

Λ BARYONS

(S = -1, I = 0)

$$\Lambda^0 = uds$$

Λ

$$I(J^P) = 0(\frac{1}{2}^+)$$

Mass $m = 1115.683 \pm 0.006$ MeV

$$(m_\Lambda - m_{\bar{\Lambda}}) / m_\Lambda = (-0.1 \pm 1.1) \times 10^{-5} \quad (S = 1.6)$$

Mean life $\tau = (2.632 \pm 0.020) \times 10^{-10}$ s (S = 1.6)

$$(\tau_\Lambda - \tau_{\bar{\Lambda}}) / \tau_\Lambda = -0.001 \pm 0.009$$

$$c\tau = 7.89$$
 cm

Magnetic moment $\mu = -0.613 \pm 0.004 \mu_N$

Electric dipole moment $d < 1.5 \times 10^{-16}$ e cm, CL = 95%

Decay parameters

$$p\pi^- \quad \alpha_- = 0.642 \pm 0.013$$

$$\bar{p}\pi^+ \quad \alpha_+ = -0.71 \pm 0.08$$

$$p\pi^- \quad \phi_- = (-6.5 \pm 3.5)^\circ$$

$$" \quad \gamma_- = 0.76 [a]$$

$$" \quad \Delta_- = (8 \pm 4)^\circ [a]$$

$$n\pi^0 \quad \alpha_0 = 0.65 \pm 0.04$$

$$pe^- \bar{\nu}_e \quad g_A/g_V = -0.718 \pm 0.015 [b]$$

| Λ DECAY MODES | Fraction (Γ_i/Γ) | Confidence level | ρ (MeV/c) |
|------------------------|------------------------------------|------------------|----------------|
| $p\pi^-$ | (63.9 ± 0.5) % | | 101 |
| $n\pi^0$ | (35.8 ± 0.5) % | | 104 |
| $n\gamma$ | (1.75 ± 0.15) × 10 ⁻³ | | 162 |
| $p\pi^- \gamma$ | [c] (8.4 ± 1.4) × 10 ⁻⁴ | | 101 |
| $pe^- \bar{\nu}_e$ | (8.32 ± 0.14) × 10 ⁻⁴ | | 163 |
| $p\mu^- \bar{\nu}_\mu$ | (1.57 ± 0.35) × 10 ⁻⁴ | | 131 |

Lepton (L) and/or Baryon (B) number violating decay modes

| | | | | | |
|----------------|-----|-----|--------------------|-----|-----|
| $\pi^+ e^-$ | L,B | < 6 | × 10 ⁻⁷ | 90% | 549 |
| $\pi^+ \mu^-$ | L,B | < 6 | × 10 ⁻⁷ | 90% | 544 |
| $\pi^- e^+$ | L,B | < 4 | × 10 ⁻⁷ | 90% | 549 |
| $\pi^- \mu^+$ | L,B | < 6 | × 10 ⁻⁷ | 90% | 544 |
| $K^+ e^-$ | L,B | < 2 | × 10 ⁻⁶ | 90% | 449 |
| $K^+ \mu^-$ | L,B | < 3 | × 10 ⁻⁶ | 90% | 441 |
| $K^- e^+$ | L,B | < 2 | × 10 ⁻⁶ | 90% | 449 |
| $K^- \mu^+$ | L,B | < 3 | × 10 ⁻⁶ | 90% | 441 |
| $K_S^0 \nu$ | L,B | < 2 | × 10 ⁻⁵ | 90% | 447 |
| $\bar{p}\pi^+$ | B | < 9 | × 10 ⁻⁷ | 90% | 101 |

$\Lambda(1405) 1/2^-$

$$I(J^P) = 0(\frac{1}{2}^-)$$

Mass $m = 1405.1^{+1.3}_{-1.0}$ MeVFull width $\Gamma = 50.5 \pm 2.0$ MeVBelow $\bar{K}N$ threshold

| $\Lambda(1405)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $\Sigma \pi$ | 100 % | 155 |

