\[ K_{3}^{*}(1780) \]

\[ I(J^P) = \frac{1}{2}(3^-) \]

### \( K_{3}^{*}(1780) \) MASS

<table>
<thead>
<tr>
<th>VALUE (MeV)</th>
<th>EVTS</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>CHG</th>
<th>COMMENT</th>
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<tbody>
<tr>
<td>1776±7 OUR AVERAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Error includes scale factor of 1.1.</td>
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<tr>
<td>1781±8±4</td>
<td>1</td>
<td>ASTON 88 LASS 0</td>
<td>11 ( K^− p \to K^− \pi^+ n )</td>
<td></td>
<td></td>
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<tr>
<td>1740±14±15</td>
<td>1</td>
<td>ASTON 87 LASS 0</td>
<td>11 ( K^− p \to \overline{K}_S^0 \pi^+ \pi^- n )</td>
<td></td>
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<tr>
<td>1779±11</td>
<td>2</td>
<td>BALDI 76 SPEC +</td>
<td>10 ( K^+ p \to K^0 \pi^+ p )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1776±26</td>
<td>3</td>
<td>BRANDENBURG 76D ASPK 0</td>
<td>13 ( K^± p \to K^± \pi^0 N )</td>
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</tr>
</tbody>
</table>

• • • We do not use the following data for averages, fits, limits, etc. • • •

<table>
<thead>
<tr>
<th>1776±7 OUR AVERAGE</th>
<th>1781±8±4</th>
<th>1740±14±15</th>
<th>1779±11</th>
<th>1776±26</th>
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<tr>
<td>ASTON 88 LASS 0</td>
<td>11 ( K^− p \to K^− \pi^+ n )</td>
<td>11 ( K^− p \to \overline{K}_S^0 \pi^+ \pi^- n )</td>
<td>10 ( K^+ p \to K^0 \pi^+ p )</td>
<td>13 ( K^± p \to K^± \pi^0 N )</td>
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<tr>
<td>BALDI 76 SPEC +</td>
<td>( K^+ p \to K^0 \pi^+ p )</td>
<td>( K^± p \to K^± \pi^0 N )</td>
<td>( K^± p \to K^± \pi^0 N )</td>
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<td>BRANDENBURG 76D ASPK 0</td>
<td>( K^± p \to K^± \pi^0 N )</td>
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<td>( K^± p \to K^± \pi^0 N )</td>
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</tr>
</tbody>
</table>

1 From energy-independent partial-wave analysis.
2 From a fit to \( Y_{2}^{0} \) moment. \( J^P = 3^- \) found.
3 Confirmed by phase shift analysis of ESTABROOKS 78, yields \( J^P = 3^- \).
4 From a partial wave amplitude analysis.
5 From a fit to the \( Y_{2}^{0} \) moment.

### \( K_{3}^{*}(1780) \) WIDTH

<table>
<thead>
<tr>
<th>VALUE (MeV)</th>
<th>EVTS</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>CHG</th>
<th>COMMENT</th>
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<td>159±21 OUR AVERAGE</td>
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<td>Error includes scale factor of 1.3. See the ideogram below.</td>
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<tr>
<td>203±30±8</td>
<td>6</td>
<td>ASTON 88 LASS 0</td>
<td>11 ( K^− p \to K^− \pi^+ n )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>171±42±20</td>
<td>6</td>
<td>ASTON 87 LASS 0</td>
<td>11 ( K^− p \to \overline{K}_S^0 \pi^+ \pi^- n )</td>
<td></td>
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</tr>
<tr>
<td>135±22</td>
<td>7</td>
<td>BALDI 76 SPEC +</td>
<td>10 ( K^+ p \to K^0 \pi^+ p )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• • • We do not use the following data for averages, fits, limits, etc. • • •

