\[ \Sigma(2250) \]

\[ I(J^P) = 1(?^?) \]

Status:  

Results from partial-wave analyses are too weak to warrant separating them from the production and cross-section experiments. LASINSKI 71 in \( \overline{K}N \) using a Pomeron + resonances model, and DEBELLEFON 76, DEBELLEFON 77, and DEBELLEFON 78 in energy-dependent partial-wave analyses of \( \overline{K}N \rightarrow \Lambda \pi, \Sigma \pi, \) and \( N\overline{K} \), respectively, suggest two resonances around this mass.

### \( \Sigma(2250) \) Mass

<table>
<thead>
<tr>
<th>VALUE (MeV)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
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<tr>
<td>2210 to 2280 (( \approx ) 2250) OUR ESTIMATE</td>
<td></td>
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</tr>
<tr>
<td>2270 ( \pm ) 50</td>
<td>DEBELLEFON 78</td>
<td>DPWA</td>
<td>( D_5 ) wave</td>
</tr>
<tr>
<td>2210 ( \pm ) 30</td>
<td>DEBELLEFON 78</td>
<td>DPWA</td>
<td>( G_9 ) wave</td>
</tr>
<tr>
<td>2275 ( \pm ) 20</td>
<td>DEBELLEFON 77</td>
<td>DPWA</td>
<td>( D_5 ) wave</td>
</tr>
<tr>
<td>2215 ( \pm ) 20</td>
<td>DEBELLEFON 77</td>
<td>DPWA</td>
<td>( G_9 ) wave</td>
</tr>
<tr>
<td>2300 ( \pm ) 30</td>
<td>DEBELLEFON 77</td>
<td>DPWA</td>
<td>( D_5 ) wave</td>
</tr>
<tr>
<td>2250 ( \pm ) 7</td>
<td>LU 70</td>
<td>CNTR</td>
<td>Total, charge exchange</td>
</tr>
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</table>

\* We do not use the following data for averages, fits, limits, etc. \* \* \* \n
### \( \Sigma(2250) \) Width

<table>
<thead>
<tr>
<th>VALUE (MeV)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
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</thead>
<tbody>
<tr>
<td>60 to 150 (( \approx ) 100) OUR ESTIMATE</td>
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<td>120 ( \pm ) 40</td>
<td>DEBELLEFON 78</td>
<td>DPWA</td>
<td>( D_5 ) wave</td>
</tr>
<tr>
<td>80 ( \pm ) 20</td>
<td>DEBELLEFON 78</td>
<td>DPWA</td>
<td>( G_9 ) wave</td>
</tr>
<tr>
<td>70 ( \pm ) 20</td>
<td>DEBELLEFON 77</td>
<td>DPWA</td>
<td>( D_5 ) wave</td>
</tr>
<tr>
<td>60 ( \pm ) 20</td>
<td>DEBELLEFON 77</td>
<td>DPWA</td>
<td>( G_9 ) wave</td>
</tr>
<tr>
<td>130 ( \pm ) 20</td>
<td>DEBELLEFON 75b</td>
<td>HBC</td>
<td>( K^- p \rightarrow \Xi^+ 0 K^0 )</td>
</tr>
<tr>
<td>192 ( \pm ) 30</td>
<td>VANHORN 75</td>
<td>DPWA</td>
<td>( K^- p \rightarrow \Lambda \pi^0, F_5 ) wave</td>
</tr>
<tr>
<td>100 ( \pm ) 20</td>
<td>AGUILAR-RAIMUNDI 70</td>
<td>HBC</td>
<td>( K^- p \rightarrow \Xi^+ 0 K^0 )</td>
</tr>
<tr>
<td>164 ( \pm ) 50</td>
<td>BRICMAN 70</td>
<td>CNTR</td>
<td>Total, charge exchange</td>
</tr>
<tr>
<td>230 ( \pm ) 20</td>
<td>BOCK 65</td>
<td>HBC</td>
<td>( \overline{p} p ) 5.7 GeV/c</td>
</tr>
</tbody>
</table>
We do not use the following data for averages, fits, limits, etc.

