# $\Lambda(1810)\ P_{01}$

$I(J^P) = 0(\frac{1}{2}^+)$ Status: ***

Almost all the recent analyses contain a $P_{01}$ state, and sometimes two of them, but the masses, widths, and branching ratios vary greatly. See also the $\Lambda(1600)\ P_{01}$.

## $\Lambda(1810)$ MASS

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **1750 to 1850 (≈ 1810) OUR ESTIMATE** | | | | |
| 1841±20 | GOPAL | 80 | DPWA | $\overline{K}N \rightarrow \overline{K}N$ |
| 1853±20 | GOPAL | 77 | DPWA | $\overline{K}N$ multichannel |
| 1735± 5 | CARROLL | 76 | DPWA | Isospin-0 total $\sigma$ |
| 1746±10 | PREVOST | 74 | DPWA | $K^-N \rightarrow \Sigma(1385)\pi$ |
| 1780±20 | LANGBEIN | 72 | IPWA | $\overline{K}N$ multichannel |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 1861 or 1953 | [1] MARTIN | 77 | DPWA | $\overline{K}N$ multichannel |
| 1755 | KIM | 71 | DPWA | K-matrix analysis |
| 1800 | ARMENTEROS | 70 | HBC | $\overline{K}N \rightarrow \overline{K}N$ |
| 1750 | ARMENTEROS | 70 | HBC | $\overline{K}N \rightarrow \Sigma\pi$ |
| 1690±10 | BARBARO-... | 70 | HBC | $\overline{K}N \rightarrow \Sigma\pi$ |
| 1740 | BAILEY | 69 | DPWA | $\overline{K}N \rightarrow \overline{K}N$ |
| 1745 | ARMENTEROS | 68B | HBC | $\overline{K}N \rightarrow \overline{K}N$ |

## $\Lambda(1810)$ WIDTH

| *VALUE* (MeV) | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|
| **50 to 250 (≈ 150) OUR ESTIMATE** | | | | |
| 164±20 | GOPAL | 80 | DPWA | $\overline{K}N \rightarrow \overline{K}N$ |
| 90±20 | CAMERON | 78B | DPWA | $K^-p \rightarrow N\overline{K}^*$ |
| 166±20 | GOPAL | 77 | DPWA | $\overline{K}N$ multichannel |
| 46±20 | PREVOST | 74 | DPWA | $K^-N \rightarrow \Sigma(1385)\pi$ |
| 120±10 | LANGBEIN | 72 | IPWA | $\overline{K}N$ multichannel |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 535 or 585 | [1] MARTIN | 77 | DPWA | $\overline{K}N$ multichannel |
| 28 | CARROLL | 76 | DPWA | Isospin-0 total $\sigma$ |
| 35 | KIM | 71 | DPWA | K-matrix analysis |
| 30 | ARMENTEROS | 70 | HBC | $\overline{K}N \rightarrow \overline{K}N$ |
| 70 | ARMENTEROS | 70 | HBC | $\overline{K}N \rightarrow \Sigma\pi$ |
| 22 | BARBARO-... | 70 | HBC | $\overline{K}N \rightarrow \Sigma\pi$ |
| 300 | BAILEY | 69 | DPWA | $\overline{K}N \rightarrow \overline{K}N$ |
| 147 | ARMENTEROS | 68B | HBC | |

## Λ(1810) DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $N\overline{K}$ | 20–50 % |
| $\Gamma_2$ | $\Sigma\pi$ | 10–40 % |
| $\Gamma_3$ | $\Sigma(1385)\pi$ | seen |
| $\Gamma_4$ | $N\overline{K}^*(892)$ | 30–60 % |
| $\Gamma_5$ | $N\overline{K}^*(892)$, $S$=1/2, $P$-wave | |
| $\Gamma_6$ | $N\overline{K}^*(892)$, $S$=3/2, $P$-wave | |

