$N(1710)\ 1/2^+$

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

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

N(1710) POLE POSITION

REAL PART

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
1670 to 1770 (≈ 1720) OUR ESTIMATE					
1690±15		SOKHOYAN	15A	DPWA	Multichannel
1770± 5±2	[1]	SVARC	14	L+P	$\pi N \to \pi N$
1690		HOEHLER	93	SPED	$\pi N \to \pi N$
1698		CUTKOSKY	90	IPWA	$\pi N \to \pi N$
1690±20		CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1690±15		GUTZ	14	DPWA	Multichannel
1670		SHKLYAR	13	DPWA	Multichannel
1687±17		ANISOVICH	12A	DPWA	Multichannel
1644		SHRESTHA	12A	DPWA	Multichannel
1711±15	[2]	BATINIC	10	DPWA	$\pi N \to N\pi,\ N\eta$
1679		VRANA	00	DPWA	Multichannel

−2×IMAGINARY PART

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
80 to 380 (≈ 230) OUR ESTIMATE					
170±20		SOKHOYAN	15A	DPWA	Multichannel
98± 8±5	[1]	SVARC	14	L+P	$\pi N \to \pi N$
200		HOEHLER	93	SPED	$\pi N \to \pi N$
88		CUTKOSKY	90	IPWA	$\pi N \to \pi N$
80±20		CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
170±20		GUTZ	14	DPWA	Multichannel
159		SHKLYAR	13	DPWA	Multichannel
200±25		ANISOVICH	12A	DPWA	Multichannel
104		SHRESTHA	12A	DPWA	Multichannel
174±16	[2]	BATINIC	10	DPWA	$\pi N \to N\pi,\ N\eta$
132		VRANA	00	DPWA	Multichannel

N(1710) ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)		*DOCUMENT ID*		*TECN*	*COMMENT*
5 to 15 (≈ 8) OUR ESTIMATE					
6±3		SOKHOYAN	15A	DPWA	Multichannel
5±1±1	[1]	SVARC	14	L+P	$\pi N \to \pi N$
15		HOEHLER	93	SPED	$\pi N \to \pi N$
9		CUTKOSKY	90	IPWA	$\pi N \to \pi N$
8±2		CUTKOSKY	80	IPWA	$\pi N \to \pi N$

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

6±3	GUTZ	14	DPWA	Multichannel
11	SHKLYAR	13	DPWA	Multichannel
6±4	ANISOVICH	12A	DPWA	Multichannel
24	[2] BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
130±35	SOKHOYAN	15A	DPWA	Multichannel
−104± 7±3	[1] SVARC	14	L+P	$\pi N \to \pi N$
−167	CUTKOSKY	90	IPWA	$\pi N \to \pi N$
175±35	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

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

120±45	GUTZ	14	DPWA	Multichannel
9	SHKLYAR	13	DPWA	Multichannel
120±70	ANISOVICH	12A	DPWA	Multichannel
20	[2] BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$

N(1710) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \to N(1710) \to N\eta$

MODULUS (%)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
12±4	0 ± 45	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to N(1710) \to \Lambda K$

MODULUS (%)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
17±6	−110 ± 20	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to N(1710) \to N(1535)\pi$

MODULUS (%)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
10±4	140 ± 40	GUTZ	14	DPWA	Multichannel

N(1710) BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1680 to 1740 (≈ 1710) OUR ESTIMATE				
1715±20	SOKHOYAN	15A	DPWA	Multichannel
1737±17	SHKLYAR	13	DPWA	Multichannel
1700±50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
1723± 9	HOEHLER	79	IPWA	$\pi N \to \pi N$

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

1715±20	GUTZ	14	DPWA	Multichannel
1710±20	ANISOVICH	12A	DPWA	Multichannel
1662± 7	SHRESTHA	12A	DPWA	Multichannel
1729±16	[2] BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
1752± 3	PENNER	02C	DPWA	Multichannel
1699±65	VRANA	00	DPWA	Multichannel

N(1710) BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
50 to 250 (≈ 100) OUR ESTIMATE				
175± 15	SOKHOYAN	15A	DPWA	Multichannel
368±120	SHKLYAR	13	DPWA	Multichannel
93± 30	CUTKOSKY	90	IPWA	$\pi N \to \pi N$
90± 30	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
120± 15	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
175± 15	GUTZ	14	DPWA	Multichannel
200± 18	ANISOVICH	12A	DPWA	Multichannel
116± 17	SHRESTHA	12A	DPWA	Multichannel
180± 17	[2] BATINIC	10	DPWA	$\pi N \to N\pi, N\eta$
386± 59	PENNER	02C	DPWA	Multichannel
143±100	VRANA	00	DPWA	Multichannel

