NODE=B014

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

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

Older and obsolete values are listed and referenced in the 2014 edition, Chinese Physics **C38** 070001 (2014). NODE=B014

N(1710) POLE POSITION

NODE=B014215

REAL PART

NODE=B014RE
NODE=B014RE

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*	
1650 to 1750 (≈ 1700) OUR ESTIMATE					→ UNCHECKED ←
1605± 7	ROENCHEN	22	DPWA	Multichannel	
1690±15	ANISOVICH	17A	DPWA	Multichannel	
1697±23	[1] ANISOVICH	17A	L+P	$\gamma p,\ \pi^- p \to\ K\Lambda$	OCCUR=2
1770± 5±2	[2] SVARC	14	L+P	$\pi N \to\ \pi N$	
1690±20	CUTKOSKY	80	IPWA	$\pi N \to\ \pi N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1615	HUNT	19	DPWA	Multichannel	
1651	ROENCHEN	15A	DPWA	Multichannel	
1690±15	SOKHOYAN	15A	DPWA	Multichannel	
1690±15	GUTZ	14	DPWA	Multichannel	
1670	SHKLYAR	13	DPWA	Multichannel	
1687±17	ANISOVICH	12A	DPWA	Multichannel	
1711±15	[3] BATINIC	10	DPWA	$\pi N \to\ N\pi,\ N\eta$	
1679	VRANA	00	DPWA	Multichannel	
1690	HOEHLER	93	SPED	$\pi N \to\ \pi N$	
1698	CUTKOSKY	90	IPWA	$\pi N \to\ \pi N$	

[1] Statistical error only. NODE=B014RE;LINKAGE=A
[2] Fit to the amplitudes of HOEHLER 79. NODE=B014RE;LINKAGE=SV
[3] 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. NODE=B014RE;LINKAGE=BA

−2×IMAGINARY PART

NODE=B014IM
NODE=B014IM

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*	
80 to 160 (≈ 120) OUR ESTIMATE					→ UNCHECKED ←
115± 5	ROENCHEN	22	DPWA	Multichannel	
155±25	ANISOVICH	17A	DPWA	Multichannel	
84±34	[1] ANISOVICH	17A	L+P	$\gamma p,\ \pi^- p \to\ K\Lambda$	OCCUR=2
98± 8±5	[2] SVARC	14	L+P	$\pi N \to\ \pi N$	
80±20	CUTKOSKY	80	IPWA	$\pi N \to\ \pi N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
169	HUNT	19	DPWA	Multichannel	
121	ROENCHEN	15A	DPWA	Multichannel	
170±20	SOKHOYAN	15A	DPWA	Multichannel	
170±20	GUTZ	14	DPWA	Multichannel	
159	SHKLYAR	13	DPWA	Multichannel	
200±25	ANISOVICH	12A	DPWA	Multichannel	
174±16	[3] BATINIC	10	DPWA	$\pi N \to\ N\pi,\ N\eta$	
132	VRANA	00	DPWA	Multichannel	
200	HOEHLER	93	SPED	$\pi N \to\ \pi N$	
88	CUTKOSKY	90	IPWA	$\pi N \to\ \pi N$	

[1] Statistical error only. NODE=B014IM;LINKAGE=A
[2] Fit to the amplitudes of HOEHLER 79. NODE=B014IM;LINKAGE=SV
[3] 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. NODE=B014IM;LINKAGE=BA

N(1710) ELASTIC POLE RESIDUE

NODE=B014220

MODULUS $|r|$

NODE=B014RER
NODE=B014RER

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*	
4 to 10 (≈ 7) OUR ESTIMATE					→ UNCHECKED ←
5.5±2.4	ROENCHEN	22	DPWA	Multichannel	
6 ±3	SOKHOYAN	15A	DPWA	Multichannel	
5 ±1 ±1	[1] SVARC	14	L+P	$\pi N \to\ \pi N$	
8 ±2	CUTKOSKY	80	IPWA	$\pi N \to\ \pi N$	

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

3.2		ROENCHEN	15A	DPWA	Multichannel
6 ±3		GUTZ	14	DPWA	Multichannel
11		SHKLYAR	13	DPWA	Multichannel
6 ±4		ANISOVICH	12A	DPWA	Multichannel
24	[2]	BATINIC	10	DPWA	$\pi N \to N\pi,\ N\eta$
15		HOEHLER	93	SPED	$\pi N \to \pi N$
9		CUTKOSKY	90	IPWA	$\pi N \to \pi N$

[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.

