# $\Sigma(1580)$ $3/2^-$

$I(J^P) = 1(\frac{3}{2}^-)$ Status: ∗

OMITTED FROM SUMMARY TABLE

Seen in the isospin-1 $\overline{K}N$ cross section at BNL (LI 73, CARROLL 76) and in a partial-wave analysis of $K^- p \rightarrow \Lambda\pi^0$ for c.m. energies 1560–1600 MeV by LITCHFIELD 74. LITCHFIELD 74 finds $J^P = 3/2^-$. Not seen by ENGLER 78, CAMERON 78C, OLMSTED 04, nor by PRAKHOV 04.

Neither ZHANG 13A nor SARANTSEV 19 see any evidence for this state.

## $\Sigma(1580)$ POLE POSITION

### REAL PART

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $1607^{+13}_{-11}$ | [1] KAMANO | 15 | DPWA | Multichannel |

[1] From the preferred solution A in KAMANO 15. Solution B reports M = $1492^{+4}_{-7}$ MeV.

### −2×IMAGINARY PART

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| $253^{+30}_{-18}$ | [2] KAMANO | 15 | DPWA | Multichannel |

[2] From the preferred solution A in KAMANO 15. Solution B reports M = $138^{+8}_{-14}$ MeV.

## $\Sigma(1580)$ POLE RESIDUES

The "normalized residue" is the residue divided by $\Gamma_{pole}/2$.

### Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow N\overline{K}$

| MODULUS | PHASE (°) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.00778 | 51 | [3] KAMANO | 15 | DPWA | Multichannel |

[3] From the preferred solution A in KAMANO 15.

### Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow \Sigma\pi$

| MODULUS | PHASE (°) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.0625 | −6 | [4] KAMANO | 15 | DPWA | Multichannel |

[4] From the preferred solution A in KAMANO 15.

### Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow \Lambda\pi$

| MODULUS | PHASE (°) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.059 | 156 | [5] KAMANO | 15 | DPWA | Multichannel |

[5] From the preferred solution A in KAMANO 15.

### Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow \Sigma(1385)\pi$, $S$-wave

| MODULUS | PHASE (°) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.0368 | −18 | [6] KAMANO | 15 | DPWA | Multichannel |

[6] From the preferred solution A in KAMANO 15.

### Normalized residue in $N\overline{K} \rightarrow \Sigma(1580) \rightarrow \Sigma(1385)\pi$, $D$-wave

| MODULUS | PHASE (°) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.0103 | 123 | [7] KAMANO | 15 | DPWA | Multichannel |

[7] From the preferred solution A in KAMANO 15.

## $\Sigma(1580)$ MASS

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **≈ 1580 OUR ESTIMATE** | | | | |
| 1583±4 | [8] CARROLL | 76 | DPWA | Isospin-1 total $\sigma$ |
| 1582±4 | [9] LITCHFIELD | 74 | DPWA | $K^- p \rightarrow \Lambda\pi^0$ |

[8] CARROLL 76 sees a total-cross-section bump with $(J+1/2)\ \Gamma_{el}\ /\ \Gamma_{total} = 0.06$.

[9] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

## $\Sigma(1580)$ WIDTH

| VALUE (MeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| 15 | [10] CARROLL | 76 | DPWA | Isospin-1 total $\sigma$ |
| 11±4 | [11] LITCHFIELD | 74 | DPWA | $K^- p \rightarrow \Lambda\pi^0$ |

[10] CARROLL 76 sees a total-cross-section bump with $(J+1/2)\ \Gamma_{el}\ /\ \Gamma_{total} = 0.06$.

[11] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

## Σ(1580) DECAY MODES

| | Mode |
|---|---|
| $\Gamma_1$ | $N\overline{K}$ |
| $\Gamma_2$ | $\Lambda\pi$ |
| $\Gamma_3$ | $\Sigma\pi$ |
| $\Gamma_4$ | $\Sigma(1385)\pi$, $S$-wave |
| $\Gamma_5$ | $\Sigma(1385)\pi$, $D$-wave |
| $\Gamma_6$ | $N\overline{K}^*(892)$, $S$=1/2, $D$-wave |
| $\Gamma_7$ | $N\overline{K}^*(892)$, $S$=3/2, $S$-wave |
| $\Gamma_8$ | $N\overline{K}^*(892)$, $S$=3/2, $D$-wave |

## Σ(1580) 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 |
|---|---|---|---|
| $+0.03 \pm 0.01$ | [12] LITCHFIELD 74 | DPWA | $\overline{K}N$ multichannel |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| 0.003 | [13] KAMANO 15 | DPWA | Multichannel |

[12] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

[13] From the preferred solution A in KAMANO 15.

