# $N(2250)\ 9/2^-$

$I(J^P) = \frac{1}{2}(\frac{9}{2}^-)$ Status: ****

Some obsolete results published before 1980 were last included in our 2006 edition, Journal of Physics **G33** 1 (2006).

## *N*(2250) BREIT-WIGNER MASS

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **2200 to 2350 (≈ 2275) OUR ESTIMATE** | | | | |
| 2280± 40 | ANISOVICH | 12A | DPWA | Multichannel |
| 2302± 6 | ARNDT | 06 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 2250± 80 | CUTKOSKY | 80 | IPWA | $\pi N \rightarrow \pi N$ |
| 2268± 15 | HOEHLER | 79 | IPWA | $\pi N \rightarrow \pi N$ |
| 2200±100 | HENDRY | 78 | MPWA | $\pi N \rightarrow \pi N$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 2376± 43 | ARNDT | 04 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 2291 | ARNDT | 95 | DPWA | $\pi N \rightarrow N\pi$ |

## *N*(2250) BREIT-WIGNER WIDTH

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **230 to 800 (≈ 500) OUR ESTIMATE** | | | | |
| 520± 50 | ANISOVICH | 12A | DPWA | Multichannel |
| 628± 28 | ARNDT | 06 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 480±120 | CUTKOSKY | 80 | IPWA | $\pi N \rightarrow \pi N$ |
| 300± 40 | HOEHLER | 79 | IPWA | $\pi N \rightarrow \pi N$ |
| 350±100 | HENDRY | 78 | MPWA | $\pi N \rightarrow \pi N$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 924±178 | ARNDT | 04 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 772 | ARNDT | 95 | DPWA | $\pi N \rightarrow N\pi$ |

## *N*(2250) POLE POSITION

### REAL PART

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **2150 to 2250 (≈ 2200) OUR ESTIMATE** | | | | |
| 2157± 3±14 | [1] SVARC | 14 | MLS | $\pi N \rightarrow \pi N$ |
| 2195±45 | ANISOVICH | 12A | DPWA | Multichannel |
| 2217 | ARNDT | 06 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 2187 | [2] HOEHLER | 93 | SPED | $\pi N \rightarrow \pi N$ |
| 2150±50 | CUTKOSKY | 80 | IPWA | $\pi N \rightarrow \pi N$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 2238 | ARNDT | 04 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 2087 | ARNDT | 95 | DPWA | $\pi N \rightarrow N\pi$ |
| 2243 | ARNDT | 91 | DPWA | $\pi N \rightarrow \pi N$ Soln SM90 |

### −2×IMAGINARY PART

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **350 to 550 (≈ 450) OUR ESTIMATE** | | | | |
| 412± 7±44 | [1] SVARC | 14 | MLS | $\pi N \to \pi N$ |
| 470± 50 | ANISOVICH | 12A | DPWA | Multichannel |
| 431 | ARNDT | 06 | DPWA | $\pi N \to \pi N, \eta N$ |
| 388 | [2] HOEHLER | 93 | SPED | $\pi N \to \pi N$ |
| 360±100 | CUTKOSKY | 80 | IPWA | $\pi N \to \pi N$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 536 | ARNDT | 04 | DPWA | $\pi N \to \pi N, \eta N$ |
| 680 | ARNDT | 95 | DPWA | $\pi N \to N\pi$ |
| 650 | ARNDT | 91 | DPWA | $\pi N \to \pi N$ Soln SM90 |

## *N*(2250) ELASTIC POLE RESIDUE

### MODULUS $|r|$

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| 24±1±5 | [1] SVARC | 14 | MLS | $\pi N \to \pi N$ |
| 26±5 | ANISOVICH | 12A | DPWA | Multichannel |
| 21 | ARNDT | 06 | DPWA | $\pi N \to \pi N, \eta N$ |
| 21 | HOEHLER | 93 | SPED | $\pi N \to \pi N$ |
| 20±6 | CUTKOSKY | 80 | IPWA | $\pi N \to \pi N$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 33 | ARNDT | 04 | DPWA | $\pi N \to \pi N, \eta N$ |
| 24 | ARNDT | 95 | DPWA | $\pi N \to N\pi$ |
| 47 | ARNDT | 91 | DPWA | $\pi N \to \pi N$ Soln SM90 |

