$\Delta(1900)$ $1/2^-$

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

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

Δ(1900) POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1830 to 1900 (≈ 1865) OUR ESTIMATE				
1845±20	SOKHOYAN	15A	DPWA	Multichannel
1865±35±19	[1] SVARC	14	L+P	$\pi N \to \pi N$
1870±40	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1957	HUNT	19	DPWA	Multichannel
1845±20	GUTZ	14	DPWA	Multichannel
1845±25	ANISOVICH	12A	DPWA	Multichannel
1795	VRANA	00	DPWA	Multichannel
1780	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
180 to 300 (≈ 240) OUR ESTIMATE				
295±35	SOKHOYAN	15A	DPWA	Multichannel
187±50±19	[1] SVARC	14	L+P	$\pi N \to \pi N$
180±50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
447	HUNT	19	DPWA	Multichannel
295±35	GUTZ	14	DPWA	Multichannel
300±45	ANISOVICH	12A	DPWA	Multichannel
58	VRANA	00	DPWA	Multichannel

[1] Fit to the amplitudes of HOEHLER 79.

Δ(1900) ELASTIC POLE RESIDUE

MODULUS |r|

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
8 to 14 (≈ 11) OUR ESTIMATE				
11±2	SOKHOYAN	15A	DPWA	Multichannel
11±4±2	[1] SVARC	14	L+P	$\pi N \to \pi N$
10±3	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11±2	GUTZ	14	DPWA	Multichannel
10±3	ANISOVICH	12A	DPWA	Multichannel

[1] Fit to the amplitudes of HOEHLER 79.

PHASE θ

VALUE (°)	DOCUMENT ID		TECN	COMMENT
−115±20	SOKHOYAN	15A	DPWA	Multichannel
20±27±19	[1] SVARC	14	L+P	$\pi N \to \pi N$
+ 20±40	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−115±20	GUTZ	14	DPWA	Multichannel
−125±20	ANISOVICH	12A	DPWA	Multichannel

[1] Fit to the amplitudes of HOEHLER 79.

Δ(1900) INELASTIC POLE RESIDUE

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

Normalized residue in $N\pi \to \Delta(1900) \to \Sigma K$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.07±0.02	−50 ± 30	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to \Delta(1900) \to \Delta\pi$, D-wave

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.18±0.10	105 ± 25	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.12^{+0.08}_{-0.05}$	110 ± 20	ANISOVICH	12A	DPWA	Multichannel

Normalized residue in $N\pi \to \Delta(1900) \to \Delta(1232)\eta$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.013±0.006	undefined	GUTZ	14	DPWA	Multichannel

Normalized residue in $N\pi \to \Delta(1900) \to N(1440)\pi$

MODULUS	PHASE (°)	DOCUMENT ID		TECN	COMMENT
0.11±0.06	115 ± 30	SOKHOYAN	15A	DPWA	Multichannel

Normalized residue in $N\pi \to \Delta(1900) \to N(1520)\pi$

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

Δ(1900) BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1840 to 1920 (≈ 1860) OUR ESTIMATE				
1989±22	[1] HUNT	19	DPWA	Multichannel
1840±20	SOKHOYAN	15A	DPWA	Multichannel
1890±50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
1908±30	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1840±20	GUTZ	14	DPWA	Multichannel
1840±30	ANISOVICH	12A	DPWA	Multichannel
1868±12	[1] SHRESTHA	12A	DPWA	Multichannel
1802±87	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

Δ(1900) BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
180 to 320 (≈ 250) OUR ESTIMATE				
457±60	[1] HUNT	19	DPWA	Multichannel
295±30	SOKHOYAN	15A	DPWA	Multichannel
170±50	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
140±40	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
295±30	GUTZ	14	DPWA	Multichannel
300±45	ANISOVICH	12A	DPWA	Multichannel
234±27	[1] SHRESTHA	12A	DPWA	Multichannel
48±45	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

