Λ BARYONS
($S = -1$, $I = 0$)

$\Lambda^0 = uds$

NODE=BXXX020

Λ

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

NODE=S018

Mass $m = 1115.683 \pm 0.006$ MeV NODE=S018M;DTYPE=M

$(m_\Lambda - m_{\overline{\Lambda}}) \,/\, m_\Lambda = (-0.1 \pm 1.1) \times 10^{-5}$ (S = 1.6) NODE=S018DM;DTYPE=x

Mean life $\tau = (2.617 \pm 0.010) \times 10^{-10}$ s (S = 1.5) NODE=S018T;DTYPE=T

$(\tau_\Lambda - \tau_{\overline{\Lambda}}) \,/\, \tau_\Lambda = (0.9 \pm 3.2) \times 10^{-3}$ NODE=S018DT;DTYPE=t

$c\tau = 7.845$ cm NODE=S018CTA;DTYPE=C;OUR EVAL

Magnetic moment $\mu = -0.613 \pm 0.004\ \mu_N$ NODE=S018MM;DTYPE=m

Electric dipole moment $d < 1.5 \times 10^{-16}$ $e$cm, CL = 95% NODE=S018EDM;DTYPE=e

Decay parameters

CLUMP=D

$p\pi^-$ $\alpha_- = 0.748 \pm 0.008$ (S = 2.4) NODE=S018A-;DTYPE=d;CLUMP=D

$\overline{p}\pi^+$ $\alpha_+ = -0.758 \pm 0.005$ (S = 1.2) NODE=S018A+;DTYPE=d;CLUMP=D

$\overline{n}\pi^0$ $\overline{\alpha}_0 = -0.675 \pm 0.011$ (S = 1.2) NODE=S018A00;DTYPE=d;CLUMP=D

$n\pi^0$ $\alpha_0 = 0.670 \pm 0.012$ NODE=S018A06;DTYPE=d;CLUMP=D

$n\gamma$ $\alpha_\gamma = -0.16 \pm 0.11$ NODE=S018A04;DTYPE=d;CLUMP=D

$p\pi^-$ $\phi_- = (-6.5 \pm 3.5)^\circ$ NODE=S018F-;DTYPE=d;CLUMP=D

$p\pi^-$ $\gamma_- = 0.66 \pm 0.01$ [a] NODE=S018G-;DTYPE=d;CLUMP=D;OUR EVAL;→ UNCHECKED ←

$p\pi^-$ $\Delta_- = (5.7 \pm 3.0)^\circ$ [a] NODE=S018D-;DTYPE=d;CLUMP=D;OUR EVAL;→ UNCHECKED ←

$\overline{\alpha}_0 \,/\, \alpha_+$ in $\overline{\Lambda} \to \overline{n}\pi^0$, $\overline{\Lambda} \to \overline{p}\pi^+ = 0.876^{+0.022}_{-0.020}$ (S = 1.4) NODE=S018A1;DTYPE=d;CLUMP=D

$(\alpha_0 + \overline{\alpha}_0)/(\alpha_0 - \overline{\alpha}_0)$ in $\Lambda \to n\pi^0$, $\overline{\Lambda} \to \overline{n}\pi^0 = (0.1^{+1.0}_{-1.1}) \times 10^{-2}$ NODE=S018A07;DTYPE=d;CLUMP=D

$pe^-\overline{\nu}_e$ $g_A/g_V = -0.718 \pm 0.015$ [b] NODE=S018AV;DTYPE=d;CLUMP=D

Λ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)	
$p\pi^-$		(64.1 ± 0.5) %		101	NODE=S018235;DESIG=1
$n\pi^0$		(35.9 ± 0.5) %		104	DESIG=2
$n\gamma$		$(8.3 \pm 0.7) \times 10^{-4}$		162	DESIG=6
$p\pi^-\gamma$	[c]	$(8.5 \pm 1.4) \times 10^{-4}$		101	DESIG=5
$pe^-\overline{\nu}_e$		$(8.34 \pm 0.14) \times 10^{-4}$		163	DESIG=4
$p\mu^-\overline{\nu}_\mu$		$(1.51 \pm 0.19) \times 10^{-4}$		131	DESIG=3
Lepton (L) and/or Baryon (B) number violating decay modes					NODE=S018;CLUMP=A
π^+e^-	L,B	$< 6 \times 10^{-7}$	90%	549	DESIG=7
$\pi^+\mu^-$	L,B	$< 6 \times 10^{-7}$	90%	544	DESIG=8
π^-e^+	L,B	$< 4 \times 10^{-7}$	90%	549	DESIG=9
$\pi^-\mu^+$	L,B	$< 6 \times 10^{-7}$	90%	544	DESIG=10
K^+e^-	L,B	$< 2 \times 10^{-6}$	90%	449	DESIG=11
$K^+\mu^-$	L,B	$< 3 \times 10^{-6}$	90%	441	DESIG=12
K^-e^+	L,B	$< 2 \times 10^{-6}$	90%	449	DESIG=13
$K^-\mu^+$	L,B	$< 3 \times 10^{-6}$	90%	441	DESIG=14
$K^0_S\nu$	L,B	$< 2 \times 10^{-5}$	90%	447	DESIG=15
$\overline{p}\pi^+$	B	$< 9 \times 10^{-7}$	90%	101	DESIG=16
invisible		$< 7.4 \times 10^{-5}$	90%	–	DESIG=103