### $\Gamma(\Lambda\pi)/\Gamma_{total}$ — $\Gamma_2/\Gamma$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| 0.490 | [14] KAMANO 15 | DPWA | Multichannel |

[14] From the preferred solution A in KAMANO 15.

### $\Gamma(\Sigma\pi)/\Gamma_{total}$ — $\Gamma_3/\Gamma$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| 0.387 | [15] KAMANO 15 | DPWA | Multichannel |

[15] From the preferred solution A in KAMANO 15.

### $\Gamma(\Sigma(1385)\pi, S\text{-wave})/\Gamma_{total}$ — $\Gamma_4/\Gamma$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | |
| 0.12 | [16] KAMANO 15 | DPWA | Multichannel |

[16] From the preferred solution A in KAMANO 15.

### $\Gamma(\Sigma(1385)\pi, D\text{-wave})/\Gamma_{total}$ — $\Gamma_5/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.001 | [17] KAMANO | 15 | DPWA | Multichannel |

[17] From the preferred solution A in KAMANO 15.

### $\Gamma(N\overline{K}^*(892), S=1/2, D\text{-wave})/\Gamma_{total}$ — $\Gamma_6/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| not seen | [18] KAMANO | 15 | DPWA | Multichannel |

[18] From the preferred solution A in KAMANO 15.

### $\Gamma(N\overline{K}^*(892), S=3/2, S\text{-wave})/\Gamma_{total}$ — $\Gamma_7/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| not seen | [19] KAMANO | 15 | DPWA | Multichannel |

[19] From the preferred solution A in KAMANO 15.

### $\Gamma(N\overline{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{total}$ — $\Gamma_8/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| not seen | [20] KAMANO | 15 | DPWA | Multichannel |

[20] From the preferred solution A in KAMANO 15.

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1580) \to \Lambda\pi$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| not seen | CAMERON | 78C | HBC | $K^0_L p \to \Lambda\pi^+$ |
| not seen | ENGLER | 78 | HBC | $K^0_L p \to \Lambda\pi^+$ |
| $+0.10\pm0.02$ | [21] LITCHFIELD | 74 | DPWA | $K^- p \to \Lambda\pi^0$ |

[21] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Sigma(1580) \to \Sigma\pi$ — $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| not seen | CAMERON | 78C | HBC | $K^0_L p \to \Sigma^0\pi^+$ |
| not seen | ENGLER | 78 | HBC | $K^0_L p \to \Sigma^0\pi^+$ |
| $+0.03\pm0.04$ | [22] LITCHFIELD | 74 | DPWA | $\overline{K}N$ multichannel |

[22] The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\overline{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

# Σ(1580) REFERENCES


| | | | | | |
|---|---|---|---|---|---|
| SARANTSEV | 19 | EPJ A55 180 | A.V. Sarantsev *et al.* | (BONN, PNPI) | |
| KAMANO | 15 | PR C92 025205 | H. Kamano *et al.* | (ANL, OSAK) | |
| ZHANG | 13A | PR C88 035205 | H. Zhang *et al.* | (KSU) | |
| OLMSTED | 04 | PL B588 29 | J. Olmsted *et al.* | (BNL Crystal Ball Collab.) | |
| PRAKHOV | 04 | PR C69 042202 | S. Prakhov *et al.* | (BNL Crystal Ball Collab.) | |
| CAMERON | 78C | NP B132 189 | W. Cameron *et al.* | (BGNA, EDIN, GLAS+) | I |
| ENGLER | 78 | PR D18 3061 | A. Engler *et al.* | (CMU, ANL) | |
| CARROLL | 76 | PRL 37 806 | A.S. Carroll *et al.* | (BNL) | I |
| LITCHFIELD | 74 | PL 51B 509 | P.J. Litchfield | (CERN) | IJP |
| LI | 73 | Purdue Conf. 283 | K.K. Li | (BNL) | I |