# $\Xi(1820)$ $D_{13}$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$ Status: ∗∗∗

The clearest evidence is an 8-standard-deviation peak in $\Lambda K^-$ seen by GAY 76. TEODORO 78 favors $J$=3/2, but cannot make a parity discrimination. BIAGI 87C is consistent with $J$=3/2 and favors negative parity for this $J$ value.

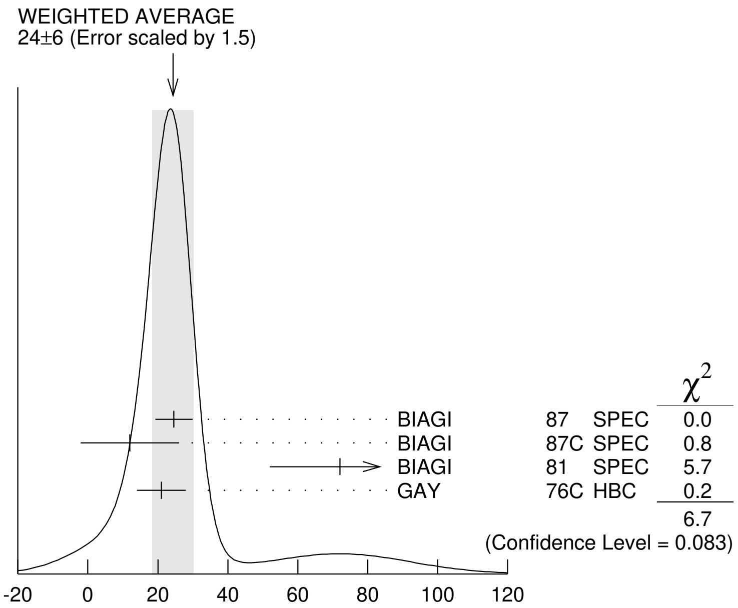
## $\Xi(1820)$ MASS

We only average the measurements that appear to us to be most significant and best determined.

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|---|
| **1823 ± 5 OUR ESTIMATE** | | | | | | |
| **1823.4± 1.4 OUR AVERAGE** | | | | | | |
| 1819.4± 3.1±2.0 | 280 | [1] BIAGI | 87 | SPEC | 0 | $\Xi^-$ Be → ($\Lambda K^-$) X |
| 1826 ± 3 ±1 | 54 | BIAGI | 87C | SPEC | 0 | $\Xi^-$ Be → ($\Lambda \overline{K}^0$) X |
| 1822 ± 6 | | JENKINS | 83 | MPS | − | $K^- p \rightarrow K^+$ (MM) |
| 1830 ± 6 | 300 | BIAGI | 81 | SPEC | − | SPS hyperon beam |
| 1823 ± 2 | 130 | GAY | 76C | HBC | − | $K^- p$ 4.2 GeV/$c$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| 1817 ± 3 | | ADAMOVICH | 99B | WA89 | | $\Sigma^-$ nucleus, 345 GeV |
| 1797 ±19 | 74 | BRIEFEL | 77 | HBC | 0 | $K^- p$ 2.87 GeV/$c$ |
| 1829 ± 9 | 68 | BRIEFEL | 77 | HBC | −0 | $\Xi(1530)\pi$ |
| 1860 ±14 | 39 | BRIEFEL | 77 | HBC | − | $\Sigma^- \overline{K}^0$ |
| 1870 ± 9 | 44 | BRIEFEL | 77 | HBC | 0 | $\Lambda \overline{K}^0$ |
| 1813 ± 4 | 57 | BRIEFEL | 77 | HBC | − | $\Lambda K^-$ |
| 1807 ±27 | | DIBIANCA | 75 | DBC | −0 | $\Xi\pi\pi$, $\Xi^*\pi$ |
| 1762 ± 8 | 28 | [2] BADIER | 72 | HBC | −0 | $\Xi\pi$, $\Xi\pi\pi$, $YK$ |
| 1838 ± 5 | 38 | [2] BADIER | 72 | HBC | −0 | $\Xi\pi$, $\Xi\pi\pi$, $YK$ |
| 1830 ±10 | 25 | [3] CRENNELL | 70B | DBC | −0 | 3.6, 3.9 GeV/$c$ |
| 1826 ±12 | | [4] CRENNELL | 70B | DBC | −0 | 3.6, 3.9 GeV/$c$ |
| 1830 ±10 | 40 | ALITTI | 69 | HBC | − | $\Lambda$, $\Sigma \overline{K}$ |
| 1814 ± 4 | 30 | BADIER | 65 | HBC | 0 | $\Lambda \overline{K}^0$ |
| 1817 ± 7 | 29 | SMITH | 65C | HBC | −0 | $\Lambda \overline{K}^0$, $\Lambda K^-$ |
| 1770 | | HALSTEINSLID | 63 | FBC | −0 | $K^-$ freon 3.5 GeV/$c$ |