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

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

NODE=B037

Mass $m = 1405.1^{+1.3}_{-1.0}$ MeV NODE=B037M1;DTYPE=M

Full width $\Gamma = 50.5 \pm 2.0$ MeV NODE=B037W1;DTYPE=G

Below $\overline{K}N$ threshold

$\Lambda(1405)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$\Sigma\pi$	100 %	155	NODE=B037215;DESIG=1;OUR EST

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

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

NODE=B038

Mass m = 1518 to 1520 ($\approx$ 1519) MeV [d]
Full width Γ = 15 to 17 ($\approx$ 16) MeV [d]

NODE=B038M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B038W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1520)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	(45 $\pm$1) %	242	NODE=B038215;DESIG=1;OUR EST
$\Sigma\pi$	(42 $\pm$1) %	268	DESIG=2;OUR EST
$\Lambda\pi\pi$	(10 $\pm$1) %	259	DESIG=3;OUR EST
$\Sigma\pi\pi$	(0.9 $\pm$0.1) %	168	DESIG=6;OUR EST
$\Lambda\gamma$	(0.85$\pm$0.15) %	350	DESIG=4;OUR EST

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

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

NODE=B101

Mass m = 1570 to 1630 ($\approx$ 1600) MeV
Full width Γ = 150 to 250 ($\approx$ 200) MeV

NODE=B101M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B101W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	15–30 %	343	NODE=B101215;DESIG=1;OUR EST
$\Sigma\pi$	10–60 %	338	DESIG=2;OUR EST
$\Lambda\sigma$	(19$\pm$4) %	–	DESIG=5
$\Sigma(1385)\pi$	(9$\pm$4) %	158	DESIG=3

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

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

NODE=B040

Mass m = 1670 to 1678 ($\approx$ 1674) MeV
Full width Γ = 25 to 35 ($\approx$ 30) MeV

NODE=B040M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B040W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	20–30 %	418	NODE=B040215;DESIG=1;OUR EST
$\Sigma\pi$	25–55 %	398	DESIG=3;OUR EST
$\Lambda\eta$	10–25 %	88	DESIG=2;OUR EST
$\Sigma(1385)\pi$, D-wave	(6.0$\pm$2.0) %	235	DESIG=4
$N\overline{K}^*(892)$, S=3/2, D-wave	(5 $\pm$4) %	†	DESIG=5
$\Lambda\sigma$	(20 $\pm$8) %	–	DESIG=10

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

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

NODE=B055

Mass m = 1685 to 1695 ($\approx$ 1690) MeV
Full width Γ = 60 to 80 ($\approx$ 70) MeV

NODE=B055M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B055W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1690)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	20–30 %	433	NODE=B055215;DESIG=1;OUR EST
$\Sigma\pi$	20–40 %	410	DESIG=2;OUR EST
$\Lambda\sigma$	(5.0 ± 2.0) %	–	DESIG=14
$\Lambda\pi\pi$	~ 25 %	419	DESIG=3;OUR EST
$\Sigma\pi\pi$	~ 20 %	358	DESIG=4;OUR EST
$\Sigma(1385)\pi$, S-wave	$(9\ \pm5\ )$ %	251	DESIG=5
$\Sigma(1385)\pi$, D-wave	(3.0 ± 2.0) %	251	DESIG=9

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

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

NODE=B036

Mass m = 1750 to 1850 ($\approx$ 1800) MeV

Full width Γ = 150 to 250 ($\approx$ 200) MeV

NODE=B036M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B036W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1800)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	25–40 %	528	NODE=B036215;DESIG=1;OUR EST
$\Sigma\pi$	$(27\ \pm6)$ %	494	DESIG=2
$\Lambda\sigma$	$(15\ \pm4)$ %	–	DESIG=8
$\Sigma(1385)\pi$	$(\ 9\ \pm4)$ %	349	DESIG=3
$\Lambda\eta$	0.01 to 0.10	326	DESIG=7
$N\overline{K}^*(892)$	seen	†	DESIG=6;OUR EST

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

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

NODE=B077

Mass m = 1740 to 1840 ($\approx$ 1790) MeV

Full width Γ = 50 to 170 ($\approx$ 110) MeV

NODE=B077M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B077W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1810)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	0.05 to 0.35	520	NODE=B077215;DESIG=1
$\Sigma\pi$	$(16\ \pm\ 5)$ %	487	DESIG=2
$\Sigma(1385)\pi$	$(40\ \pm15)$ %	340	DESIG=3
$N\overline{K}^*(892)$	30–60 %	†	DESIG=6;OUR EST