Δ(1900) DECAY MODES

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

	Mode	Fraction (Γ_i/Γ)
Γ_1	$N\pi$	4–12%
Γ_2	ΣK	seen
Γ_3	$N\pi\pi$	> 52%
Γ_4	$\Delta(1232)\pi$, D-wave	30–70%
Γ_5	$N\rho$	22–60 %
Γ_6	$N\rho$, S=1/2, S-wave	11–35%
Γ_7	$N\rho$, S=3/2, D-wave	11–25%
Γ_8	$N(1440)\pi$	3–32%
Γ_9	$N(1520)\pi$	2–10%
Γ_{10}	$\Delta(1232)\eta$	< 2%
Γ_{11}	$N\gamma$, helicity=1/2	0.06–0.43 %

Δ(1900) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ — Γ_1/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4–12% OUR ESTIMATE				
3.7± 0.8	[1] HUNT	19	DPWA	Multichannel
7 ± 2	SOKHOYAN	15A	DPWA	Multichannel
10 ± 3	CUTKOSKY	80	IPWA	$\pi N \to \pi N$
8 ± 4	HOEHLER	79	IPWA	$\pi N \to \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7 ± 2	GUTZ	14	DPWA	Multichannel
7 ± 3	ANISOVICH	12A	DPWA	Multichannel
8 ± 1	[1] SHRESTHA	12A	DPWA	Multichannel
33 ±10	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(\Delta(1232)\pi, D\text{-wave})/\Gamma_{total}$ — Γ_4/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
30–70% OUR ESTIMATE				
42 ± 8	[1] HUNT	19	DPWA	Multichannel
50 ± 20	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
15^{+50}_{-10}	ANISOVICH	12A	DPWA	Multichannel
56 ± 6	[1] SHRESTHA	12A	DPWA	Multichannel
28 ± 1	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(N\rho, S=1/2, S\text{-wave})/\Gamma_{total}$ — Γ_6/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
11–35% OUR ESTIMATE				
23 ± 12	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
12 ± 4	[1] SHRESTHA	12A	DPWA	Multichannel
30 ± 2	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(N\rho, S=3/2, D\text{-wave})/\Gamma_{total}$ — Γ_7/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
11–25% OUR ESTIMATE				
18 ± 7	[1] HUNT	19	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
23 ± 5	[1] SHRESTHA	12A	DPWA	Multichannel
5 ± 1	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(N(1440)\pi)/\Gamma_{total}$ — Γ_8/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
3–32% OUR ESTIMATE				
12 ± 9	[1] HUNT	19	DPWA	Multichannel
20 ± 12	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 1	[1] SHRESTHA	12A	DPWA	Multichannel
4 ± 1	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma(N(1520)\pi)/\Gamma_{total}$ — Γ_9/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
2–10% OUR ESTIMATE				
6 ± 4	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma(\Delta(1232)\eta)/\Gamma_{total}$ — Γ_{10}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
< 2% OUR ESTIMATE				
1 ± 1	GUTZ	14	DPWA	Multichannel

$\Delta(1900)$ PHOTON DECAY AMPLITUDES AT THE POLE

$\Delta(1900) \rightarrow N\gamma$, helicity-1/2 amplitude $A_{1/2}$

MODULUS ($GeV^{-1/2}$)	PHASE ($^\circ$)	DOCUMENT ID		TECN	COMMENT
0.064 ± 0.015	60 ± 20	SOKHOYAN	15A	DPWA	Multichannel

$\Delta(1900)$ BREIT-WIGNER PHOTON DECAY AMPLITUDES

$\Delta(1900) \rightarrow N\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE ($GeV^{-1/2}$)	DOCUMENT ID		TECN	COMMENT
0.212 ± 0.029	[1] HUNT	19	DPWA	Multichannel
0.065 ± 0.015	SOKHOYAN	15A	DPWA	Multichannel
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.057 ± 0.014	GUTZ	14	DPWA	Multichannel
-0.082 ± 0.009	[1] SHRESTHA	12A	DPWA	Multichannel

[1] Statistical error only.

$\Delta(1900)$ REFERENCES

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

HUNT	19	PR C99 055205	B.C. Hunt, D.M. Manley	
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)
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
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HOEHLER	79	PDAT 12-1	G. Hohler *et al.*	(KARLT) IJP
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