100  DEBELLEFON 76  IPWA  $D_5$ wave
140  DEBELLEFON 76  IPWA  $G_9$ wave
170  COOL  70  CNTR  $K^- p, K^- d$ total
125  LU  70  CNTR  $\gamma p \rightarrow K^+ Y^*$
150  BLANPIED 65  CNTR  $\gamma p \rightarrow K^+ Y^*$
21 $^+$17  BOCK  65  HBC  $\overline{\pi} p$ 5.7 GeV/c

### $\Sigma(2250)$ DECAY MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Fraction ($\Gamma_i/\Gamma$)</th>
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<tr>
<td>$\Gamma_1$</td>
<td>$N K$</td>
</tr>
<tr>
<td>$\Gamma_2$</td>
<td>$\Lambda \pi$</td>
</tr>
<tr>
<td>$\Gamma_3$</td>
<td>$\Sigma \pi$</td>
</tr>
<tr>
<td>$\Gamma_4$</td>
<td>$N K \pi$</td>
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<tr>
<td>$\Gamma_5$</td>
<td>$\Xi(1530) K$</td>
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</table>

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

### $\Sigma(2250)$ BRANCHING RATIOS

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

\[
\frac{\Gamma(NK)}{\Gamma_{\text{total}}} \quad \frac{\Gamma_1}{\Gamma}
\]

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
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<th>COMMENT</th>
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<tr>
<td>$&lt;0.1$ OUR ESTIMATE</td>
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<tr>
<td>0.08±0.02</td>
<td>DEBELLEFON 78</td>
<td>DPWA</td>
<td>$D_5$ wave</td>
</tr>
<tr>
<td>0.02±0.01</td>
<td>DEBELLEFON 78</td>
<td>DPWA</td>
<td>$G_9$ wave</td>
</tr>
</tbody>
</table>

\[
(J+\frac{1}{2})\times\frac{\Gamma(NK)}{\Gamma_{\text{total}}} \quad \frac{\Gamma_1}{\Gamma}
\]

<table>
<thead>
<tr>
<th>VALUE</th>
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<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>••• We do not use the following data for averages, fits, limits, etc. •••</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.16±0.12</td>
<td>BRICMAN</td>
<td>CNTR</td>
<td>Total, charge exchange</td>
</tr>
<tr>
<td>0.42</td>
<td>COOL</td>
<td>CNTR</td>
<td>$K^- p, K^- d$ total</td>
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<tr>
<td>0.47</td>
<td>BUGG</td>
<td>CNTR</td>
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</table>

\[
\frac{(\Gamma_2^{1/2}/\Gamma_{\text{total}})}{\Gamma_{\text{total}} \rightarrow \Sigma(2250) \rightarrow \Lambda \pi} \quad \frac{(\Gamma_1\Gamma_2)^{1/2}/\Gamma}{\Gamma_{\text{total}} \rightarrow \Sigma(2250) \rightarrow \Lambda \pi}
\]

<table>
<thead>
<tr>
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<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>−0.16±0.03</td>
<td>VANHORN</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \Lambda \pi^0, F_5$ wave</td>
</tr>
<tr>
<td>+0.11</td>
<td>DEBELLEFON 76</td>
<td>IPWA</td>
<td>$D_5$ wave</td>
</tr>
<tr>
<td>−0.10</td>
<td>DEBELLEFON 76</td>
<td>IPWA</td>
<td>$G_9$ wave</td>
</tr>
<tr>
<td>−0.18</td>
<td>BARBARO-... 70</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \Lambda \pi^0, G_9$ wave</td>
</tr>
</tbody>
</table>

(\Gamma_f^2)^{1/2}/\Gamma_{total} \text{ in } N\bar{K} \rightarrow \Sigma(2250) \rightarrow \Sigma \pi \quad \Gamma(\Sigma\pi)/\Gamma(\Sigma\pi) \quad \Gamma_1/\Gamma_3