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

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

NODE=B039

Mass m = 1815 to 1825 ($\approx$ 1820) MeV

Full width Γ = 70 to 90 ($\approx$ 80) MeV

NODE=B039M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B039W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1820)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	55–65 %	545	NODE=B039215;DESIG=1;OUR EST
$\Sigma\pi$	8–14 %	509	DESIG=2;OUR EST
$\Sigma(1385)\pi$	5–10 %	366	DESIG=7;OUR EST
$N\overline{K}^*(892)$, S=3/2, P-wave	(3.0 ± 1.0) %	†	DESIG=8

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

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

NODE=B056

Mass m = 1820 to 1830 ($\approx$ 1825) MeV

Full width Γ = 60 to 120 ($\approx$ 90) MeV

NODE=B056M;DTYPE=M;OUR EST; → UNCHECKED ←
NODE=B056W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1830)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)	
$N\overline{K}$	0.04 to 0.08		549	NODE=B056215;DESIG=1
$\Sigma\pi$	35–75 %		512	DESIG=2;OUR EST
$\Sigma(1385)\pi$	>15 %		370	DESIG=3;OUR EST
$\Sigma(1385)\pi$, D-wave	(40 ±15) %	3.2	370	DESIG=5

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

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

NODE=B060

Mass m = 1870 to 1910 (≈ 1890) MeV

Full width Γ = 80 to 160 (≈ 120) MeV

NODE=B060M;DTYPE=M;OUR EST; → UNCHECKED ←

NODE=B060W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(1890)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	0.24 to 0.36	599	NODE=B060215;DESIG=1
$\Sigma\pi$	3–10 %	560	DESIG=2;OUR EST
$\Sigma(1385)\pi$	seen	423	DESIG=8;OUR EST
$\Sigma(1385)\pi$, P-wave	(6.0 ±3.0) %	423	DESIG=4
$\Sigma(1385)\pi$, F-wave	(4.0 ±2.0) %	423	DESIG=5
$N\overline{K}^*(892)$	seen	236	DESIG=6;OUR EST

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

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

NODE=B041

Mass m = 2090 to 2110 (≈ 2100) MeV

Full width Γ = 100 to 250 (≈ 200) MeV

NODE=B041M;DTYPE=M;OUR EST; → UNCHECKED ←

NODE=B041W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(2100)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	25–35 %	751	NODE=B041215;DESIG=1;OUR EST
$\Sigma\pi$	∼ 5 %	705	DESIG=2;OUR EST
$\Lambda\eta$	<3 %	617	DESIG=5;OUR EST
ΞK	<3 %	491	DESIG=3;OUR EST
$\Lambda\omega$	<8 %	443	DESIG=4;OUR EST
$\Sigma(1385)\pi$, G-wave	(1.0±1.0) %	584	DESIG=11
$N\overline{K}^*(892)$	10–20 %	515	DESIG=8;OUR EST
$N\overline{K}^*(892)$, S=3/2, D-wave	(4.0±2.0) %	515	DESIG=6

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

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

NODE=B035

Mass m = 2050 to 2130 (≈ 2090) MeV

Full width Γ = 200 to 300 (≈ 250) MeV

NODE=B035M;DTYPE=M;OUR EST; → UNCHECKED ←

NODE=B035W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(2110)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	5–25 %	744	NODE=B035215;DESIG=1;OUR EST
$\Sigma\pi$	10–40 %	698	DESIG=2;OUR EST
$\Lambda\omega$	seen	432	DESIG=3;OUR EST
$\Lambda\omega$, S=3/2 , P-wave	(5.0±2.0) %	432	DESIG=11
$\Sigma(1385)\pi$	seen	576	DESIG=4;OUR EST
$N\overline{K}^*(892)$	10–60 %	505	DESIG=5;OUR EST

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

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

NODE=B042

Mass m = 2340 to 2370 (≈ 2350) MeV

Full width Γ = 100 to 250 (≈ 150) MeV

NODE=B042M;DTYPE=M;OUR EST; → UNCHECKED ←

NODE=B042W;DTYPE=G;OUR EST; → UNCHECKED ←

$\Lambda(2350)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\overline{K}$	∼ 12 %	915	NODE=B042215;DESIG=1;OUR EST
$\Sigma\pi$	∼ 10 %	867	DESIG=2;OUR EST

NOTES

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

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

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 $\overline{B}_f[\gamma_\lambda(g_V + g_A\gamma_5) + i(g_{WM}/m_{B_i})\,\sigma_{\lambda\nu}\,q^\nu]B_i$, and ϕ_{AV} is defined by $g_A/g_V = \left|g_A/g_V\right|e^{i\phi_{AV}}$. See the "Note on Baryon Decay Parameters" in the neutron Particle Listings. LINKAGE=SBD

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

[d] Our estimate. See the Particle Listings for details. LINKAGE=BH