

$$\Lambda(2100) \ 7/2^-$$

$$I(J^P) = 0(\frac{7}{2}^-) \ \text{Status: } ****$$

Most of the results published before 1973 are now obsolete and have been omitted. They may be found in our 1982 edition Physics Letters **111B** 1 (1982).

This entry only includes results from partial-wave analyses. Parameters of peaks seen in cross sections and in invariant-mass distributions around 2100 MeV used to be listed in a separate entry immediately following. It may be found in our 1986 edition Physics Letters **170B** 1 (1986).

### $\Lambda(2100)$ POLE POSITION

#### REAL PART

| VALUE (MeV)   | DOCUMENT ID  | TECN     | COMMENT                 |
|---|--------------|----------|-------------------------|
| <b>2040±14</b>  | SARANTSEV 19 | DPWA     | $\bar{K}N$ multichannel |
| ••• We do not use the following data for averages, fits, limits, etc. ••• |              |          |                         |
| 2023  | ZHANG        | 13A DPWA | Multichannel            |

#### −2×IMAGINARY PART

| VALUE (MeV)   | DOCUMENT ID  | TECN     | COMMENT                 |
|---|--------------|----------|-------------------------|
| <b>215±29</b>   | SARANTSEV 19 | DPWA     | $\bar{K}N$ multichannel |
| ••• We do not use the following data for averages, fits, limits, etc. ••• |              |          |                         |
| 239   | ZHANG        | 13A DPWA | Multichannel            |

### $\Lambda(2100)$ POLE RESIDUE

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

#### Normalized residue in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow N\bar{K}$

| MODULUS          | PHASE (°)       | DOCUMENT ID  | TECN | COMMENT                 |
|------------------|-----------------|--------------|------|-------------------------|
| <b>0.28±0.06</b> | <b>−40 ± 10</b> | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow \Sigma\pi$

| MODULUS          | PHASE (°)       | DOCUMENT ID  | TECN | COMMENT                 |
|------------------|-----------------|--------------|------|-------------------------|
| <b>0.09±0.02</b> | <b>−35 ± 15</b> | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow \Sigma(1385)\pi$ , *D*-wave

| MODULUS          | PHASE (°) | DOCUMENT ID  | TECN | COMMENT                 |
|------------------|-----------|--------------|------|-------------------------|
| <b>0.04±0.03</b> |           | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow \Sigma(1385)\pi$ , *G*-wave

| MODULUS          | PHASE (°)       | DOCUMENT ID  | TECN | COMMENT                 |
|------------------|-----------------|--------------|------|-------------------------|
| <b>0.06±0.03</b> | <b>−45 ± 15</b> | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

#### Normalized residue in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow N\bar{K}^*(892)$ , *S*=3/2, *D*-wave

| MODULUS          | PHASE (°)       | DOCUMENT ID  | TECN | COMMENT                 |
|------------------|-----------------|--------------|------|-------------------------|
| <b>0.11±0.06</b> | <b>−30 ± 30</b> | SARANTSEV 19 | DPWA | $\bar{K}N$ multichannel |

**$\Lambda(2100)$  MASS**

| <u>VALUE (MeV)</u>  | <u>DOCUMENT ID</u>        | <u>TECN</u> | <u>COMMENT</u>                     |
|---|---------------------------|-------------|------------------------------------|
| <b>2090 to 2110 (<math>\approx 2100</math>) OUR ESTIMATE</b>                  |                           |             |                                    |
| 2090 $\pm$ 15   | SARANTSEV 19              | DPWA        | $\bar{K}N$ multichannel            |
| 2086 $\pm$ 6  | ZHANG 13A                 | DPWA        | Multichannel                       |
| 2104 $\pm$ 10   | GOPAL 80                  | DPWA        | $\bar{K}N \rightarrow \bar{K}N$    |
| 2106 $\pm$ 30   | DEBELLEFON 78             | DPWA        | $\bar{K}N \rightarrow \bar{K}N$    |
| 2110 $\pm$ 10   | GOPAL 77                  | DPWA        | $\bar{K}N$ multichannel            |
| 2105 $\pm$ 10   | HEMINGWAY 75              | DPWA        | $K^- p \rightarrow \bar{K}N$       |
| 2115 $\pm$ 10   | KANE 74                   | DPWA        | $K^- p \rightarrow \Sigma \pi$     |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                           |             |                                    |
| 2094  | BACCARI 77                | DPWA        | $K^- p \rightarrow \Lambda \omega$ |
| 2094  | DECLAIS 77                | DPWA        | $\bar{K}N \rightarrow \bar{K}N$    |
| 2110 or 2089  | <sup>1</sup> NAKKASYAN 75 | DPWA        | $K^- p \rightarrow \Lambda \omega$ |