## $\Xi(1820)$ WIDTH

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|---|
| **$24^{+15}_{-10}$ OUR ESTIMATE** | | | | | | |
| **24 ± 6 OUR AVERAGE** | | Error includes scale factor of 1.5. See the ideogram below. | | | | |
| 24.6 ± 5.3 | 280 | [1] BIAGI | 87 | SPEC | 0 | $\Xi^-$ Be $\rightarrow$ $(\Lambda K^-)$ X |
| 12 ± 14 ± 1.7 | 54 | BIAGI | 87C | SPEC | 0 | $\Xi^-$ Be $\rightarrow$ $(\Lambda \overline{K}^0)$ X |
| 72 ± 20 | 300 | BIAGI | 81 | SPEC | − | SPS hyperon beam |
| 21 ± 7 | 130 | GAY | 76C | HBC | − | $K^- p$ 4.2 GeV/$c$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| 23 ± 13 | | ADAMOVICH | 99B | WA89 | | $\Sigma^-$ nucleus, 345 GeV |
| 99 ± 57 | 74 | BRIEFEL | 77 | HBC | 0 | $K^- p$ 2.87 GeV/$c$ |
| 52 ± 34 | 68 | BRIEFEL | 77 | HBC | −0 | $\Xi(1530)\pi$ |
| 72 ± 17 | 39 | BRIEFEL | 77 | HBC | − | $\Sigma^- \overline{K}^0$ |
| 44 ± 11 | 44 | BRIEFEL | 77 | HBC | 0 | $\Lambda \overline{K}^0$ |
| 26 ± 11 | 57 | BRIEFEL | 77 | HBC | − | $\Lambda K^-$ |
| 85 ± 58 | | DIBIANCA | 75 | DBC | −0 | $\Xi\pi\pi$, $\Xi^*\pi$ |
| 51 ± 13 | | [2] BADIER | 72 | HBC | −0 | Lower mass |
| 58 ± 13 | | [2] BADIER | 72 | HBC | −0 | Higher mass |
| $103^{+38}_{-24}$ | | [3] CRENNELL | 70B | DBC | −0 | 3.6, 3.9 GeV/$c$ |
| $48^{+36}_{-19}$ | | [4] CRENNELL | 70B | DBC | −0 | 3.6, 3.9 GeV/$c$ |
| $55^{+40}_{-20}$ | | ALITTI | 69 | HBC | − | $\Lambda$, $\Sigma\overline{K}$ |
| 12 ± 4 | | BADIER | 65 | HBC | 0 | $\Lambda \overline{K}^0$ |
| 30 ± 7 | | SMITH | 65B | HBC | −0 | $\Lambda \overline{K}$ |
| < 80 | | HALSTEINSLID | 63 | FBC | −0 | $K^-$ freon 3.5 GeV/$c$ |




$\Xi(1820)$ width (MeV)

## $\Xi(1820)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $\Lambda \overline{K}$ | large |
| $\Gamma_2$ | $\Sigma \overline{K}$ | small |
| $\Gamma_3$ | $\Xi \pi$ | small |
| $\Gamma_4$ | $\Xi(1530)\pi$ | small |
| $\Gamma_5$ | $\Xi \pi \pi (\text{not}\, \Xi(1530)\pi)$ | |

## $\Xi(1820)$ BRANCHING RATIOS

The dominant modes seem to be $\Lambda \overline{K}$ and (perhaps) $\Xi(1530)\pi$, but the branching fractions are very poorly determined.

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

| *VALUE* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|
| **0.30±0.15** | ALITTI | 69 | HBC | − | $K^- p$ 3.9–5 GeV/$c$ |

### $\Gamma(\Xi \pi)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma$

| *VALUE* | *DOCUMENT ID* | | *TECN* | *CHG* | *COMMENT* |
|---|---|---|---|---|---|
| **0.10±0.10** | ALITTI | 69 | HBC | − | $K^- p$ 3.9–5 GeV/$c$ |

### $\Gamma(\Xi\pi)/\Gamma(\Lambda\overline{K})$ — $\Gamma_3/\Gamma_1$

| VALUE | CL% | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|---|
| **<0.36** | 95 | GAY | 76C | HBC | − | $K^- p$ 4.2 GeV/$c$ |
| **0.20±0.20** | | BADIER | 65 | HBC | 0 | $K^- p$ 3 GeV/$c$ |

