Ξ BARYONS
($S = -2$, $I = 1/2$)

$\Xi^0 = uss$, $\Xi^- = dss$

Ξ^0

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

P is not yet measured; + is the quark model prediction.

Mass $m = 1314.86 \pm 0.20$ MeV
$m_{\Xi^-} - m_{\Xi^0} = 6.85 \pm 0.21$ MeV
Mean life $\tau = (2.90 \pm 0.09) \times 10^{-10}$ s
$c\tau = 8.71$ cm
Magnetic moment $\mu = -1.250 \pm 0.014\ \mu_N$

Decay parameters

$\Lambda\pi^0$	$\alpha = -0.348 \pm 0.009$
α FOR $\overline{\Xi}^0 \to \overline{\Lambda}\pi^0$	$= 0.379 \pm 0.004$
"	$\phi = (0.3 \pm 0.6)^\circ$
ϕ ANGLE FOR $\overline{\Xi}^0 \to \overline{\Lambda}\pi^0$ with $\tan\phi = \beta/\gamma$	$= -0.3 \pm 0.6$ degrees
$\Delta\phi_{CP}(\Xi^0) = (\ \phi_{\overline{\Xi}^0} + \phi_{\Xi^0}\ )/2$	$= 0.0 \pm 0.4$ degrees
A_{CP} FOR $\Xi^0 \to \Lambda\pi^0$, $\overline{\Xi}^0 \to \overline{\Lambda}\pi^0$	$= (-5 \pm 7) \times 10^{-3}$
"	$\gamma = 0.85$ [a]
"	$\Delta = (218^{+12}_{-19})^\circ$ [a]
$\Lambda\gamma$	$\alpha = -0.70 \pm 0.07$
$\Lambda e^+ e^-$	$\alpha = -0.8 \pm 0.2$
$\Sigma^0\gamma$	$\alpha = -0.69 \pm 0.06$
$\Sigma^+ e^- \overline{\nu}_e$	$g_1(0)/f_1(0) = 1.22 \pm 0.05$
$\Sigma^+ e^- \overline{\nu}_e$	$f_2(0)/f_1(0) = 2.0 \pm 0.9$

Ξ^0 DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\pi^0$	(99.524 ± 0.012) %		135
$\Lambda\gamma$	$(\ 1.17\ \pm 0.07\ ) \times 10^{-3}$		184
$\Lambda e^+ e^-$	$(\ 7.6\ \pm 0.6\ ) \times 10^{-6}$		184
$\Sigma^0\gamma$	$(\ 3.33\ \pm 0.10\ ) \times 10^{-3}$		117
$\Sigma^+ e^- \overline{\nu}_e$	$(\ 2.52\ \pm 0.08\ ) \times 10^{-4}$		120
$\Sigma^+ \mu^- \overline{\nu}_\mu$	$(\ 2.33\ \pm 0.35\ ) \times 10^{-6}$		64
$\Delta S = \Delta Q$ (SQ) violating modes or $\Delta S = 2$ forbidden ($S2$) modes			
$\Sigma^- e^+ \nu_e$	SQ $< 1.6 \times 10^{-4}$	90%	112
$\Sigma^- \mu^+ \nu_\mu$	SQ $< 9 \times 10^{-4}$	90%	49

$p\pi^-$	S2	<	8	$\times 10^{-6}$	90%	299
$pe^-\overline{\nu}_e$	S2	<	1.3	$\times 10^{-3}$		323
$p\mu^-\overline{\nu}_\mu$	S2	<	1.3	$\times 10^{-3}$		309

Ξ^-

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

P is not yet measured; + is the quark model prediction.

Mass $m = 1321.71 \pm 0.07$ MeV
$(m_{\Xi^-} - m_{\overline{\Xi}^+}) / m_{\Xi^-} = (-3 \pm 9) \times 10^{-5}$
Mean life $\tau = (1.639 \pm 0.015) \times 10^{-10}$ s
$c\tau = 4.91$ cm
$(\tau_{\Xi^-} - \tau_{\overline{\Xi}^+}) / \tau_{\Xi^-} = -0.01 \pm 0.07$
Magnetic moment $\mu = -0.6507 \pm 0.0025\ \mu_N$
$(\mu_{\Xi^-} + \mu_{\overline{\Xi}^+}) / \left|\mu_{\Xi^-}\right| = +0.01 \pm 0.05$