 **$\Lambda(2100)$  WIDTH**

| <u>VALUE (MeV)</u>  | <u>DOCUMENT ID</u>        | <u>TECN</u> | <u>COMMENT</u>                     |
|---|---------------------------|-------------|------------------------------------|
| <b>100 to 250 (<math>\approx 200</math>) OUR ESTIMATE</b>                     |                           |             |                                    |
| 290 $\pm$ 30  | SARANTSEV 19              | DPWA        | $\bar{K}N$ multichannel            |
| 305 $\pm$ 16  | ZHANG 13A                 | DPWA        | Multichannel                       |
| 157 $\pm$ 40  | DEBELLEFON 78             | DPWA        | $\bar{K}N \rightarrow \bar{K}N$    |
| 250 $\pm$ 30  | GOPAL 77                  | DPWA        | $\bar{K}N$ multichannel            |
| 241 $\pm$ 30  | HEMINGWAY 75              | DPWA        | $K^- p \rightarrow \bar{K}N$       |
| 152 $\pm$ 15  | KANE 74                   | DPWA        | $K^- p \rightarrow \Sigma \pi$     |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                           |             |                                    |
| 98  | BACCARI 77                | DPWA        | $K^- p \rightarrow \Lambda \omega$ |
| 250   | DECLAIS 77                | DPWA        | $\bar{K}N \rightarrow \bar{K}N$    |
| 244 or 302  | <sup>1</sup> NAKKASYAN 75 | DPWA        | $K^- p \rightarrow \Lambda \omega$ |

 **$\Lambda(2100)$  DECAY MODES**

| Mode  | Fraction ( $\Gamma_i/\Gamma$ ) |
|---|--------------------------------|
| $\Gamma_1$ $N\bar{K}$   | 25–35 %                        |
| $\Gamma_2$ $\Sigma \pi$   | $\sim 5$ %                     |
| $\Gamma_3$ $\Lambda \eta$                                       | $< 3$ %                        |
| $\Gamma_4$ $\Xi K$  | $< 3$ %                        |
| $\Gamma_5$ $\Lambda \omega$                                     | $< 8$ %                        |
| $\Gamma_6$ $\Sigma(1385)\pi$ , <i>D</i> -wave                   |                                |
| $\Gamma_7$ $\Sigma(1385)\pi$ , <i>G</i> -wave                   | (1.0 $\pm$ 1.0) %              |
| $\Gamma_8$ $N\bar{K}^*(892)$                                    | 10–20 %                        |
| $\Gamma_9$ $N\bar{K}^*(892)$ , <i>S</i> =3/2, <i>D</i> -wave    | (4.0 $\pm$ 2.0) %              |
| $\Gamma_{10}$ $N\bar{K}^*(892)$ , <i>S</i> =1/2, <i>G</i> -wave |                                |
| $\Gamma_{11}$ $N\bar{K}^*(892)$ , <i>S</i> =3/2, <i>G</i> -wave |                                |

**$\Lambda(2100)$  BRANCHING RATIOS**

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

 **$\Gamma(N\bar{K})/\Gamma_{\text{total}}$   $\Gamma_1/\Gamma$** 

| <u>VALUE</u>  | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                  |
|---|--------------------|-------------|---------------------------------|
| <b>0.25 to 0.35 (<math>\approx 0.30</math>) OUR ESTIMATE</b>                  |                    |             |                                 |
| 0.24 $\pm$ 0.05   | SARANTSEV 19       | DPWA        | $\bar{K}N$ multichannel         |
| 0.23 $\pm$ 0.01   | ZHANG 13A          | DPWA        | Multichannel                    |
| 0.34 $\pm$ 0.03   | GOPAL 80           | DPWA        | $\bar{K}N \rightarrow \bar{K}N$ |
| 0.24 $\pm$ 0.06   | DEBELLEFON 78      | DPWA        | $\bar{K}N \rightarrow \bar{K}N$ |
| 0.31 $\pm$ 0.03   | HEMINGWAY 75       | DPWA        | $K^- p \rightarrow \bar{K}N$    |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                    |             |                                 |
| 0.29  | DECLAIS 77         | DPWA        | $\bar{K}N \rightarrow \bar{K}N$ |
| 0.30 $\pm$ 0.03   | GOPAL 77           | DPWA        | See GOPAL 80                    |

