen <i>et al.</i>	
SOKHOYAN 15A	EPJ A51 95	V. Sokhoyan <i>et al.</i>	(CBELSA/TAPS Collab.)
PDG 14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
ROENCHEN 14	EPJ A50 101	D. Roenchen <i>et al.</i>	
Also	EPJ A51 63 (errat.)	D. Roenchen <i>et al.</i>	
SVARC 14	PR C89 045205	A. Svarc <i>et al.</i>	(RBI Zagreb, UNI Tuzla)
ANISOVICH 13B	EPJ A49 67	A.V. Anisovich <i>et al.</i>	
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)
WILLIAMS 09	PR C80 065209	M. Williams <i>et al.</i>	(JLab CLAS Collab.)
ARNDT 06	PR C74 045205	R.A. Arndt <i>et al.</i>	(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 <i>et al.</i>	(CMU, LBL) IJP
Also	PR D20 2839	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
HOEHLER 79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP
Also	Toronto Conf. 3	R. Koch	(KARLT) IJP