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
120 to 270 (≈ 190) OUR ESTIMATE				
−114±29	ROENCHEN	22	DPWA	Multichannel
130±35	SOKHOYAN	15A	DPWA	Multichannel
−104± 7±3	[1] SVARC	14	L+P	$\pi N \to \pi N$
175±35	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

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

55		ROENCHEN	15A	DPWA	Multichannel
120±45		GUTZ	14	DPWA	Multichannel
9		SHKLYAR	13	DPWA	Multichannel
120±70		ANISOVICH	12A	DPWA	Multichannel
20	[2]	BATINIC	10	DPWA	$\pi N \to N\pi,\ N\eta$
−167		CUTKOSKY	90	IPWA	$\pi N \to \pi N$

[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.

$N(1710)$ 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
0.28±0.13	91 ± 32	ROENCHEN	22	DPWA	Multichannel
0.12±0.04	0 ± 45	ANISOVICH	12A	DPWA	Multichannel

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

0.16	−180	ROENCHEN	15A	DPWA	Multichannel

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

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.20±0.10	−144 ± 39	ROENCHEN	22	DPWA	Multichannel
0.16±0.05	−160 ± 25	ANISOVICH	17A	DPWA	Multichannel
$0.12^{+0.24}_{-0.12}$	−119 ± 83	[1] ANISOVICH	17A	L+P	$\gamma p,\ \pi^- p \to K\Lambda$

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

0.12	−32	ROENCHEN	15A	DPWA	Multichannel
0.17±0.06	−110 ± 20	ANISOVICH	12A	DPWA	Multichannel

[1] Statistical error only.

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

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.055±0.024	162 ± 153	ROENCHEN	22	DPWA	Multichannel

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

0.004	−43	ROENCHEN	15A	DPWA	Multichannel

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

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.10±0.04	140 ± 40	GUTZ	14	DPWA	Multichannel

$N(1710)$ BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1680 to 1740 (≈ 1710) OUR ESTIMATE				
1648±16	[1] HUNT	19	DPWA	Multichannel
1715±20	SOKHOYAN	15A	DPWA	Multichannel
1737±17	[1] 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	[1] 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

[1] Statistical error only.

[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) BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
80 to 200 (≈ 140) OUR ESTIMATE				
195± 46	[1] HUNT	19	DPWA	Multichannel
175± 15	SOKHOYAN	15A	DPWA	Multichannel
368±120	[1] 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	[1] 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

[1] Statistical error only.

[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) 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	$N\pi\pi$	14–48 %
Γ_7	$\Delta(1232)\pi$, P-wave	3–9 %
Γ_8	$N\rho$, S=1/2, P-wave	11–23 %
Γ_9	$N\sigma$	<16 %
Γ_{10}	$N(1535)\pi$	9–21 %
Γ_{11}	$p\gamma$, helicity=1/2	0.002–0.08 %
Γ_{12}	$n\gamma$, helicity=1/2	0.0–0.02%

NODE=B014M
→ UNCHECKED ←
NODE=B014M;LINKAGE=A
NODE=B014M;LINKAGE=BT
NODE=B014W
NODE=B014W
→ UNCHECKED ←
NODE=B014W;LINKAGE=A
NODE=B014W;LINKAGE=BA
NODE=B014225;NODE=B014
NODE=B014
DESIG=1;OUR EST
DESIG=2;OUR EST
DESIG=12;OUR EST
DESIG=3;OUR EST
DESIG=4;OUR EST
DESIG=5;OUR EST
DESIG=6
DESIG=7
DESIG=188
DESIG=187;OUR EST
DESIG=10;OUR EST
DESIG=11;OUR EST