Decay parameters

$\Lambda\pi^-$ $\alpha = -0.385 \pm 0.008$ (S = 2.4)
$\overline{\Lambda}\pi^+$ $\overline{\alpha} = 0.374^{+0.005}_{-0.006}$
$(\alpha + \overline{\alpha}) / (\alpha - \overline{\alpha})$ for $\Xi^- \to \Lambda\pi^-$, $\overline{\Xi}^+ \to \overline{\Lambda}\pi^+ = (-9^{+11}_{-8}) \times 10^{-3}$
$[\alpha(\Xi^-)\alpha_-(\Lambda) - \overline{\alpha}\overline{\Xi}^+\alpha_+(\overline{\Lambda})] / [\text{ sum }] = (0 \pm 7) \times 10^{-4}$
$\Lambda\pi^-$ $\phi_- = (-1.5 \pm 0.6)^\circ$
" $\gamma = 0.89$ [a]
" $\Delta = (175.9 \pm 1.5)^\circ$ [a]
$\overline{\Lambda}\pi^+$ $\phi_+ = (0.6^{+0.7}_{-1.0})^\circ$
$\Delta\phi_{CP} = (\phi_- + \phi_+)/2 = (-0.2^{+0.5}_{-0.6})^\circ$
$\Lambda e^-\overline{\nu}_e$ $g_A/g_V = -0.25 \pm 0.05$ [b]

Ξ^- DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\pi^-$	(99.887±0.035) %		140
$\Sigma^-\gamma$	(1.27 ±0.23) × 10^{-4}		118
$\Lambda e^-\overline{\nu}_e$	(5.63 ±0.31) × 10^{-4}		190
$\Lambda\mu^-\overline{\nu}_\mu$	(3.5 $^{+3.5}_{-2.2}$) × 10^{-4}		163
$\Sigma^0 e^-\overline{\nu}_e$	(8.7 ±1.7) × 10^{-5}		123
$\Sigma^0\mu^-\overline{\nu}_\mu$	< 8 × 10^{-4}	90%	70
$\Xi^0 e^-\overline{\nu}_e$	< 2.59 × 10^{-4}	90%	7

$\Delta S = 2$ forbidden ($S2$) modes

$n\pi^-$	S2	<	1.9	$\times 10^{-5}$	90%	304
$ne^-\overline{\nu}_e$	S2	<	3.2	$\times 10^{-3}$	90%	327
$n\mu^-\overline{\nu}_\mu$	S2	<	1.5	%	90%	314

$p\pi^-\pi^-$	*S2*	$<$ 4	$\times 10^{-4}$	90%	223
$p\pi^- e^-\overline{\nu}_e$	*S2*	$<$ 4	$\times 10^{-4}$	90%	305
$p\pi^-\mu^-\overline{\nu}_\mu$	*S2*	$<$ 4	$\times 10^{-4}$	90%	251
$p\mu^-\mu^-$	*L*	$<$ 4	$\times 10^{-8}$	90%	272

$\Xi(1530)\ 3/2^+$

$I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$

$\Xi(1530)^0$ mass $m = 1531.80 \pm 0.32$ MeV (S = 1.3)
$\Xi(1530)^-$ mass $m = 1535.0 \pm 0.6$ MeV
$\Xi(1530)^0$ full width $\Gamma = 9.1 \pm 0.5$ MeV
$\Xi(1530)^-$ full width $\Gamma = 9.9^{+1.7}_{-1.9}$ MeV

$\Xi(1530)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Xi\pi$	100 %		158
$\Xi\gamma$	<3.7 %	90%	202

$\Xi(1690)$

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

Mass $m = 1690 \pm 10$ MeV [c]
Full width $\Gamma = 20 \pm 15$ MeV

$\Xi(1690)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda\overline{K}$	seen	240
$\Sigma\overline{K}$	seen	70
$\Xi\pi$	seen	311
$\Xi^-\pi^+\pi^-$	possibly seen	213

$\Xi(1820)\ 3/2^-$

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

Mass $m = 1823 \pm 5$ MeV [c]
Full width $\Gamma = 24^{+15}_{-10}$ MeV [c]

$\Xi(1820)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda\overline{K}$	large	402
$\Sigma\overline{K}$	small	324
$\Xi\pi$	small	421
$\Xi(1530)\pi$	small	237

Ξ(1950)

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

Mass $m = 1950 \pm 15$ MeV [c]
Full width $\Gamma = 60 \pm 20$ MeV [c]

Ξ(1950) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda\overline{K}$	seen	522
$\Sigma\overline{K}$	possibly seen	460
$\Xi\pi$	seen	519

Ξ(2030)

$I(J^P) = \frac{1}{2}(\geq \frac{5}{2}^?)$

Mass $m = 2025 \pm 5$ MeV [c]
Full width $\Gamma = 20^{+15}_{-5}$ MeV [c]

Ξ(2030) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda\overline{K}$	~ 20 %	585
$\Sigma\overline{K}$	~ 80 %	529
$\Xi\pi$	small	574
$\Xi(1530)\pi$	small	416
$\Lambda\overline{K}\pi$	small	499
$\Sigma\overline{K}\pi$	small	428

NOTES

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

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

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.

[c] Our estimate. See the Particle Listings for details.