<table>
<thead>
<tr>
<th>159±21 OUR AVERAGE</th>
<th>203±30±8</th>
<th>171±42±20</th>
<th>135±22</th>
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<tbody>
<tr>
<td>ASTON 88 LASS 0</td>
<td>11 ( K^− p \to K^− \pi^+ n )</td>
<td>11 ( K^− p \to \overline{K}_S^0 \pi^+ \pi^- n )</td>
<td>10 ( K^+ p \to K^0 \pi^+ p )</td>
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<tr>
<td>BALDI 76 SPEC +</td>
<td>( K^+ p \to K^0 \pi^+ p )</td>
<td>( K^± p \to K^± \pi^0 N )</td>
<td>( K^± p \to K^± \pi^0 N )</td>
</tr>
</tbody>
</table>

\( K^± p \to K^± \pi^0 N \)
191±24 2060 CLELAND 82 SPEC ± 50 $K^+ p \rightarrow K^0_S \pi^\pm p$
225±60 9 ASTON 81 LASS 0 11 $K^- p \rightarrow K^- \pi^+ n$
80 190 TOAFF 81 HBC ~ 6.5 $K^- p \rightarrow \overline{K}^0 \pi^- p$
240±50 ETKIN 80 MPS 0 6 $K^- p \rightarrow \overline{K}^0 \pi^+ \pi^-$
181±44 10 BEUSCH 78 OMEG 10 $K^- p \rightarrow \overline{K}^0 \pi^+ \pi^- n$
96±31 CHUNG 78 MPS 0 6 $K^- p \rightarrow K^- \pi^+ n$
270±70 11 BRANDENBURG 76 ASPK 0 13 $K^\pm p \rightarrow K^\pm \pi^\mp N$

6 From energy-independent partial-wave analysis.
7 From a fit to $Y^2_6$ moment. $J^P = 3^-$ found.
8 From a partial wave amplitude analysis.
9 From a fit to $Y^0_6$ moment.
10 Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
11 ESTABROOKS 78 find that BRANDENBURG 76 data are consistent with 175 MeV width. Not averaged.

WEIGHTED AVERAGE
159±21 (Error scaled by 1.3)

$K^*_3(1780)$ width (MeV)

$\chi^2 \over 3.3$
(Confidence Level = 0.196)

$K^*_3(1780)$ DECAY MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Fraction ($\Gamma_i/\Gamma$)</th>
<th>Confidence level</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Gamma_1$</td>
<td>$K\rho$</td>
<td>(31 ± 9 ) %</td>
</tr>
<tr>
<td>$\Gamma_2$</td>
<td>$K^*(892)\pi$</td>
<td>(20 ± 5 ) %</td>
</tr>
<tr>
<td>$\Gamma_3$</td>
<td>$K\pi$</td>
<td>(18.8± 1.0 ) %</td>
</tr>
<tr>
<td>$\Gamma_4$</td>
<td>$K\eta$</td>
<td>(30 ±13 ) %</td>
</tr>
<tr>
<td>$\Gamma_5$</td>
<td>$K^*_2(1430)\pi$</td>
<td>&lt; 16 %</td>
</tr>
</tbody>
</table>

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CONstrained FIT INFORMATION

An overall fit to 3 branching ratios uses 4 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 0.0$ for 1 degrees of freedom.

The following off-diagonal array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the $x_i$ whose labels appear in this array to sum to one.

\[
\begin{array}{c|ccc}
  & x_2 & x_3 & x_4 \\
  x_1 & 85 & & \\
  x_2 & 18 & 21 & \\
  x_3 & -98 & -94 & -27 \\
\end{array}
\]

$K^*_3(1780)$ BRANCHING RATIOS

<table>
<thead>
<tr>
<th>$\Gamma(K^\rho)/\Gamma(K^*(892)^\pi)$</th>
<th>$\Gamma_1/\Gamma_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE</td>
<td>DOCUMENT ID</td>
</tr>
<tr>
<td>$1.52 \pm 0.23$ OUR FIT</td>
<td>ASTON</td>
</tr>
<tr>
<td>$1.52 \pm 0.21 \pm 0.10$</td>
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</table>