<table>
<thead>
<tr>
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<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>+0.06 ± 0.02</td>
<td>DEBELLEFON 77</td>
<td>DPWA</td>
<td>D_5 wave</td>
</tr>
<tr>
<td>-0.03 ± 0.02</td>
<td>DEBELLEFON 77</td>
<td>DPWA</td>
<td>G_9 wave</td>
</tr>
<tr>
<td>+0.07</td>
<td>BARBARO-... 70</td>
<td>DPWA</td>
<td>K^− p → \Sigma \pi, G_9 wave</td>
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</table>

Γ(N\bar{K})/Γ(Σ\pi) \quad Γ_2/Γ_3

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.18</td>
<td>BARNES 69</td>
<td>HBC</td>
<td>1 standard dev. limit</td>
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</table>

Γ(Λ\pi)/Γ(Σ\pi) \quad Γ_1/Γ_5

<table>
<thead>
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<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.18 ± 0.04</td>
<td>DEBELLEFON 75B</td>
<td>HBC</td>
<td>K^− p → Ξ^{+0} K^0</td>
</tr>
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</table>

### Σ(2250) FOOTNOTES

1. Seen in the (initial and final state) D_5 wave. Isospin not determined.

### Σ(2250) REFERENCES

<p>| | | | |</p>
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<td>DEBELLEFON 78</td>
<td>NC 42A 403</td>
<td>A. de Bellefon et al.</td>
<td>(CDEF, SACL) IJP</td>
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<td>DEBELLEFON 77</td>
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<td>A. de Bellefon et al.</td>
<td>(CDEF, SACL) IJP</td>
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<td>DEBELLEFON 76</td>
<td>NP B109 129</td>
<td>A. de Bellefon, A. Berthon</td>
<td>(CDEF) IJP</td>
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<td>Also</td>
<td>NP B90 1</td>
<td>A. de Bellefon et al.</td>
<td>(CDEF, SACL) IJP</td>
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<td>A.J. van Horn</td>
<td>(LBL) IJP</td>
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<td>Also</td>
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<td>A.J. van Horn</td>
<td>(LBL) IJP</td>
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<td>LASINSKI 71</td>
<td>NP B29 258</td>
<td>T.A. Lasinski</td>
<td>(EPI) IJP</td>
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<td>AGUILAR-... 70B</td>
<td>PRL 25 58</td>
<td>M. Aguilar-Benitez et al.</td>
<td>(BNL, SYRA)</td>
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<td>BARBARO-... 70</td>
<td>Duke Conf. 173</td>
<td>A. Barbaro-Galtieri</td>
<td>(LRL) IJP</td>
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<td>BRICMAN 70</td>
<td>PL 31B 152</td>
<td>C. Bricman et al.</td>
<td>(CERN, CAEN, SACL)</td>
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<td>COOL 70</td>
<td>PR D1 1887</td>
<td>R.L. Cool et al.</td>
<td>(BNL) IJP</td>
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<td>PRL 16 1223</td>
<td>R.L. Cool et al.</td>
<td>(BNL) IJP</td>
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<tr>
<td>LU 70</td>
<td>PR D2 1846</td>
<td>D.C. Lu et al.</td>
<td>(YALE)</td>
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<td>BARNES 69</td>
<td>PRL 22 479</td>
<td>V.E. Barnes et al.</td>
<td>(BNL, SYRA)</td>
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<tr>
<td>BUGG 68</td>
<td>PR 168 1466</td>
<td>D.V. Bugg et al.</td>
<td>(RHEL, BIRM, CAVE) I</td>
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<td>BLANPIED 65</td>
<td>PRL 14 741</td>
<td>W.A. Blanpied et al.</td>
<td>(YALE, CEA)</td>
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<td>BOCK 65</td>
<td>PL 17 166</td>
<td>R.K. Bock et al.</td>
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