

$\Sigma(1940) D_{13}$ $I(J^P) = 1(\frac{3}{2}^-)$ Status: ***

For results published before 1974 (they are now obsolete), see our 1982 edition Physics Letters **111B** (1982).

Not all analyses require this state. It is not required by the GOYAL 77 analysis of $K^- n \rightarrow (\Sigma\pi)^-$ nor by the GOPAL 80 analysis of $K^- n \rightarrow K^- n$. See also HEMINGWAY 75.

 $\Sigma(1940)$ MASS

| <u>VALUE (MeV)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|-------------------------------------------------------------------------------|---------------------|-------------|-------------------------------------------------------|
| 1900 to 1950 (\approx 1940) OUR ESTIMATE | | | |
| 1920 \pm 50 | GOPAL | 77 | DPWA $\bar{K}N$ multichannel |
| 1950 \pm 30 | BAILLON | 75 | IPWA $\bar{K}N \rightarrow \Lambda\pi$ |
| 1949 $^{+40}_{-60}$ | VANHORN | 75 | DPWA $K^- p \rightarrow \Lambda\pi^0$ |
| 1935 \pm 80 | KANE | 74 | DPWA $K^- p \rightarrow \Sigma\pi$ |
| 1940 \pm 20 | LITCHFIELD | 74B | DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$ |
| 1950 \pm 20 | LITCHFIELD | 74C | DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$ |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 1886 or 1893 | ¹ MARTIN | 77 | DPWA $\bar{K}N$ multichannel |
| 1940 | DEBELLEFON | 76 | IPWA $K^- p \rightarrow \Lambda\pi^0, F_{17}$ wave |

 $\Sigma(1940)$ WIDTH

| <u>VALUE (MeV)</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|-------------------------------------------------------------------------------|---------------------|-------------|----------------------------------------------|
| 150 to 300 (\approx 220) OUR ESTIMATE | | | |
| 170 \pm 25 | CAMERON | 78B | DPWA $K^- p \rightarrow N\bar{K}^*$ |
| 300 \pm 80 | GOPAL | 77 | DPWA $\bar{K}N$ multichannel |
| 150 \pm 75 | BAILLON | 75 | IPWA $\bar{K}N \rightarrow \Lambda\pi$ |
| 160 $^{+70}_{-40}$ | VANHORN | 75 | DPWA $K^- p \rightarrow \Lambda\pi^0$ |
| 330 \pm 80 | KANE | 74 | DPWA $K^- p \rightarrow \Sigma\pi$ |
| 60 \pm 20 | LITCHFIELD | 74B | DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$ |
| 70 $^{+30}_{-20}$ | LITCHFIELD | 74C | DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$ |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| 157 or 159 | ¹ MARTIN | 77 | DPWA $\bar{K}N$ multichannel |

$\Sigma(1940)$ DECAY MODES

| Mode | Fraction (Γ_i/Γ) |
|------------------------------------------------------------|--------------------------------|
| Γ_1 $N\bar{K}$ | <20 % |
| Γ_2 $\Lambda\pi$ | seen |
| Γ_3 $\Sigma\pi$ | seen |
| Γ_4 $\Sigma(1385)\pi$ | seen |
| Γ_5 $\Sigma(1385)\pi$, <i>S</i> -wave | |
| Γ_6 $\Lambda(1520)\pi$ | seen |
| Γ_7 $\Lambda(1520)\pi$, <i>P</i> -wave | |
| Γ_8 $\Lambda(1520)\pi$, <i>F</i> -wave | |
| Γ_9 $\Delta(1232)\bar{K}$ | seen |
| Γ_{10} $\Delta(1232)\bar{K}$, <i>S</i> -wave | |
| Γ_{11} $\Delta(1232)\bar{K}$, <i>D</i> -wave | |
| Γ_{12} $N\bar{K}^*(892)$ | seen |
| Γ_{13} $N\bar{K}^*(892)$, $S=3/2$, <i>S</i> -wave | |

 $\Sigma(1940)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on Λ and Σ Resonances.

 $\Gamma(N\bar{K})/\Gamma_{\text{total}}$ Γ_1/Γ

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|-----------------------------|---------------------|-------------|------------------------------|
| <0.2 OUR ESTIMATE | | | |
| <0.04 | GOPAL | 77 | DPWA $\bar{K}N$ multichannel |
| 0.14 or 0.13 | ¹ MARTIN | 77 | DPWA $\bar{K}N$ multichannel |

 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Lambda\pi$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---------------------------------------------------------------------------|---------------------|-------------|----------------------------------------|
| -0.06 ± 0.03 | GOPAL | 77 | DPWA $\bar{K}N$ multichannel |
| -0.04 ± 0.02 | BAILLON | 75 | IPWA $\bar{K}N \rightarrow \Lambda\pi$ |
| $-0.05^{+0.03}_{-0.02}$ | VANHORN | 75 | DPWA $K^-p \rightarrow \Lambda\pi^0$ |
| -0.153 ± 0.070 | DEVENISH | 74B | Fixed- <i>t</i> dispersion rel. |
| ••• We do not use the following data for averages, fits, limits, etc. ••• | | | |
| -0.15 or -0.14 | ¹ MARTIN | 77 | DPWA $\bar{K}N$ multichannel |