<table>
<thead>
<tr>
<th>$\Gamma(K^*(892)^\pi)/\Gamma(K^\pi)$</th>
<th>$\Gamma_2/\Gamma_3$</th>
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</thead>
<tbody>
<tr>
<td>VALUE</td>
<td>DOCUMENT ID</td>
</tr>
<tr>
<td>$1.09 \pm 0.26$ OUR FIT</td>
<td>ASTON</td>
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<td>$1.09 \pm 0.26$</td>
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<table>
<thead>
<tr>
<th>$\Gamma(K^\pi)/\Gamma_{\text{total}}$</th>
<th>$\Gamma_3/\Gamma_2$</th>
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</thead>
<tbody>
<tr>
<td>VALUE</td>
<td>DOCUMENT ID</td>
</tr>
<tr>
<td>$0.188 \pm 0.010$ OUR FIT</td>
<td>ASTON</td>
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<tr>
<td>$0.188 \pm 0.010$ OUR AVERAGE</td>
<td>ESTABROOKS 78</td>
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<table>
<thead>
<tr>
<th>$\Gamma(K^\eta)/\Gamma(K^\pi)$</th>
<th>$\Gamma_4/\Gamma_3$</th>
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<tbody>
<tr>
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<tr>
<td>$1.6 \pm 0.7$ OUR FIT</td>
<td>BIRD</td>
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<td>$0.41 \pm 0.050$</td>
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<td>$0.50 \pm 0.18$</td>
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<tr>
<td>$0.19 \pm 0.02$</td>
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\(^{12}\) This result supersedes ASTON 88B.

<table>
<thead>
<tr>
<th>$\Gamma(K^<em>_2(1430)^\pi)/\Gamma(K^</em>(892)^\pi)$</th>
<th>$\Gamma_5/\Gamma_2$</th>
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<tbody>
<tr>
<td>VALUE</td>
<td>DOCUMENT ID</td>
</tr>
<tr>
<td>$&lt;0.78$</td>
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\(^{12}\) We do not use the following data for averages, fits, limits, etc. ••••

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### $K^*_3(1780)$ References

<table>
<thead>
<tr>
<th>Reference</th>
<th>Year</th>
<th>Journal/Volume/Issue</th>
<th>Authors</th>
<th>Institution(s)</th>
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<tr>
<td>BIRD</td>
<td>89</td>
<td>SLAC-332</td>
<td>P.F. Bird</td>
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<td>ASTON</td>
<td>88</td>
<td>NP B296 493</td>
<td>D. Aston et al.</td>
<td>(SLAC, NAGO, CINC, INUS)</td>
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<td>ASTON</td>
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<td>PL B201 169</td>
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<td>D. Aston et al.</td>
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<td>M. Baubillier et al.</td>
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<td>BAUBILLIER</td>
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<td>CLELAND</td>
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<td>NP B208 189</td>
<td>W.E. Celand et al.</td>
<td>(DURH, GEVA, LAUS+)</td>
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<td>ASTON</td>
<td>81D</td>
<td>PL 99B 502</td>
<td>D. Aston et al.</td>
<td>(SLAC, CARL, OTTA) JP</td>
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<td>TOAFF</td>
<td>81</td>
<td>PR D23 1500</td>
<td>S. Toaff et al.</td>
<td>(ANL, KANS)</td>
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<td>ETKIN</td>
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<td>PR D22 42</td>
<td>A. Etkin et al.</td>
<td>(BNL, CUNY) JP</td>
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<td>BEUSCH</td>
<td>78</td>
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<td>W. Beusch et al.</td>
<td>(CERN, AACH3, ETH) JP</td>
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<td>CHUNG</td>
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<td>S.U. Chung et al.</td>
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<td>NP B133 490</td>
<td>P.G. Estabrooks et al.</td>
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<td>AGUILAR-BENITZ</td>
<td>73</td>
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<td>M. Aguilar-Benitez et al.</td>
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<td>PR D8 2837</td>
<td>V. Waluch, S.M. Flatte, J.H. Friedman</td>
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<td>CARMONY</td>
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<td>D.D. Carmony et al.</td>
<td>(PURD, UCD, IUPU)</td>
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<td>71</td>
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<td>A. Firestone et al.</td>
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