$\Lambda(2020)$ 7/2$^+$

$I(J^P) = 0(7^+)$ Status: *

Omitted from summary table

In Litchfield 71, need for the state rests solely on a possibly inconsistent polarization measurement at 1.784 GeV/$c$. HEMINGWAY 75 does not require this state. GOPAL 77 does not need it in either $N\bar{K}$ or $\Sigma\pi$. With new $K^-n$ angular distributions included, Declais 77 sees it. However, this and other new data are included in GOPAL 80 and the state is not required. Baccari 77 weakly supports it.

### $\Lambda(2020)$ Pole Position

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1757</td>
<td>1 KAMANO</td>
<td>15 DPWA Multichannel</td>
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</table>

1 From the preferred solution A in KAMANO 15. Solution B reports $M = 2041^{+80}_{-82}$ MeV.

### $-2\times$ Imaginary Part

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
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</thead>
<tbody>
<tr>
<td>146</td>
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<td>15 DPWA Multichannel</td>
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</tr>
</tbody>
</table>

1 From the preferred solution A in KAMANO 15. Solution B reports $M = 238^{+114}_{-34}$ MeV.

### $\Lambda(2020)$ Pole Residues

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

Normalized residue in $N\bar{K} \rightarrow \Lambda(2020) \rightarrow N\bar{K}$

<table>
<thead>
<tr>
<th>MODULUS</th>
<th>PHASE (°)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000145</td>
<td>77</td>
<td>1 KAMANO</td>
<td>15 DPWA Multichannel</td>
<td></td>
</tr>
</tbody>
</table>

1 From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(2020) \rightarrow \Sigma\pi$

<table>
<thead>
<tr>
<th>MODULUS</th>
<th>PHASE (°)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0112</td>
<td>120</td>
<td>1 KAMANO</td>
<td>15 DPWA Multichannel</td>
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</tr>
</tbody>
</table>

1 From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Lambda(2020) \rightarrow \Lambda\eta$

<table>
<thead>
<tr>
<th>MODULUS</th>
<th>PHASE (°)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000786</td>
<td>100</td>
<td>1 KAMANO</td>
<td>15 DPWA Multichannel</td>
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</tr>
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</table>

1 From the preferred solution A in KAMANO 15.
**Normalized residue in $NK \rightarrow \Lambda(2020) \rightarrow \Sigma(1385)\pi$, F-wave**

<table>
<thead>
<tr>
<th>MODULUS</th>
<th>PHASE (°)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00451</td>
<td>−82</td>
<td>1 KAMANO 15</td>
<td>DPWA</td>
<td>Multichannel</td>
</tr>
</tbody>
</table>

1 From the preferred solution A in KAMANO 15.

**Normalized residue in $NK \rightarrow \Lambda(2020) \rightarrow \Sigma(1385)\pi$, H-wave**

<table>
<thead>
<tr>
<th>MODULUS</th>
<th>PHASE (°)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0000298</td>
<td>−128</td>
<td>1 KAMANO 15</td>
<td>DPWA</td>
<td>Multichannel</td>
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1 From the preferred solution A in KAMANO 15.

### $\Lambda(2020)$ MASS

<table>
<thead>
<tr>
<th>VALUE (MeV)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>≈ 2020 OUR ESTIMATE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2043±22</td>
<td>ZHANG 13A</td>
<td>DPWA</td>
<td>Multichannel</td>
</tr>
<tr>
<td>2140</td>
<td>BACCARI 77</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \Lambda \omega$</td>
</tr>
<tr>
<td>2117</td>
<td>DECLAIS 77</td>
<td>DPWA</td>
<td>$KN \rightarrow \bar{KN}$</td>
</tr>
<tr>
<td>2100±30</td>
<td>LITCHFIELD 71</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \bar{KN}$</td>
</tr>
<tr>
<td>2020±20</td>
<td>BARBARO-... 70</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \Sigma \pi$</td>
</tr>
</tbody>
</table>

