Δ(1910) 1/2+

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

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

Δ(1910) POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1800 to 1900 (≈ 1850) OUR ESTIMATE				
1802± 6	ROENCHEN	22	DPWA	Multichannel
1840±40	SOKHOYAN	15A	DPWA	Multichannel
1896±11	[1] SVARC	14	L+P	$\pi N \to \pi N$
1880±30	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1801	HUNT	19	DPWA	Multichannel
1799	ROENCHEN	15A	DPWA	Multichannel
1840±40	GUTZ	14	DPWA	Multichannel
1850±40	ANISOVICH	12A	DPWA	Multichannel
1771	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
1880	VRANA	00	DPWA	Multichannel
1874	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
200 to 500 (≈ 350) OUR ESTIMATE				
550±11	ROENCHEN	22	DPWA	Multichannel
370±60	SOKHOYAN	15A	DPWA	Multichannel
302±22	[1] SVARC	14	L+P	$\pi N \to \pi N$
200±40	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
224	HUNT	19	DPWA	Multichannel
648	ROENCHEN	15A	DPWA	Multichannel
370±60	GUTZ	14	DPWA	Multichannel
350±45	ANISOVICH	12A	DPWA	Multichannel
479	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
496	VRANA	00	DPWA	Multichannel
283	HOEHLER	93	SPED	$\pi N \to \pi N$

[1] Fit to the amplitudes of HOEHLER 79.

Δ(1910) ELASTIC POLE RESIDUE

MODULUS |r|

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
20 to 30 (≈ 25) OUR ESTIMATE				
35±13	ROENCHEN	22	DPWA	Multichannel
25± 6	SOKHOYAN	15A	DPWA	Multichannel
29± 2	[1] SVARC	14	L+P	$\pi N \to \pi N$
20± 4	CUTKOSKY	80	IPWA	$\pi N \to \pi N$

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

90	ROENCHEN	15A	DPWA	Multichannel
25± 6	GUTZ	14	DPWA	Multichannel
24± 6	ANISOVICH	12A	DPWA	Multichannel
45	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
38	HOEHLER	93	SPED	$\pi N \to \pi N$

[1] Fit to the amplitudes of HOEHLER 79.

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
−180 to 90 (≈ − 90) OUR ESTIMATE				
93± 7	ROENCHEN	22	DPWA	Multichannel
−155±30	SOKHOYAN	15A	DPWA	Multichannel
− 83± 4±1	[1] SVARC	14	L+P	$\pi N \to \pi N$
− 90±30	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
− 83	ROENCHEN	15A	DPWA	Multichannel
−155±30	GUTZ	14	DPWA	Multichannel
−145±30	ANISOVICH	12A	DPWA	Multichannel
+172	ARNDT	06	DPWA	$\pi N \to \pi N$, ηN

[1] Fit to the amplitudes of HOEHLER 79.

Δ(1910) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \to \Delta(1910) \to \Sigma K$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.002±0.002	138 ± 10	ROENCHEN	22	DPWA	Multichannel
0.07 ±0.02	−110 ± 30	ANISOVICH	12A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.019	−123	ROENCHEN	15A	DPWA	Multichannel

Normalized residue in $N\pi \to \Delta(1910) \to \Delta\pi$, P-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.24±0.09	−42 ± 7	ROENCHEN	22	DPWA	Multichannel
0.24±0.10	85 ± 35	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.58	131	ROENCHEN	15A	DPWA	Multichannel
0.16±0.09	95 ± 40	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to \Delta(1910) \to \Delta(1232)\eta$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.11±0.04	−150 ± 50	GUTZ	14	DPWA	Multichannel

Normalized residue in $N\pi \to \Delta(1910) \to N(1440)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.06±0.03	170 ± 45	SOKHOYAN	15A	DPWA	Multichannel

Δ(1910) BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1850 to 1950 (≈ 1900) OUR ESTIMATE				
1846 ±18	[1] HUNT	19	DPWA	Multichannel
1845 ±40	SOKHOYAN	15A	DPWA	Multichannel
2067.9± 1.7	[1] ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
1910 ±40	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
1888 ±20	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1845 ±40	GUTZ	14	DPWA	Multichannel
1860 ±40	ANISOVICH	12A	DPWA	Multichannel
1934 ± 5	[1] SHRESTHA	12A	DPWA	Multichannel
1995 ±12	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