### $\Gamma(\Xi\pi)/\Gamma(\Xi(1530)\pi)$ — $\Gamma_3/\Gamma_4$

| VALUE | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| $\mathbf{1.5^{+0.6}_{-0.4}}$ | APSELL | 70 | HBC | 0 | $K^- p$ 2.87 GeV/$c$ |

### $\Gamma(\Sigma\overline{K})/\Gamma_{\text{total}}$ — $\Gamma_2/\Gamma$

| VALUE | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| **0.30±0.15** | ALITTI | 69 | HBC | − | $K^- p$ 3.9–5 GeV/$c$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| <0.02 | TRIPP | 67 | RVUE | | Use SMITH 65C |

### $\Gamma(\Sigma\overline{K})/\Gamma(\Lambda\overline{K})$ — $\Gamma_2/\Gamma_1$

| VALUE | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| **0.24±0.10** | GAY | 76C | HBC | − | $K^- p$ 4.2 GeV/$c$ |

### $\Gamma(\Xi(1530)\pi)/\Gamma_{\text{total}}$ — $\Gamma_4/\Gamma$

| VALUE | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| **0.30±0.15** | ALITTI | 69 | HBC | − | $K^- p$ 3.9–5 GeV/$c$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| seen | ASTON | 85B | LASS | | $K^- p$ 11 GeV/$c$ |
| not seen | [5] HASSALL | 81 | HBC | | $K^- p$ 6.5 GeV/$c$ |
| <0.25 | [6] DAUBER | 69 | HBC | | $K^- p$ 2.7 GeV/$c$ |

### $\Gamma(\Xi(1530)\pi)/\Gamma(\Lambda\overline{K})$ — $\Gamma_4/\Gamma_1$

| VALUE | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| **0.38±0.27 OUR AVERAGE** Error includes scale factor of 2.3. | | | | | |
| 1.0 ±0.3 | GAY | 76C | HBC | − | $K^- p$ 4.2 GeV/$c$ |
| 0.26±0.13 | SMITH | 65C | HBC | −0 | $K^- p$ 2.45–2.7 GeV/$c$ |

### $\Gamma(\Xi\pi\pi(\text{not }\Xi(1530)\pi))/\Gamma(\Lambda\overline{K})$ — $\Gamma_5/\Gamma_1$

| VALUE | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| **0.30±0.20** | BIAGI | 87 | SPEC | − | $\Xi^-$ Be 116 GeV |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| <0.14 | [7] BADIER | 65 | HBC | 0 | 1 st. dev. limit |
| >0.1 | SMITH | 65C | HBC | −0 | $K^- p$ 2.45–2.7 GeV/$c$ |

### $\Gamma(\Xi\pi\pi(\text{not }\Xi(1530)\pi))/\Gamma(\Xi(1530)\pi)$ — $\Gamma_5/\Gamma_4$

| VALUE | DOCUMENT ID | | TECN | CHG | COMMENT |
|---|---|---|---|---|---|
| consistent with zero | GAY | 76C | HBC | − | $K^- p$ 4.2 GeV/$c$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.3±0.5 | [8] APSELL | 70 | HBC | 0 | $K^- p$ 2.87 GeV/$c$ |

## $\Xi(1820)$ FOOTNOTES

[1] BIAGI 87 also sees weak signals in the in the $\Xi^- \pi^+ \pi^-$ channel at 1782.6 ± 1.4 MeV ($\Gamma$ = 6.0 ± 1.5 MeV) and 1831.9 ± 2.8 MeV ($\Gamma$ = 9.6 ± 9.9 MeV).

[2] BADIER 72 adds all channels and divides the peak into lower and higher mass regions. The data can also be fitted with a single Breit-Wigner of mass 1800 MeV and width 150 MeV.

[3] From a fit to inclusive $\Xi\pi$, $\Xi\pi\pi$, and $\Lambda K^-$ spectra.

[4] From a fit to inclusive $\Xi\pi$ and $\Xi\pi\pi$ spectra only.

[5] Including $\Xi\pi\pi$.

[6] DAUBER 69 uses in part the same data as SMITH 65C.

[7] For the decay mode $\Xi^- \pi^+ \pi^0$ only. This limit includes $\Xi(1530)\pi$.

[8] Or less. Upper limit for the 3-body decay.

## $\Xi(1820)$ REFERENCES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| ASTON | 85B | PR D32 2270 | D. Aston *et al.* | (SLAC, CARL, CNRC, CINC) | |
| JENKINS | 83 | PRL 51 951 | C.M. Jenkins *et al.* | (FSU, BRAN, LBL+) | |
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