 **$\Gamma(\Sigma\pi)/\Gamma_{\text{total}}$   $\Gamma_2/\Gamma$** 

| <u>VALUE</u>                      | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|-----------------------------------|--------------------|-------------|-------------------------|
| <b>0.030<math>\pm</math>0.015</b> | SARANTSEV 19       | DPWA        | $\bar{K}N$ multichannel |

 **$\Gamma(\Sigma(1385)\pi, D\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_6/\Gamma$** 

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|--------------|--------------------|-------------|-------------------------|
| <0.01        | SARANTSEV 19       | DPWA        | $\bar{K}N$ multichannel |

 **$\Gamma(\Sigma(1385)\pi, G\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$** 

| <u>VALUE</u>                    | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|---------------------------------|--------------------|-------------|-------------------------|
| <b>0.01<math>\pm</math>0.01</b> | SARANTSEV 19       | DPWA        | $\bar{K}N$ multichannel |

 **$\Gamma(N\bar{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{\text{total}}$   $\Gamma_9/\Gamma$** 

| <u>VALUE</u>                    | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>          |
|---------------------------------|--------------------|-------------|-------------------------|
| <b>0.04<math>\pm</math>0.02</b> | SARANTSEV 19       | DPWA        | $\bar{K}N$ multichannel |

 **$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Lambda(2100) \rightarrow \Sigma\pi$   $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$** 

| <u>VALUE</u>     | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                |
|------------------|--------------------|-------------|-------------------------------|
| +0.03 $\pm$ 0.01 | ZHANG 13A          | DPWA        | Multichannel                  |
| +0.12 $\pm$ 0.04 | GOPAL 77           | DPWA        | $\bar{K}N$ multichannel       |
| +0.11 $\pm$ 0.01 | KANE 74            | DPWA        | $K^- p \rightarrow \Sigma\pi$ |

 **$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Lambda(2100) \rightarrow \Lambda\eta$   $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$** 

| <u>VALUE</u>       | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>                  |
|--------------------|--------------------|-------------|---------------------------------|
| -0.050 $\pm$ 0.020 | RADER 73           | MPWA        | $K^- p \rightarrow \Lambda\eta$ |

 **$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$  in  $N\bar{K} \rightarrow \Lambda(2100) \rightarrow \Xi K$   $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$** 

| <u>VALUE</u>  | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u>            |
|---|--------------------|-------------|---------------------------|
| 0.035 $\pm$ 0.018   | LITCHFIELD 71      | DPWA        | $K^- p \rightarrow \Xi K$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • |                    |             |                           |
| 0.003   | MULLER 69B         | DPWA        | $K^- p \rightarrow \Xi K$ |
| 0.05  | TRIPP 67           | RVUE        | $K^- p \rightarrow \Xi K$ |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow \Lambda\omega$ |                           |      |                                   | $(\Gamma_1 \Gamma_5)^{1/2} / \Gamma$ |
|---|---------------------------|------|-----------------------------------|--------------------------------------|
| VALUE   | DOCUMENT ID               | TECN | COMMENT                           |                                      |
| -0.070  | <sup>2</sup> BACCARI 77   | DPWA | $GD_{37}$ wave                    |                                      |
| +0.011  | <sup>2</sup> BACCARI 77   | DPWA | $GG_{17}$ wave                    |                                      |
| +0.008  | <sup>2</sup> BACCARI 77   | DPWA | $GG_{37}$ wave                    |                                      |
| 0.122 or 0.154  | <sup>1</sup> NAKKASYAN 75 | DPWA | $K^- p \rightarrow \Lambda\omega$ |                                      |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow N\bar{K}^*(892), S=3/2, D\text{-wave}$ |             |      |                                | $(\Gamma_1 \Gamma_9)^{1/2} / \Gamma$ |
|---|-------------|------|--------------------------------|--------------------------------------|
| VALUE   | DOCUMENT ID | TECN | COMMENT                        |                                      |
| +0.16 ± 0.02  | ZHANG 13A   | DPWA | Multichannel                   |                                      |
| +0.21 ± 0.04  | CAMERON 78B | DPWA | $K^- p \rightarrow N\bar{K}^*$ |                                      |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow N\bar{K}^*(892), S=1/2, G\text{-wave}$ |                          |      |                                | $(\Gamma_1 \Gamma_{10})^{1/2} / \Gamma$ |
|---|--------------------------|------|--------------------------------|---|
| VALUE   | DOCUMENT ID              | TECN | COMMENT                        |   |
| -0.03 ± 0.02  | ZHANG 13A                | DPWA | Multichannel                   |   |
| -0.04 ± 0.03  | <sup>3</sup> CAMERON 78B | DPWA | $K^- p \rightarrow N\bar{K}^*$ |   |

