

$\Delta(1940) D_{33}$

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

OMITTED FROM SUMMARY TABLE

The latest GWU analysis (ARNDT 06) finds no evidence for this resonance.

 $\Delta(1940)$ BREIT-WIGNER MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
≈ 1940 OUR ESTIMATE			
2057 ± 110	MANLEY	92	IPWA $\pi N \rightarrow \pi N$ & $N\pi\pi$
2058.1 ± 34.5	CHEW	80	BPWA $\pi^+ p \rightarrow \pi^+ p$
1940 ± 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1990 ± 40	HORN	08A	DPWA Multichannel

 $\Delta(1940)$ BREIT-WIGNER WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
460 ± 320	MANLEY	92	IPWA $\pi N \rightarrow \pi N$ & $N\pi\pi$
198.4 ± 45.5	CHEW	80	BPWA $\pi^+ p \rightarrow \pi^+ p$
200 ± 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
410 ± 70	HORN	08A	DPWA Multichannel

 $\Delta(1940)$ POLE POSITION**REAL PART**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1900 ± 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
1915 or 1926	¹ LONGACRE	78	IPWA $\pi N \rightarrow N\pi\pi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1985 ± 30	HORN	08A	DPWA Multichannel

-2xIMAGINARY PART

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
200 ± 60	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
190 or 186	¹ LONGACRE	78	IPWA $\pi N \rightarrow N\pi\pi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
390 ± 50	HORN	08A	DPWA Multichannel

 $\Delta(1940)$ ELASTIC POLE RESIDUE**MODULUS $|r|$**

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
8 ± 3	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

PHASE θ

<u>VALUE ($^\circ$)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
135 \pm 45	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$

$\Delta(1940)$ DECAY MODES

Mode
Γ_1 $N\pi$
Γ_2 ΣK
Γ_3 $N\pi\pi$
Γ_4 $\Delta(1232)\pi$, S-wave
Γ_5 $\Delta(1232)\pi$, D-wave
Γ_6 $N\rho$, S=3/2, S-wave
Γ_7 $N(1535)\pi$
Γ_8 $N a_0(980)$
Γ_9 $\Delta(1232)\eta$
Γ_{10} $N\gamma$, helicity=1/2
Γ_{11} $N\gamma$, helicity=3/2

$\Delta(1940)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	Γ_1/Γ
0.18 \pm 0.12	MANLEY 92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$	
0.18	CHEW 80	BPWA	$\pi^+ p \rightarrow \pi^+ p$	
0.05 \pm 0.02	CUTKOSKY 80	IPWA	$\pi N \rightarrow \pi N$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.09 \pm 0.04	HORN 08A	DPWA	Multichannel	

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow \Sigma K$	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$
<0.015	CANDLIN 84	DPWA	$\pi^+ p \rightarrow \Sigma^+ K^+$	

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow \Delta(1232)\pi$, S-wave	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$(\Gamma_1\Gamma_4)^{1/2}/\Gamma$
+0.11 \pm 0.10	MANLEY 92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$	

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow \Delta(1232)\pi$, D-wave	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$(\Gamma_1\Gamma_5)^{1/2}/\Gamma$
+0.27 \pm 0.16	MANLEY 92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$	

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow N\rho$, S=3/2, S-wave	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$(\Gamma_1\Gamma_6)^{1/2}/\Gamma$
+0.25 \pm 0.10	MANLEY 92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$	

$\Gamma(N(1535)\pi)/\Gamma_{\text{total}}$ Γ_7/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.02±0.01	HORN	08A	DPWA Multichannel

$\Gamma(N_{a_0}(980))/\Gamma_{\text{total}}$ Γ_8/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.02±0.01	HORN	08A	DPWA Multichannel

$\Gamma(\Delta(1232)\eta)/\Gamma_{\text{total}}$ Γ_9/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.04±0.02	HORN	08A	DPWA Multichannel

$\Delta(1940)$ PHOTON DECAY AMPLITUDES

Papers on γN amplitudes predating 1981 may be found in our 2006 edition, Journal of Physics, G **33** 1 (2006).

$\Delta(1940) \rightarrow N\gamma$, helicity-1/2 amplitude $A_{1/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.036±0.058	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
0.160±0.040	HORN	08A	DPWA Multichannel

$\Delta(1940) \rightarrow N\gamma$, helicity-3/2 amplitude $A_{3/2}$

<u>VALUE (GeV^{-1/2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.031±0.012	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$
0.110±0.030	HORN	08A	DPWA Multichannel

$\Delta(1940)$ FOOTNOTES

¹ LONGACRE 78 values are from a search for poles in the unitarized T-matrix. The first (second) value uses, in addition to $\pi N \rightarrow N\pi\pi$ data, elastic amplitudes from a Saclay (CERN) partial-wave analysis.

$\Delta(1940)$ REFERENCES

HORN	08A	EPJ A38 173	I. Horn <i>et al.</i>	(CB-ELSA Collab.)
Also		PRL 101 202002	I. Horn <i>et al.</i>	(CB-ELSA Collab.)
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KENT) IJP
Also		PR D30 904	D.M. Manley <i>et al.</i>	(VPI)
CANDLIN	84	NP B238 477	D.J. Candlin <i>et al.</i>	(EDIN, RAL, LOWC)
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)
Also		NP B197 365	K. Fujii <i>et al.</i>	(NAGO)
CHEW	80	Toronto Conf. 123	D.M. Chew	(LBL) IJP
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP
Also		PR D20 2839	R.E. Cutkosky <i>et al.</i>	(CMU, LBL)
LONGACRE	78	PR D17 1795	R.S. Longacre <i>et al.</i>	(LBL, SLAC)