

$\Delta(1940) D_{33}$

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

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 $\pi N \rightarrow \pi N$

 $\Delta(1940)$ 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 $\pi N \rightarrow \pi N$

 $\Delta(1940)$ 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 $\pi N \rightarrow N\pi\pi$

-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 $\pi N \rightarrow N\pi\pi$

 $\Delta(1940)$ 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 ± 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	$N\gamma$, helicity=1/2
Γ_8	$N\gamma$, helicity=3/2

 $\Delta(1940)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
0.18 ± 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 ± 0.02	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow \Sigma K$				$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
<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				$(\Gamma_1\Gamma_4)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
$+0.11 \pm 0.10$	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				$(\Gamma_1\Gamma_5)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
$+0.27 \pm 0.16$	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				$(\Gamma_1\Gamma_6)^{1/2}/\Gamma$
VALUE	DOCUMENT ID	TECN	COMMENT	
$+0.25 \pm 0.10$	MANLEY	92	IPWA	$\pi N \rightarrow \pi N \ \& \ N\pi\pi$

 $\Delta(1940)$ 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 $A_{1/2}$

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
-0.036 ± 0.058	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$

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

VALUE ($\text{GeV}^{-1/2}$)	DOCUMENT ID	TECN	COMMENT
-0.031 ± 0.012	AWAJI	81	DPWA $\gamma N \rightarrow \pi N$

$\Delta(1940)$ 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

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)