 $\Lambda(1520) 3/2^-$

$$I(J^P) = 0(\frac{3}{2}^-)$$

Mass $m = 1519.5 \pm 1.0$ MeV [d]Full width $\Gamma = 15.6 \pm 1.0$ MeV [d]

| $\Lambda(1520)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | (45 \pm 1) % | 243 |
| $\Sigma \pi$ | (42 \pm 1) % | 268 |
| $\Lambda \pi \pi$ | (10 \pm 1) % | 259 |
| $\Sigma \pi \pi$ | (0.9 \pm 0.1) % | 169 |
| $\Lambda \gamma$ | (0.85 \pm 0.15) % | 350 |

 $\Lambda(1600) 1/2^+$

$$I(J^P) = 0(\frac{1}{2}^+)$$

Mass $m = 1560$ to 1700 (≈ 1600) MeVFull width $\Gamma = 50$ to 250 (≈ 150) MeV

| $\Lambda(1600)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | 15–30 % | 343 |
| $\Sigma \pi$ | 10–60 % | 338 |

 $\Lambda(1670) 1/2^-$

$$I(J^P) = 0(\frac{1}{2}^-)$$

Mass $m = 1660$ to 1680 (≈ 1670) MeVFull width $\Gamma = 25$ to 50 (≈ 35) MeV

| $\Lambda(1670)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|---|--------------------------------|-------------|
| $N\bar{K}$ | 20–30 % | 414 |
| $\Sigma\pi$ | 25–55 % | 394 |
| $\Lambda\eta$ | 10–25 % | 69 |
| $N\bar{K}^*(892)$, $S=3/2$, D -wave | (5 ± 4) % | † |

 $\Lambda(1690) 3/2^-$

$$I(J^P) = 0(\frac{3}{2}^-)$$

Mass $m = 1685$ to 1695 (≈ 1690) MeVFull width $\Gamma = 50$ to 70 (≈ 60) MeV

| $\Lambda(1690)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | 20–30 % | 433 |
| $\Sigma\pi$ | 20–40 % | 410 |
| $\Lambda\pi\pi$ | ~ 25 % | 419 |
| $\Sigma\pi\pi$ | ~ 20 % | 358 |

 $\Lambda(1800) 1/2^-$

$$I(J^P) = 0(\frac{1}{2}^-)$$

Mass $m = 1720$ to 1850 (≈ 1800) MeVFull width $\Gamma = 200$ to 400 (≈ 300) MeV

| $\Lambda(1800)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | 25–40 % | 528 |
| $\Sigma\pi$ | seen | 494 |
| $\Sigma(1385)\pi$ | seen | 349 |
| $\Lambda\eta$ | (6 ± 5) % | 326 |
| $N\bar{K}^*(892)$ | seen | † |

 $\Lambda(1810) 1/2^+$

$$I(J^P) = 0(\frac{1}{2}^+)$$

Mass $m = 1750$ to 1850 (≈ 1810) MeVFull width $\Gamma = 50$ to 250 (≈ 150) MeV

| $\Lambda(1810)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | 20–50 % | 537 |
| $\Sigma\pi$ | 10–40 % | 501 |
| $\Sigma(1385)\pi$ | seen | 357 |
| $N\bar{K}^*(892)$ | 30–60 % | † |

$\Lambda(1820) 5/2^+$

$$I(J^P) = 0(\frac{5}{2}^+)$$

Mass $m = 1815$ to 1825 (≈ 1820) MeVFull width $\Gamma = 70$ to 90 (≈ 80) MeV

| $\Lambda(1820)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|---|--------------------------------|-------------|
| $N\bar{K}$ | 55–65 % | 545 |
| $\Sigma\pi$ | 8–14 % | 509 |
| $\Sigma(1385)\pi$ | 5–10 % | 366 |
| $N\bar{K}^*(892)$, $S=3/2$, P -wave | (3.0 ± 1.0) % | † |