N(1710) DECAY MODES

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

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	5–20 %
Γ_2	$N\eta$	10–50 %
Γ_3	$N\omega$	1–5 %
Γ_4	ΛK	5–25 %
Γ_5	ΣK	seen
Γ_6	$N\pi\pi$	seen
Γ_7	$\Delta(1232)\pi$	
Γ_8	$\Delta(1232)\pi$, P-wave	seen
Γ_9	$N(1535)\pi$	9–21 %
Γ_{10}	$N\rho$	
Γ_{11}	$N\rho$, S=1/2, P-wave	seen
Γ_{12}	$p\gamma$, helicity=1/2	0.002–0.08 %
Γ_{13}	$n\gamma$, helicity=1/2	0.0–0.02%

N(1710) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ Γ_1/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5± 3	SOKHOYAN	15A	DPWA	Multichannel
2± 2	SHKLYAR	13	PWA	Multichannel
20± 4	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
12± 4	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
5± 4	ANISOVICH	12A	DPWA	Multichannel
15± 4	SHRESTHA	12A	DPWA	Multichannel
22±24	[2] BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
14± 8	PENNER	02C	DPWA	Multichannel
27±13	VRANA	00	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
10 to 50 OUR ESTIMATE				
45± 4	SHKLYAR	13	DPWA	Multichannel
17±10	ANISOVICH	12A	DPWA	Multichannel

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

11± 7	SHRESTHA	12A	DPWA	Multichannel
6± 8	[2] BATINIC	10	DPWA	$\pi N \rightarrow N\pi, N\eta$
36±11	PENNER	02C	DPWA	Multichannel
6± 1	VRANA	00	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
2±2	DENISENKO	16	DPWA	Multichannel
3±2	SHKLYAR	13	DPWA	Multichannel

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

13±2	PENNER	02C	DPWA	Multichannel

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5 to 25 OUR ESTIMATE				
23± 7	ANISOVICH	12A	DPWA	Multichannel
5± 3	SHKLYAR	05	DPWA	Multichannel

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

8± 4	SHRESTHA	12A	DPWA	Multichannel
5± 2	PENNER	02C	DPWA	Multichannel
10±10	VRANA	00	DPWA	Multichannel

$\Gamma(\Sigma K)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT

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

7±7	PENNER	02C	DPWA	Multichannel

$\Gamma(\Delta(1232)\pi, P\text{-wave})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT

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

6±3	SHRESTHA	12A	DPWA	Multichannel
39±8	VRANA	00	DPWA	Multichannel

$\Gamma(N(1535)\pi)/\Gamma_{total}$ Γ_9/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
15 ± 6	GUTZ	14	DPWA	Multichannel

$\Gamma(N\rho, S{=}1/2, P\text{-wave})/\Gamma_{total}$ Γ_{11}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
17 ± 6	SHRESTHA	12A	DPWA	Multichannel
17 ± 1	VRANA	00	DPWA	Multichannel

N(1710) PHOTON DECAY AMPLITUDES AT THE POLE

$N(1710) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN
$0.028^{+0.009}_{-0.002}$	103^{+20}_{-6}	ROENCHEN	14	DPWA

N(1710) BREIT-WIGNER PHOTON DECAY AMPLITUDES

$N(1710) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.050 ± 0.010	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.05\ \pm0.01$	GUTZ	14	DPWA	Multichannel
-0.050 ± 0.001	SHKLYAR	13	DPWA	Multichannel
0.052 ± 0.015	ANISOVICH	12A	DPWA	Multichannel
-0.008 ± 0.003	SHRESTHA	12A	DPWA	Multichannel
0.044	PENNER	02D	DPWA	Multichannel

$N(1710) \rightarrow n\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
-0.040 ± 0.020	ANISOVICH	13B	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.017 ± 0.003	SHRESTHA	12A	DPWA	Multichannel
-0.024	PENNER	02D	DPWA	Multichannel

N(1710) FOOTNOTES

[1] Fit to the amplitudes of HOEHLER 79.

[2] BATINIC 10 finds evidence for a second P_{11} state with all parameters except for the phase of the pole residue very similar to the parameters we give here.

N(1710) REFERENCES

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

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.)
PDG	14	CP C38 070001	K. Olive *et al.*	(PDG Collab.)
ROENCHEN	14	EPJ A50 101	D. Roenchen *et al.*	
Also		EPJ A51 63 (errat.)	D. Roenchen *et al.*	
SVARC	14	PR C89 045205	A. Svarc *et al.*	
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich *et al.*	
SHKLYAR	13	PR C87 015201	V. Shklyar, H. Lenske, U. Mosel	(GIES)
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)
SHKLYAR	05	PR C72 015210	V. Shklyar, H. Lenske, U. Mosel	(GIES)
PENNER	02C	PR C66 055211	G. Penner, U. Mosel	(GIES)
PENNER	02D	PR C66 055212	G. Penner, U. Mosel	(GIES)
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	90	PR D42 235	R.E. Cutkosky, S. Wang	(CMU)
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