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

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

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

$\Delta(1900)$ POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1830 to 1900 ($\approx$ 1865) OUR ESTIMATE				
1845 ± 20	SOKHOYAN	15A	DPWA	Multichannel
$1865\pm35\pm19$	[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. • • •				
1845 ± 20	GUTZ	14	DPWA	Multichannel
1845 ± 25	ANISOVICH	12A	DPWA	Multichannel
1844	SHRESTHA	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.

$-2\times$IMAGINARY PART

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
180 to 300 ($\approx$ 240) OUR ESTIMATE				
295 ± 35	SOKHOYAN	15A	DPWA	Multichannel
$187\pm50\pm19$	[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. • • •				
295 ± 35	GUTZ	14	DPWA	Multichannel
300 ± 45	ANISOVICH	12A	DPWA	Multichannel
223	SHRESTHA	12A	DPWA	Multichannel
58	VRANA	00	DPWA	Multichannel

[1] Fit to the amplitudes of HOEHLER 79.

$\Delta(1900)$ ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
8 to 14 ($\approx$ 11) OUR ESTIMATE				
11 ± 2	SOKHOYAN	15A	DPWA	Multichannel
$11\pm4\pm2$	[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
$20\pm27\pm19$	[1] SVARC	14	L+P	$\pi N \to \pi N$
$+\ 20\pm40$	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.

$\Delta(1900)$ 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

$\Delta(1900)$ BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
1840 to 1920 ($\approx$ 1860) OUR ESTIMATE				
1840 ± 20	SOKHOYAN	15A	DPWA	Multichannel
1868 ± 12	[1] SHRESTHA	12A	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
1802 ± 87	VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Delta(1900)$ BREIT-WIGNER WIDTH

VALUE (MeV)		DOCUMENT ID		TECN	COMMENT
180 to 320 ($\approx$ 250) OUR ESTIMATE					
295 ± 30		SOKHOYAN	15A	DPWA	Multichannel
234 ± 27	[1]	SHRESTHA	12A	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
48 ± 45		VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Delta(1900)$ 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	$N\pi\pi$	45–85 %
Γ_4	$\Delta(1232)\pi$	
Γ_5	$\Delta(1232)\pi$, D-wave	30–70 %
Γ_6	$N\rho$	
Γ_7	$N\rho$, $S=1/2$, S-wave	8–16 %
Γ_8	$N\rho$, $S=3/2$, D-wave	18–28 %
Γ_9	$N(1440)\pi$	8–32 %
Γ_{10}	$N(1520)\pi$	2–10 %
Γ_{11}	$\Delta(1232)\eta$	0–2 %
Γ_{12}	$N\gamma$, helicity=1/2	0.06–0.43 %

$\Delta(1900)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{total}$ $\hfill \Gamma_1/\Gamma$

VALUE (%)		DOCUMENT ID		TECN	COMMENT
4 to 12 ($\approx$ 8) OUR ESTIMATE					
7 ± 2		SOKHOYAN	15A	DPWA	Multichannel
8 ± 1	[1]	SHRESTHA	12A	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
33 ± 10		VRANA	00	DPWA	Multichannel

[1] Statistical error only.

$\Gamma\big(\Delta(1232)\pi,\,D\text{-wave}\big)/\Gamma_{\text{total}}$ $\qquad\qquad\qquad$ Γ_5/Γ

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

[1] Statistical error only.

$\Gamma\big(N\rho,\,S=1/2,\,S\text{-wave}\big)/\Gamma_{\text{total}}$ $\qquad\qquad\qquad$ Γ_7/Γ

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

[1] Statistical error only.

$\Gamma\big(N\rho,\,S=3/2,\,D\text{-wave}\big)/\Gamma_{\text{total}}$ $\qquad\qquad\qquad$ Γ_8/Γ

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

[1] Statistical error only.

$\Gamma\big(N(1440)\pi\big)/\Gamma_{\text{total}}$ $\qquad\qquad\qquad$ Γ_9/Γ

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

[1] Statistical error only.

$\Gamma\big(N(1520)\pi\big)/\Gamma_{\text{total}}$ $\qquad\qquad\qquad$ Γ_{10}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
6 ± 4	SOKHOYAN	15A	DPWA	Multichannel

$\Gamma\big(\Delta(1232)\eta\big)/\Gamma_{\text{total}}$ $\qquad\qquad\qquad$ Γ_{11}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1 ± 1	GUTZ	14 DPWA	Multichannel

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

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

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

Δ(1900) BREIT-WIGNER PHOTON DECAY AMPLITUDES

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

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

Δ(1900) REFERENCES

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

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
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