$N(1710)$ BRANCHING RATIOS

NODE=B014230

$\Gamma(N\pi)/\Gamma_{total}$ Γ_1/Γ

NODE=B014R1
NODE=B014R1

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5 to 20 (≈ 10) OUR ESTIMATE				→ UNCHECKED ←
12± 6	[1] HUNT	19	DPWA	Multichannel
5± 3	SOKHOYAN	15A	DPWA	Multichannel
2± 2	[1] 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	[1] SHRESTHA	12A	DPWA	Multichannel
22±24	[2] BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
14± 8	PENNER	02C	DPWA	Multichannel
27±13	VRANA	00	DPWA	Multichannel

[1] Statistical error only. NODE=B014R1;LINKAGE=A
[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. NODE=B014R1;LINKAGE=BA

$\Gamma(N\eta)/\Gamma_{total}$ Γ_2/Γ

NODE=B014R11
NODE=B014R11

VALUE (%)	DOCUMENT ID		TECN	COMMENT
10 to 50 (≈ 30) OUR ESTIMATE				→ UNCHECKED ←
18±10	MUELLER	20	DPWA	Multichannel
17± 8	[1] HUNT	19	DPWA	Multichannel
45± 4	[1] SHKLYAR	13	DPWA	Multichannel
17±10	ANISOVICH	12A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11± 7	[1] SHRESTHA	12A	DPWA	Multichannel
6± 8	[2] BATINIC	10	DPWA	$\pi N \to N\pi$, $N\eta$
36±11	PENNER	02C	DPWA	Multichannel
6± 1	VRANA	00	DPWA	Multichannel

[1] Statistical error only. NODE=B014R11;LINKAGE=A
[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. NODE=B014R11;LINKAGE=BA

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

NODE=B014R17
NODE=B014R17

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1 to 5 (≈ 3) OUR ESTIMATE				→ UNCHECKED ←
2±2	DENISENKO	16	DPWA	Multichannel
3±2	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
13±2	PENNER	02C	DPWA	Multichannel

[1] Statistical error only. NODE=B014R17;LINKAGE=A

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

NODE=B014R15
NODE=B014R15

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5 to 25 (≈ 15) OUR ESTIMATE				→ UNCHECKED ←
1.8± 1.5	[1] HUNT	19	DPWA	Multichannel
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	[1] SHRESTHA	12A	DPWA	Multichannel
5 ± 2	PENNER	02C	DPWA	Multichannel
10 ±10	VRANA	00	DPWA	Multichannel

[1] Statistical error only. NODE=B014R15;LINKAGE=A

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

NODE=B014R16
NODE=B014R16

VALUE (%)	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7±7	PENNER	02C	DPWA	Multichannel

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

NODE=B014R13
NODE=B014R13

VALUE (%)	DOCUMENT ID		TECN	COMMENT
3–9 % OUR ESTIMATE				
28±9	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6±3	[1] SHRESTHA	12A	DPWA	Multichannel
39±8	VRANA	00	DPWA	Multichannel

→ UNCHECKED ←

[1] Statistical error only.

NODE=B014R13;LINKAGE=A

$\Gamma(N\rho, S{=}1/2, P\text{-wave})/\Gamma_{total}$ Γ_8/Γ

NODE=B014R12
NODE=B014R12

VALUE (%)	DOCUMENT ID		TECN	COMMENT
11–23 % OUR ESTIMATE				
17±9	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
17±6	[1] SHRESTHA	12A	DPWA	Multichannel
17±1	VRANA	00	DPWA	Multichannel

→ UNCHECKED ←

[1] Statistical error only.

NODE=B014R12;LINKAGE=A

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

NODE=B014R00
NODE=B014R00

VALUE (%)	DOCUMENT ID		TECN	COMMENT
<16 % OUR ESTIMATE				
<16	[1] HUNT	19	DPWA	Multichannel

→ UNCHECKED ←

[1] Statistical error only.