### $\Lambda(2020)$ WIDTH

<table>
<thead>
<tr>
<th>VALUE (MeV)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>200±75</td>
<td>ZHANG 13A</td>
<td>DPWA</td>
<td>Multichannel</td>
</tr>
<tr>
<td>128</td>
<td>BACCARI 77</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \Lambda \omega$</td>
</tr>
<tr>
<td>167</td>
<td>DECLAIS 77</td>
<td>DPWA</td>
<td>$KN \rightarrow \bar{KN}$</td>
</tr>
<tr>
<td>120±30</td>
<td>LITCHFIELD 71</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \bar{KN}$</td>
</tr>
<tr>
<td>160±30</td>
<td>BARBARO-... 70</td>
<td>DPWA</td>
<td>$K^- p \rightarrow \Sigma \pi$</td>
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</tbody>
</table>

### $\Lambda(2020)$ DECAY MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Fraction ($\Gamma_i/\Gamma$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Gamma_1$</td>
<td>$NK$</td>
</tr>
<tr>
<td>$\Gamma_2$</td>
<td>$\Sigma \pi$</td>
</tr>
<tr>
<td>$\Gamma_3$</td>
<td>$\Lambda \eta$</td>
</tr>
<tr>
<td>$\Gamma_4$</td>
<td>$\Sigma(1385)\pi$, F-wave</td>
</tr>
<tr>
<td>$\Gamma_5$</td>
<td>$\Sigma(1385)\pi$, H-wave</td>
</tr>
<tr>
<td>$\Gamma_6$</td>
<td>$NK^*(892)$, $S=1/2$, F-wave</td>
</tr>
<tr>
<td>$\Gamma_7$</td>
<td>$NK^*(892)$, $S=3/2$, F-wave</td>
</tr>
<tr>
<td>$\Gamma_8$</td>
<td>$NK^*(892)$, $S=3/2$, H-wave</td>
</tr>
<tr>
<td>$\Gamma_9$</td>
<td>$\Lambda \omega$</td>
</tr>
<tr>
<td>$\Gamma_{10}$</td>
<td>$NK^*(892)$, $S=1/2$ (30±9) %</td>
</tr>
</tbody>
</table>
### $\Lambda(2020)$ Branching Ratios

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

<table>
<thead>
<tr>
<th>$\Gamma(N\bar{K})/\Gamma_{total}$</th>
<th>$\Gamma_1/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>0.028 ± 0.005</td>
<td>ZHANG</td>
</tr>
<tr>
<td>0.05</td>
<td>DECLAIS</td>
</tr>
<tr>
<td>0.05 ± 0.02</td>
<td>LITCHFIELD</td>
</tr>
<tr>
<td>• • • We do not use the following data for averages, fits, limits, etc. • • •</td>
<td>1 KAMANO</td>
</tr>
<tr>
<td>not seen</td>
<td></td>
</tr>
<tr>
<td>1 From the preferred solution A in KAMANO 15.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(\Sigma \pi)/\Gamma_{total}$</th>
<th>$\Gamma_2/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>0.891</td>
<td>1 KAMANO</td>
</tr>
<tr>
<td>• • • We do not use the following data for averages, fits, limits, etc. • • •</td>
<td></td>
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<tr>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(\Lambda \eta)/\Gamma_{total}$</th>
<th>$\Gamma_3/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>0.002</td>
<td>1 KAMANO</td>
</tr>
<tr>
<td>• • • We do not use the following data for averages, fits, limits, etc. • • •</td>
<td></td>
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<tr>
<td>1 From the preferred solution A in KAMANO 15.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(\Sigma(1385) \pi, F\text{-wave})/\Gamma_{total}$</th>
<th>$\Gamma_4/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>0.105</td>
<td>1 KAMANO</td>
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<tr>
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<td></td>
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<tr>
<td>1 From the preferred solution A in KAMANO 15.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(\Sigma(1385) \pi, H\text{-wave})/\Gamma_{total}$</th>
<th>$\Gamma_5/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>not seen</td>
<td></td>
</tr>
<tr>
<td>1 From the preferred solution A in KAMANO 15.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(N\bar{K}^*(892), S=1/2, F\text{-wave})/\Gamma_{total}$</th>
<th>$\Gamma_6/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>not seen</td>
<td></td>
</tr>
<tr>
<td>1 From the preferred solution A in KAMANO 15.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(N\bar{K}^*(892), S=3/2, F\text{-wave})/\Gamma_{total}$</th>
<th>$\Gamma_7/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>0.001</td>
<td>1 KAMANO</td>
</tr>
<tr>
<td>• • • We do not use the following data for averages, fits, limits, etc. • • •</td>
<td></td>
</tr>
<tr>
<td>1 From the preferred solution A in KAMANO 15.</td>
<td></td>
</tr>
</tbody>
</table>