### PHASE $\theta$

| *VALUE* (°) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| −62± 1±11 | [1] SVARC | 14 | MLS | $\pi N \to \pi N$ |
| −38±25 | ANISOVICH | 12A | DPWA | Multichannel |
| −20 | ARNDT | 06 | DPWA | $\pi N \to \pi N, \eta N$ |
| −50±20 | CUTKOSKY | 80 | IPWA | $\pi N \to \pi N$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| −25 | ARNDT | 04 | DPWA | $\pi N \to \pi N, \eta N$ |
| −44 | ARNDT | 95 | DPWA | $\pi N \to N\pi$ |
| −37 | ARNDT | 91 | DPWA | $\pi N \to \pi N$ Soln SM90 |

## *N*(2250) DECAY MODES

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

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $N\pi$ | 5–15 % |
| $\Gamma_2$ | $N\eta$ | |
| $\Gamma_3$ | $\Lambda K$ | |

## *N*(2250) BRANCHING RATIOS

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

| *VALUE* (%) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **5 to 15 OUR ESTIMATE** | | | | |
| 12 ±4 | ANISOVICH | 12A | DPWA | Multichannel |
| 8.9±0.1 | ARNDT | 06 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 10 ±2 | CUTKOSKY | 80 | IPWA | $\pi N \rightarrow \pi N$ |
| 10 ±2 | HOEHLER | 79 | IPWA | $\pi N \rightarrow \pi N$ |
| 9 ±2 | HENDRY | 78 | MPWA | $\pi N \rightarrow \pi N$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 11.0±0.4 | ARNDT | 04 | DPWA | $\pi N \rightarrow \pi N, \eta N$ |
| 10 | ARNDT | 95 | DPWA | $\pi N \rightarrow N\pi$ |

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\pi \rightarrow N(2250) \rightarrow \Lambda K$ $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

| *VALUE* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| −0.02 | BELL | 83 | DPWA | $\pi^- p \rightarrow \Lambda K^0$ |
| not seen | SAXON | 80 | DPWA | $\pi^- p \rightarrow \Lambda K^0$ |

## *N*(2250) PHOTON DECAY AMPLITUDES

Papers on $\gamma N$ amplitudes predating 1981 may be found in our 2006 edition, Journal of Physics **G33** 1 (2006).

### $N(2250) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

| *VALUE* ($GeV^{-1/2}$) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| <0.01 | [3] ANISOVICH | 12A | DPWA | Multichannel |

### $N(2250) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

| *VALUE* ($GeV^{-1/2}$) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| <0.01 | [3] ANISOVICH | 12A | DPWA | Multichannel |

## *N*(2250) FOOTNOTES

[1] Fit to the amplitudes of HOEHLER 79.

[2] See HOEHLER 93 for a detailed discussion of the evidence for and the pole parameters of $N$ and $\Delta$ resonances as determined from Argand diagrams of $\pi N$ elastic partial-wave amplitudes and from plots of the speeds with which the amplitudes traverse the diagrams.

[3] This ANISOVICH 12A value is the complex helicity amplitude at the pole position.

## *N*(2250) REFERENCES


| | | | | |
|---|---|---|---|---|
| SVARC | 14 | PR C89 045205 | A. Svarc *et al.* | |
| ANISOVICH | 12A | EPJ A48 15 | A.V. Anisovich *et al.* | (BONN, PNPI) |
| ARNDT | 06 | PR C74 045205 | R.A. Arndt *et al.* | (GWU) |
| PDG | 06 | JP G33 1 | W.-M. Yao *et al.* | (PDG Collab.) |
| ARNDT | 04 | PR C69 035213 | R.A. Arndt *et al.* | (GWU, TRIU) |
| ARNDT | 95 | PR C52 2120 | R.A. Arndt *et al.* | (VPI, BRCO) |
| HOEHLER | 93 | $\pi N$ Newsletter 9 1 | G. Hohler | (KARL) |

| | | | | |
|---|---|---|---|---|
| ARNDT | 91 | PR D43 2131 | R.A. Arndt *et al.* | (VPI, TELE) IJP |
| BELL | 83 | NP B222 389 | K.W. Bell *et al.* | (RL) IJP |
| 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 |
| SAXON | 80 | NP B162 522 | D.H. Saxon *et al.* | (RHEL, BRIS) IJP |
| HOEHLER | 79 | PDAT 12-1 | G. Hohler *et al.* | (KARLT) IJP |
| Also | | Toronto Conf. 3 | R. Koch | (KARLT) IJP |
| HENDRY | 78 | PRL 41 222 | A.W. Hendry | (IND, LBL) IJP |
| Also | | ANP 136 1 | A.W. Hendry | (IND) |