NODE=B014R00;LINKAGE=A

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

NODE=B014R01
NODE=B014R01

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

OCCUR=2

$N(1710)$ PHOTON DECAY AMPLITUDES AT THE POLE

NODE=B014260

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

NODE=B014PA1
NODE=B014PA1

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
−0.018±0.010	40 ± 55	ROENCHEN	22	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.020	−83	ROENCHEN	15A	DPWA	Multichannel

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

NODE=B014A01
NODE=B014A01

MODULUS ($GeV^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.029±0.007	80 ± 20	ANISOVICH	17E	DPWA	Multichannel

$N(1710)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES

NODE=B014235

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

NODE=B014A1
NODE=B014A1

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.014±0.008	[1] HUNT	19	DPWA	Multichannel
0.050±0.010	SOKHOYAN	15A	DPWA	Multichannel
−0.050±0.001	[1] SHKLYAR	13	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.05 ±0.01	GUTZ	14	DPWA	Multichannel
0.052±0.015	ANISOVICH	12A	DPWA	Multichannel
−0.008±0.003	[1] SHRESTHA	12A	DPWA	Multichannel
0.044	PENNER	02D	DPWA	Multichannel

[1] Statistical error only.

NODE=B014A1;LINKAGE=B

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

NODE=B014A2
NODE=B014A2

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.0053±0.0003	[1] HUNT	19	DPWA	Multichannel
−0.040 ±0.020	ANISOVICH	13B	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.017 ±0.003	[1] SHRESTHA	12A	DPWA	Multichannel
−0.024	PENNER	02D	DPWA	Multichannel

[1] Statistical error only.

NODE=B014A2;LINKAGE=A

N(1710) REFERENCES

NODE=B014

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

NODE=B014

ROENCHEN	22	EPJ A58 229	D. Roenchen *et al.*	(JULI, GWU, BONN+)		REFID=61999
MUELLER	20	PL B803 135323	J. Mueller *et al.*	(CBELSA/TAPS Collab.)		REFID=60391
HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley			REFID=59985
ANISOVICH	17A	PRL 119 062004	A.V. Anisovich *et al.*			REFID=57949
ANISOVICH	17E	PR C96 055202	A.V. Anisovich *et al.*	(BONN, PNPI, JLAB+)		REFID=62311
DENISENKO	16	PL B755 97	I. Denisenko *et al.*			REFID=57504
ROENCHEN	15A	EPJ A51 70	D. Roenchen *et al.*			REFID=58183
SOKHOYAN	15A	EPJ A51 95	V. Sokhoyan *et al.*	(CBELSA/TAPS Collab.)		REFID=56757
GUTZ	14	EPJ A50 74	E. Gutz *et al.*	(CBELSA/TAPS Collab.)		REFID=55697
PDG	14	CP C38 070001	K. Olive *et al.*	(PDG Collab.)		REFID=55687
SVARC	14	PR C89 045205	A. Svarc *et al.*	(RBI Zagreb, UNI Tuzla)		REFID=55775
ANISOVICH	13B	EPJ A49 67	A.V. Anisovich *et al.*			REFID=56147
SHKLYAR	13	PR C87 015201	V. Shklyar, H. Lenske, U. Mosel	(GIES)		REFID=55104
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich *et al.*	(BONN, PNPI)		REFID=54041
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)		REFID=54862
BATINIC	10	PR C82 038203	M. Batinic *et al.*	(ZAGR)		REFID=53552
SHKLYAR	05	PR C72 015210	V. Shklyar, H. Lenske, U. Mosel	(GIES)		REFID=50977
PENNER	02C	PR C66 055211	G. Penner, U. Mosel	(GIES)		REFID=49129
PENNER	02D	PR C66 055212	G. Penner, U. Mosel	(GIES)		REFID=49130
VRANA	00	PRPL 328 181	T.P. Vrana, S.A. Dytman, T.-S.H. Lee	(PITT, ANL)		REFID=47593
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)		REFID=43821
CUTKOSKY	90	PR D42 235	R.E. Cutkosky, S. Wang	(CMU)		REFID=41262
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky *et al.*	(CMU, LBL)	IJP	REFID=30064
Also		PR D20 2839	R.E. Cutkosky *et al.*	(CMU, LBL)	IJP	REFID=40096
HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT)	IJP	REFID=30058
Also		Toronto Conf. 3	R. Koch	(KARLT)	IJP	REFID=30859