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Citation: M. Tanabashi et al. (Particle Data Group), Phys. Rev. D 98, 030001 (2018) and 2019 update

HTTP://PDG.LBL.GOV Page 3 Created: 5/22/2019 10:04
We do not use the following data for averages, fits, limits, etc.

1 From the preferred solution A in KAMANO 15.

\( \Gamma(NK^*(892), S=3/2, H\text{-wave}) / \Gamma_{\text{total}} \)

\( \Gamma / \Gamma \)

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30 ± 0.09</td>
<td>ZHANG 13A</td>
<td>DPWA Multichannel</td>
<td></td>
</tr>
</tbody>
</table>

\( (\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \) in \( NK \rightarrow \Lambda(2020) \rightarrow \Sigma \pi \)

\( (\Gamma_1 \Gamma_2)^{1/2} / \Gamma \)

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 0.02 ± 0.01</td>
<td>ZHANG 13A</td>
<td>DPWA Multichannel</td>
<td></td>
</tr>
<tr>
<td>− 0.15 ± 0.02</td>
<td>BARBARO-... 70</td>
<td>DPWA ( K^- p \rightarrow \Sigma \pi )</td>
<td></td>
</tr>
</tbody>
</table>

\( (\Gamma_i \Gamma_f)^{1/2} / \Gamma_{\text{total}} \) in \( NK \rightarrow \Lambda(2020) \rightarrow \Lambda \omega \)

\( (\Gamma_1 \Gamma_9)^{1/2} / \Gamma \)

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.05</td>
<td>BACCARI 77</td>
<td>DPWA ( K^- p \rightarrow \Lambda \omega )</td>
<td></td>
</tr>
</tbody>
</table>

### \( \Lambda(2020) \) REFERENCES

| KAMANO | PR C92 025205 | H. Kamano et al. | (ANL, OSAK) |
| ZHANG | PR C88 035205 | H. Zhang et al. | (KSU) |
| GOPAL | Toronto Conf. 159 | G.P. Gopal | (RHEL) |
| BACCARI | NC 41A 96 | B. Baccari et al. | (SACL, CDEF) IJP |
| DECLAI | CERN 77-16 | Y. Declais et al. | (CAEN, CERN) IJP |
| GOPAL | NP B119 362 | G.P. Gopal et al. | (LOIC, RHEL) |
| HEMINGWAY | NP B91 12 | R.J. Hemingway et al. | (CERN, HEIDH, MPIM) IJP |
| LITCHFIELD | NP B30 125 | P.J. Litchfield et al. | (RHEL, CDEF, SACL) IJP |
| BARBARO-... | Duke Conf. 173 | A. Barbaro-Galtieri | (LRL) IJP |

Hyperon Resonances, 1970

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Citation: M. Tanabashi et al. (Particle Data Group), Phys. Rev. D 98, 030001 (2018) and 2019 update