 $\Lambda(1830) 5/2^-$

$$I(J^P) = 0(\frac{5}{2}^-)$$

Mass $m = 1810$ to 1830 (≈ 1830) MeVFull width $\Gamma = 60$ to 110 (≈ 95) MeV

| $\Lambda(1830)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|---|--------------------------------|-------------|
| $N\bar{K}$ | 3–10 % | 553 |
| $\Sigma\pi$ | 35–75 % | 516 |
| $\Sigma(1385)\pi$ | >15 % | 374 |
| $\Sigma(1385)\pi$, D -wave | (52 ± 6) % | 374 |

 $\Lambda(1890) 3/2^+$

$$I(J^P) = 0(\frac{3}{2}^+)$$

Mass $m = 1850$ to 1910 (≈ 1890) MeVFull width $\Gamma = 60$ to 200 (≈ 100) MeV

| $\Lambda(1890)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|---|--------------------------------|-------------|
| $N\bar{K}$ | 20–35 % | 599 |
| $\Sigma\pi$ | 3–10 % | 560 |
| $\Sigma(1385)\pi$ | seen | 423 |
| $N\bar{K}^*(892)$ | seen | 236 |

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

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

Mass $m = 2090$ to 2110 (≈ 2100) MeVFull width $\Gamma = 100$ to 250 (≈ 200) MeV

| $\Lambda(2100)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | 25–35 % | 751 |
| $\Sigma\pi$ | ~ 5 % | 705 |
| $\Lambda\eta$ | <3 % | 617 |
| ΞK | <3 % | 491 |
| $\Lambda\omega$ | <8 % | 443 |
| $N\bar{K}^*(892)$ | 10–20 % | 515 |

 $\Lambda(2110) 5/2^+$

$$I(J^P) = 0(\frac{5}{2}^+)$$

Mass $m = 2090$ to 2140 (≈ 2110) MeV

Full width $\Gamma = 150$ to 250 (≈ 200) MeV

| $\Lambda(2110)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | 5–25 % | 757 |
| $\Sigma\pi$ | 10–40 % | 711 |
| $\Lambda\omega$ | seen | 455 |
| $\Sigma(1385)\pi$ | seen | 591 |
| $N\bar{K}^*(892)$ | 10–60 % | 525 |

 $\Lambda(2350) 9/2^+$

$$I(J^P) = 0(\frac{9}{2}^+)$$

Mass $m = 2340$ to 2370 (≈ 2350) MeV

Full width $\Gamma = 100$ to 250 (≈ 150) MeV

| $\Lambda(2350)$ DECAY MODES | Fraction (Γ_i/Γ) | p (MeV/c) |
|-----------------------------|--------------------------------|-------------|
| $N\bar{K}$ | ~ 12 % | 915 |
| $\Sigma\pi$ | ~ 10 % | 867 |

NOTES

[a] The decay parameters γ and Δ are calculated from α and ϕ using

$$\gamma = \sqrt{1-\alpha^2} \cos\phi, \quad \tan\Delta = -\frac{1}{\alpha} \sqrt{1-\alpha^2} \sin\phi.$$

See the “Note on Baryon Decay Parameters” in the neutron Particle Listings.

[b] The parameters g_A , g_V , and g_{WM} for semileptonic modes are defined by $\bar{B}_f[\gamma_\lambda(g_V + g_A\gamma_5) + i(g_{WM}/m_{B_i}) \sigma_{\lambda\nu} q^\nu]B_i$, and ϕ_{AV} is defined by $g_A/g_V = |g_A/g_V|e^{i\phi_{AV}}$. See the “Note on Baryon Decay Parameters” in the neutron Particle Listings.

[c] See the Listings for the pion momentum range used in this measurement.

[d] The error given here is only an educated guess. It is larger than the error on the weighted average of the published values.