| $(\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Lambda(2100) \rightarrow N\bar{K}^*(892), S=3/2, G\text{-wave}$ |             |      |              | $(\Gamma_1 \Gamma_{11})^{1/2} / \Gamma$ |
|---|-------------|------|--------------|---|
| VALUE   | DOCUMENT ID | TECN | COMMENT      |   |
| +0.08 ± 0.02  | ZHANG 13A   | DPWA | Multichannel |   |

### $\Lambda(2100)$ FOOTNOTES

<sup>1</sup> The NAKKASYAN 75 values are from the two best solutions found. Each has the  $\Lambda(2100)$  and one additional resonance ( $P_3$  or  $F_5$ ).

<sup>2</sup> Note that the three for BACCARI 77 entries are for three different waves.

<sup>3</sup> The published sign has been changed to be in accord with the baryon-first convention. The upper limit on the  $G_3$  wave is 0.03.

### $\Lambda(2100)$ REFERENCES

|               |                   |                                  |                         |
|---------------|-------------------|----------------------------------|-------------------------|
| SARANTSEV 19  | EPJ A55 180       | A.V. Sarantsev <i>et al.</i>     | (BONN, PNPI)            |
| ZHANG 13A     | PR C88 035205     | H. Zhang <i>et al.</i>           | (KSU)                   |
| PDG 86        | PL 170B 1         | M. Aguilar-Benitez <i>et al.</i> | (CERN, CIT+)            |
| PDG 82        | PL 111B 1         | M. Roos <i>et al.</i>            | (HELS, CIT, CERN)       |
| GOPAL 80      | Toronto Conf. 159 | G.P. Gopal                       | (RHEL) IJP              |
| CAMERON 78B   | NP B146 327       | W. Cameron <i>et al.</i>         | (RHEL, LOIC) IJP        |
| DEBELLEFON 78 | NC 42A 403        | A. de Bellefon <i>et al.</i>     | (CDEF, SACL) IJP        |
| BACCARI 77    | NC 41A 96         | B. Baccari <i>et al.</i>         | (SACL, CDEF) IJP        |
| DECLAIS 77    | CERN 77-16        | Y. Declais <i>et al.</i>         | (CAEN, CERN) IJP        |
| GOPAL 77      | NP B119 362       | G.P. Gopal <i>et al.</i>         | (LOIC, RHEL) IJP        |
| HEMINGWAY 75  | NP B91 12         | R.J. Hemingway <i>et al.</i>     | (CERN, HEIDH, MPIM) IJP |
| NAKKASYAN 75  | NP B93 85         | A. Nakkasyan                     | (CERN) IJP              |
| KANE 74       | LBL-2452          | D.F. Kane                        | (LBL) IJP               |
| RADER 73      | NC 16A 178        | R.K. Rader <i>et al.</i>         | (SACL, HEID, CERN+)     |
| LITCHFIELD 71 | NP B30 125        | P.J. Litchfield <i>et al.</i>    | (RHEL, CDEF, SACL) IJP  |
| MULLER 69B    | Thesis UCRL 19372 | R.A. Muller                      | (LRL)                   |
| TRIPP 67      | NP B3 10          | R.D. Tripp <i>et al.</i>         | (LRL, SLAC, CERN+)      |