# $\Sigma(2250)$

$I(J^P) = 1(?^?)$ Status: ***

Results from partial-wave analyses are too weak to warrant separating them from the production and cross-section experiments. LASINSKI 71 in $\overline{K}N$ using a Pomeron + resonances model, and DEBELLEFON 76, DEBELLEFON 77, and DEBELLEFON 78 in energy-dependent partial-wave analyses of $\overline{K}N \to \Lambda\pi$, $\Sigma\pi$, and $N\overline{K}$, respectively, suggest two resonances around this mass.

## $\Sigma(2250)$ MASS

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **2210 to 2280 (≈ 2250) OUR ESTIMATE** | | | | |
| $2270 \pm 50$ | DEBELLEFON | 78 | DPWA | $D_5$ wave |
| $2210 \pm 30$ | DEBELLEFON | 78 | DPWA | $G_9$ wave |
| $2275 \pm 20$ | DEBELLEFON | 77 | DPWA | $D_5$ wave |
| $2215 \pm 20$ | DEBELLEFON | 77 | DPWA | $G_9$ wave |
| $2300 \pm 30$ | [1] DEBELLEFON | 75B | HBC | $K^- p \to \Xi^{*0} K^0$ |
| $2251^{+30}_{-20}$ | VANHORN | 75 | DPWA | $K^- p \to \Lambda\pi^0$, $F_5$ wave |
| $2280 \pm 14$ | AGUILAR-... | 70B | HBC | $K^- p$ 3.9, 4.6 GeV/$c$ |
| $2237 \pm 11$ | BRICMAN | 70 | CNTR | Total, charge exchange |
| $2255 \pm 10$ | COOL | 70 | CNTR | $K^- p$, $K^- d$ total |
| $2250 \pm 7$ | BUGG | 68 | CNTR | $K^- p$, $K^- d$ total |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 2260 | DEBELLEFON | 76 | IPWA | $D_5$ wave |
| 2215 | DEBELLEFON | 76 | IPWA | $G_9$ wave |
| $2250 \pm 20$ | LU | 70 | CNTR | $\gamma p \to K^+ Y^*$ |
| 2245 | BLANPIED | 65 | CNTR | $\gamma p \to K^+ Y^*$ |
| $2299 \pm 6$ | BOCK | 65 | HBC | $\overline{p}p$ 5.7 GeV/$c$ |

## $\Sigma(2250)$ WIDTH

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **60 to 150 (≈ 100) OUR ESTIMATE** | | | | |
| $120 \pm 40$ | DEBELLEFON | 78 | DPWA | $D_5$ wave |
| $80 \pm 20$ | DEBELLEFON | 78 | DPWA | $G_9$ wave |
| $70 \pm 20$ | DEBELLEFON | 77 | DPWA | $D_5$ wave |
| $60 \pm 20$ | DEBELLEFON | 77 | DPWA | $G_9$ wave |
| $130 \pm 20$ | [1] DEBELLEFON | 75B | HBC | $K^- p \to \Xi^{*0} K^0$ |
| $192 \pm 30$ | VANHORN | 75 | DPWA | $K^- p \to \Lambda\pi^0$, $F_5$ wave |
| $100 \pm 20$ | AGUILAR-... | 70B | HBC | $K^- p$ 3.9, 4.6 GeV/$c$ |
| $164 \pm 50$ | BRICMAN | 70 | CNTR | Total, charge exchange |
| $230 \pm 20$ | BUGG | 68 | CNTR | $K^- p$, $K^- d$ total |

• • • We do not use the following data for averages, fits, limits, etc. • • •

| | | | | |
|---|---|---|---|---|
| 100 | DEBELLEFON | 76 | IPWA | $D_5$ wave |
| 140 | DEBELLEFON | 76 | IPWA | $G_9$ wave |
| 170 | COOL | 70 | CNTR | $K^- p$, $K^- d$ total |
| 125 | LU | 70 | CNTR | $\gamma p \rightarrow K^+ Y^*$ |
| 150 | BLANPIED | 65 | CNTR | $\gamma p \rightarrow K^+ Y^*$ |
| $21^{+17}_{-21}$ | BOCK | 65 | HBC | $\overline{p}p$ 5.7 GeV/$c$ |

## $\Sigma(2250)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $N\overline{K}$ | <10 % |
| $\Gamma_2$ | $\Lambda\pi$ | seen |
| $\Gamma_3$ | $\Sigma\pi$ | seen |
| $\Gamma_4$ | $N\overline{K}\pi$ | |
| $\Gamma_5$ | $\Xi(1530)K$ | |