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

## Λ(1810) BRANCHING RATIOS

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

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

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.2 to 0.5 OUR ESTIMATE** | | | | |
| 0.24±0.04 | GOPAL | 80 | DPWA | $\overline{K}N \to \overline{K}N$ |
| 0.36±0.05 | LANGBEIN | 72 | IPWA | $\overline{K}N$ multichannel |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.21±0.04 | GOPAL | 77 | DPWA | See GOPAL 80 |
| 0.52 or 0.49 | [1] MARTIN | 77 | DPWA | $\overline{K}N$ multichannel |
| 0.30 | KIM | 71 | DPWA | K-matrix analysis |
| 0.15 | ARMENTEROS | 70 | DPWA | $\overline{K}N \to \overline{K}N$ |
| 0.55 | BAILEY | 69 | DPWA | $\overline{K}N \to \overline{K}N$ |
| 0.4 | ARMENTEROS | 68B | DPWA | $\overline{K}N \to \overline{K}N$ |

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1810) \to \Sigma\pi$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| −0.24±0.04 | GOPAL | 77 | DPWA | $\overline{K}N$ multichannel |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| +0.25 or +0.23 | [1] MARTIN | 77 | DPWA | $\overline{K}N$ multichannel |
| < 0.01 | LANGBEIN | 72 | IPWA | $\overline{K}N$ multichannel |
| 0.17 | KIM | 71 | DPWA | K-matrix analysis |
| +0.20 | [2] ARMENTEROS | 70 | DPWA | $\overline{K}N \to \Sigma\pi$ |
| −0.13±0.03 | BARBARO-... | 70 | DPWA | $\overline{K}N \to \Sigma\pi$ |

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1810) \to \Sigma(1385)\pi$ $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| +0.18±0.10 | PREVOST | 74 | DPWA | $K^-N \to \Sigma(1385)\pi$ |

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1810) \to N\overline{K}^*(892)$, $S$=1/2, $P$-wave $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| −0.14±0.03 | [2] CAMERON | 78B | DPWA | $K^-p \to N\overline{K}^*$ |

### $(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{total}$ in $N\overline{K} \to \Lambda(1810) \to N\overline{K}^*(892)$, $S$=3/2, $P$-wave $(\Gamma_1\Gamma_6)^{1/2}/\Gamma$

| VALUE | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|
| $+0.35 \pm 0.06$ | CAMERON 78B | DPWA | $K^- p \to N\overline{K}^*$ |

## $\Lambda(1810)$ 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.

## $\Lambda(1810)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| GOPAL | 80 | Toronto Conf. 159 | G.P. Gopal | (RHEL) IJP |
| CAMERON | 78B | NP B146 327 | W. Cameron *et al.* | (RHEL, LOIC) IJP |
| GOPAL | 77 | NP B119 362 | G.P. Gopal *et al.* | (LOIC, RHEL) IJP |
| MARTIN | 77 | NP B127 349 | B.R. Martin, M.K. Pidcock, R.G. Moorhouse | (LOUC+) IJP |
| Also | 77B | NP B126 266 | B.R. Martin, M.K. Pidcock | (LOUC) |
| Also | 77C | NP B126 285 | B.R. Martin, M.K. Pidcock | (LOUC) IJP |
| CARROLL | 76 | PRL 37 806 | A.S. Carroll *et al.* | (BNL) I |
| PREVOST | 74 | NP B69 246 | J. Prevost *et al.* | (SACL, CERN, HEID) |
| LANGBEIN | 72 | NP B47 477 | W. Langbein, F. Wagner | (MPIM) IJP |
| KIM | 71 | PRL 27 356 | J.K. Kim | (HARV) IJP |
| Also | 70 | Duke Conf. 161 Hyperon Resonances, 1970 | J.K. Kim | (HARV) IJP |
| ARMENTEROS | 70 | Duke Conf. 123 Hyperon Resonances, 1970 | R. Armenteros *et al.* | (CERN, HEID, SACL) IJP |
| BARBARO-... | 70 | Duke Conf. 173 Hyperon Resonances, 1970 | A. Barbaro-Galtieri | (LRL) IJP |
| BAILEY | 69 | Thesis UCRL 50617 | J.M. Bailey | (LLL) IJP |
| ARMENTEROS | 68B | NP B8 195 | R. Armenteros *et al.* | (CERN, HEID, SACL) IJP |