 $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Sigma\pi$ $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---------------------------------------------------------------------------|---------------------|-------------|-----------------------------------|
| -0.08 ± 0.04 | GOPAL | 77 | DPWA $\bar{K}N$ multichannel |
| -0.14 ± 0.04 | KANE | 74 | DPWA $K^-p \rightarrow \Sigma\pi$ |
| ••• We do not use the following data for averages, fits, limits, etc. ••• | | | |
| $+0.16$ or $+0.16$ | ¹ MARTIN | 77 | DPWA $\bar{K}N$ multichannel |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Lambda(1520)\pi$, <i>P-wave</i> | $(\Gamma_1 \Gamma_7)^{1/2} / \Gamma$ |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| VALUE | DOCUMENT ID TECN COMMENT |
| < 0.03 | CAMERON 77 DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$ |
| -0.11 ± 0.04 | LITCHFIELD 74B DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$ |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Lambda(1520)\pi$, <i>F-wave</i> | $(\Gamma_1 \Gamma_8)^{1/2} / \Gamma$ |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| VALUE | DOCUMENT ID TECN COMMENT |
| 0.062 ± 0.021 | CAMERON 77 DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$ |
| -0.08 ± 0.04 | LITCHFIELD 74B DPWA $K^- p \rightarrow \Lambda(1520)\pi^0$ |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Delta(1232)\bar{K}$, <i>S-wave</i> | $(\Gamma_1 \Gamma_{10})^{1/2} / \Gamma$ |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| VALUE | DOCUMENT ID TECN COMMENT |
| -0.16 ± 0.05 | LITCHFIELD 74C DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$ |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Delta(1232)\bar{K}$, <i>D-wave</i> | $(\Gamma_1 \Gamma_{11})^{1/2} / \Gamma$ |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| VALUE | DOCUMENT ID TECN COMMENT |
| -0.14 ± 0.05 | LITCHFIELD 74C DPWA $K^- p \rightarrow \Delta(1232)\bar{K}$ |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow \Sigma(1385)\pi$ | $(\Gamma_1 \Gamma_4)^{1/2} / \Gamma$ |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| VALUE | DOCUMENT ID TECN COMMENT |
| +0.066 ± 0.025 | ² CAMERON 78 DPWA $K^- p \rightarrow \Sigma(1385)\pi$ |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1940) \rightarrow N\bar{K}^*(892)$ | $(\Gamma_1 \Gamma_{12})^{1/2} / \Gamma$ |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| VALUE | DOCUMENT ID TECN COMMENT |
| -0.09 ± 0.02 | ³ CAMERON 78B DPWA $K^- p \rightarrow N\bar{K}^*$ |

Σ(1940) FOOTNOTES

- ¹ The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.
² The published sign has been changed to be in accord with the baryon-first convention.
³ Upper limits on the D_1 and D_3 waves are each 0.03.

Σ(1940) REFERENCES

| | | | | |
|------------|-----|-------------------|---------------------------------------------|-------------------------|
| PDG | 82 | PL 111B | M. Roos <i>et al.</i> | (HELs, CIT, CERN) |
| GOPAL | 80 | Toronto Conf. 159 | G.P. Gopal | (RHEL) |
| CAMERON | 78 | NP B143 189 | W. Cameron <i>et al.</i> | (RHEL, LOIC) IJP |
| CAMERON | 78B | NP B146 327 | W. Cameron <i>et al.</i> | (RHEL, LOIC) IJP |
| CAMERON | 77 | NP B131 399 | W. Cameron <i>et al.</i> | (RHEL, LOIC) IJP |
| GOPAL | 77 | NP B119 362 | G.P. Gopal <i>et al.</i> | (LOIC, RHEL) IJP |
| GOYAL | 77 | PR D16 2746 | D.P. Goyal, A.V. Sodhi | (DELH) |
| MARTIN | 77 | NP B127 349 | B.R. Martin, M.K. Pidcock, R.G. Moorhouse | (LOUC+) IJP |
| Also | | NP B126 266 | B.R. Martin, M.K. Pidcock | (LOUC) |
| Also | | NP B126 285 | B.R. Martin, M.K. Pidcock | (LOUC) IJP |
| DEBELLEFON | 76 | NP B109 129 | A. de Bellefon, A. Berthon | (CDEF) IJP |
| BAILLON | 75 | NP B94 39 | P.H. Baillon, P.J. Litchfield | (CERN, RHEL) IJP |
| HEMINGWAY | 75 | NP B91 12 | R.J. Hemingway <i>et al.</i> | (CERN, HEIDH, MPIM) IJP |
| VANHORN | 75 | NP B87 145 | A.J. van Horn | (LBL) IJP |
| Also | | NP B87 157 | A.J. van Horn | (LBL) IJP |
| DEVENISH | 74B | NP B81 330 | R.C.E. Devenish, C.D. Froggatt, B.R. Martin | (DESY+) IJP |
| KANE | 74 | LBL-2452 | D.F. Kane | (LBL) IJP |
| LITCHFIELD | 74B | NP B74 19 | P.J. Litchfield <i>et al.</i> | (CERN, HEIDH) IJP |
| LITCHFIELD | 74C | NP B74 39 | P.J. Litchfield <i>et al.</i> | (CERN, HEIDH) IJP |