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

## $\Sigma(2250)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on $\Lambda$ and $\Sigma$ Resonances.

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

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **<0.1 OUR ESTIMATE** | | | | |
| 0.08±0.02 | DEBELLEFON | 78 | DPWA | $D_5$ wave |
| 0.02±0.01 | DEBELLEFON | 78 | DPWA | $G_9$ wave |

### $(J+\frac{1}{2})\times\Gamma(N\overline{K})/\Gamma_{total}$ $\Gamma_1/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.16±0.12 | BRICMAN | 70 | CNTR | Total, charge exchange |
| 0.42 | COOL | 70 | CNTR | $K^- p$, $K^- d$ total |
| 0.47 | BUGG | 68 | CNTR | |

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \rightarrow \Sigma(2250) \rightarrow \Lambda\pi$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| −0.16±0.03 | VANHORN | 75 | DPWA | $K^- p \rightarrow \Lambda\pi^0$, $F_5$ wave |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| +0.11 | DEBELLEFON | 76 | IPWA | $D_5$ wave |
| −0.10 | DEBELLEFON | 76 | IPWA | $G_9$ wave |
| −0.18 | BARBARO-... | 70 | DPWA | $K^- p \rightarrow \Lambda\pi^0$, $G_9$ wave |

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

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| $+0.06 \pm 0.02$ | DEBELLEFON | 77 | DPWA | $D_5$ wave |
| $-0.03 \pm 0.02$ | DEBELLEFON | 77 | DPWA | $G_9$ wave |
| $+0.07$ | BARBARO-... | 70 | DPWA | $K^- p \to \Sigma\pi$, $G_9$ wave |

### $\Gamma(N\overline{K})/\Gamma(\Sigma\pi)$ $\Gamma_1/\Gamma_3$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $<0.18$ | BARNES | 69 | HBC | 1 standard dev. limit |

### $\Gamma(\Lambda\pi)/\Gamma(\Sigma\pi)$ $\Gamma_2/\Gamma_3$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $<0.18$ | BARNES | 69 | HBC | 1 standard dev. limit |

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(2250) \to \Xi(1530)K$ $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| $0.18 \pm 0.04$ | [1] DEBELLEFON | 75B | HBC | $K^- p \to \Xi^{*0} K^0$ |

## $\Sigma(2250)$ FOOTNOTES

[1] Seen in the (initial and final state) $D_5$ wave. Isospin not determined.

## $\Sigma(2250)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| DEBELLEFON | 78 | NC 42A 403 | A. de Bellefon *et al.* | (CDEF, SACL) IJP |
| DEBELLEFON | 77 | NC 37A 175 | A. de Bellefon *et al.* | (CDEF, SACL) IJP |
| DEBELLEFON | 76 | NP B109 129 | A. de Bellefon, A. Berthon | (CDEF) IJP |
| Also | 75 | NP B90 1 | A. de Bellefon *et al.* | (CDEF, SACL) IJP |
| DEBELLEFON | 75B | NC 28A 289 | A. de Bellefon *et al.* | (CDEF, SACL) |
| VANHORN | 75 | NP B87 145 | A.J. van Horn | (LBL) IJP |
| Also | 75B | NP B87 157 | A.J. van Horn | (LBL) IJP |
| LASINSKI | 71 | NP B29 125 | T.A. Lasinski | (EFI) IJP |
| AGUILAR-... | 70B | PRL 25 58 | M. Aguilar-Benitez *et al.* | (BNL, SYRA) |
| BARBARO-... | 70 | Duke Conf. 173 Hyperon Resonances, 1970 | A. Barbaro-Galtieri | (LRL) IJP |
| BRICMAN | 70 | PL 31B 152 | C. Bricman *et al.* | (CERN, CAEN, SACL) |
| COOL | 70 | PR D1 1887 | R.L. Cool *et al.* | (BNL) I |
| Also | 66 | PRL 16 1228 | R.L. Cool *et al.* | (BNL) I |
| LU | 70 | PR D2 1846 | D.C. Lu *et al.* | (YALE) |
| BARNES | 69 | PRL 22 479 | V.E. Barnes *et al.* | (BNL, SYRA) |
| BUGG | 68 | PR 168 1466 | D.V. Bugg *et al.* | (RHEL, BIRM, CAVE) I |
| BLANPIED | 65 | PRL 14 741 | W.A. Blanpied *et al.* | (YALE, CEA) |
| BOCK | 65 | PL 17 166 | R.K. Bock *et al.* | (CERN, SACL) |