Δ(1910) BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
200 to 400 (≈ 300) OUR ESTIMATE				
260± 57	[1] HUNT	19	DPWA	Multichannel
360± 60	SOKHOYAN	15A	DPWA	Multichannel
543± 10	[1] ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
225± 50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
280± 50	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
360± 60	GUTZ	14	DPWA	Multichannel
350± 55	ANISOVICH	12A	DPWA	Multichannel
211± 11	[1] SHRESTHA	12A	DPWA	Multichannel
713±465	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

Δ(1910) DECAY MODES

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

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	10–30%
Γ_2	ΣK	4–14%
Γ_3	$\Delta(1232)\pi$	34–66%
Γ_4	$N(1440)\pi$	3–45%
Γ_5	$\Delta(1232)\eta$	5–13%
Γ_6	$N\gamma$, helicity=1/2	0.0–0.02 %

$\Delta(1910)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ — Γ_1/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
10–30% OUR ESTIMATE				
13 ± 3	[1] HUNT	19	DPWA	Multichannel
12 ± 3	SOKHOYAN	15A	DPWA	Multichannel
23.9 ± 0.1	[1] ARNDT	06	DPWA	$\pi N \to \pi N$, ηN
19 ± 3	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
24 ± 6	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
12 ± 3	GUTZ	14	DPWA	Multichannel
12 ± 3	ANISOVICH	12A	DPWA	Multichannel
17 ± 1	[1] SHRESTHA	12A	DPWA	Multichannel
29 ± 21	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(\Sigma K)/\Gamma_{total}$ — Γ_2/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4–14% OUR ESTIMATE				
9 ± 5	ANISOVICH	12A	DPWA	Multichannel

$\Gamma(\Delta(1232)\pi)/\Gamma_{total}$ — Γ_3/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
34–66% OUR ESTIMATE				
50 ± 16	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
60 ± 28	ANISOVICH	12A	DPWA	Multichannel

$\Gamma(N(1440)\pi)/\Gamma_{total}$ — Γ_4/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
3–45% OUR ESTIMATE				
33 ± 12	[1] HUNT	19	DPWA	Multichannel
6 ± 3	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
47 ± 6	[1] SHRESTHA	12A	DPWA	Multichannel
56 ± 7	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(\Delta(1232)\eta)/\Gamma_{total}$ — Γ_5/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5–13% OUR ESTIMATE				
9 ± 4	GUTZ	14	DPWA	Multichannel

Δ(1910) PHOTON DECAY AMPLITUDES AT THE POLE

Δ(1910) → *N*γ, helicity-1/2 amplitude $A_{1/2}$

MODULUS (GeV$^{-1/2}$)	PHASE (°)	DOCUMENT ID		TECN	COMMENT
−0.446±0.036	−70 ± 11	ROENCHEN	22	DPWA	Multichannel
0.027±0.009	−30 ± 60	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.321	39	ROENCHEN	15A	DPWA	Multichannel

Δ(1910) BREIT-WIGNER PHOTON DECAY AMPLITUDES

Δ(1910) → *N*γ, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV$^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.010 to 0.030 (≈ 0.020) OUR ESTIMATE				
0.203±0.056	[1] HUNT	19	DPWA	Multichannel
0.026±0.008	SOKHOYAN	15A	DPWA	Multichannel
−0.002±0.008	[1] ARNDT	96	IPWA	$\gamma N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.026±0.008	GUTZ	14	DPWA	Multichannel
0.022±0.009	ANISOVICH	12A	DPWA	Multichannel
0.030±0.002	[1] SHRESTHA	12A	DPWA	Multichannel

[1] Statistical error only.

Δ(1910) REFERENCES

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

ROENCHEN	22	EPJ A58 229	D. Roenchen *et al.*	(JULI, GWU, BONN+)
HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
ROENCHEN	15A	EPJ A51 70	D. Roenchen *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.)
SVARC	14	PR C89 045205	A. Svarc *et al.*	(RBI Zagreb, UNI Tuzla)
ANISOVICH	12A	EPJ A48 15	A.V. Anisovich *et al.*	(BONN, PNPI)
SHRESTHA	12A	PR C86 055203	M. Shrestha, D.M. Manley	(KSU)
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)
ARNDT	96	PR C53 430	R.A. Arndt, I.I. Strakovsky, R.L. Workman	(VPI)
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