

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

$\Lambda\pi^0 \quad \alpha = -0.406 \pm 0.013$

" $\phi = (21 \pm 12)^\circ$

" $\gamma = 0.85$ [a]

" $\Delta = (218^{+12}_{-19})^\circ$ [a]

$\Lambda\gamma \quad \alpha = -0.70 \pm 0.07$

$\Lambda e^+ e^- \quad \alpha = -0.8 \pm 0.2$

$\Sigma^0 \gamma \quad \alpha = -0.69 \pm 0.06$

$\Sigma^+ e^- \bar{\nu}_e \quad g_1(0)/f_1(0) = 1.21 \pm 0.05$

$\Sigma^+ e^- \bar{\nu}_e \quad f_2(0)/f_1(0) = 2.0 \pm 1.3$

Ξ^0 DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$\Lambda\pi^0$	(99.525 \pm 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
$\Sigma^+ e^- \bar{\nu}_e$	(2.53 \pm 0.08) $\times 10^{-4}$		120
$\Sigma^+ \mu^- \bar{\nu}_\mu$	(4.6 $^{+1.8}_{-1.4}$) $\times 10^{-6}$		64

$\Delta S = \Delta Q$ (SQ) violating modes or $\Delta S = 2$ forbidden (S2) modes

$\Sigma^- e^+ \nu_e$	SQ	< 9	$\times 10^{-4}$	90%	112
$\Sigma^- \mu^+ \nu_\mu$	SQ	< 9	$\times 10^{-4}$	90%	49
$p\pi^-$	S2	< 8	$\times 10^{-6}$	90%	299
$p e^- \bar{\nu}_e$	S2	< 1.3	$\times 10^{-3}$		323
$p \mu^- \bar{\nu}_\mu$	S2	< 1.3	$\times 10^{-3}$		309



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

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

$$\text{Mass } m = 1321.71 \pm 0.07 \text{ MeV}$$

$$(m_{\Xi^-} - m_{\Xi^+}) / m_{\Xi^-} = (-3 \pm 9) \times 10^{-5}$$

$$\text{Mean life } \tau = (1.639 \pm 0.015) \times 10^{-10} \text{ s}$$

$$c\tau = 4.91 \text{ cm}$$

$$(\tau_{\Xi^-} - \tau_{\Xi^+}) / \tau_{\Xi^-} = -0.01 \pm 0.07$$

$$\text{Magnetic moment } \mu = -0.6507 \pm 0.0025 \mu_N$$

$$(\mu_{\Xi^-} + \mu_{\Xi^+}) / |\mu_{\Xi^-}| = +0.01 \pm 0.05$$

Decay parameters

$$\Lambda\pi^- \quad \alpha = -0.458 \pm 0.012 \quad (S = 1.8)$$

$$[\alpha(\Xi^-)\alpha_-(\Lambda) - \alpha(\Xi^+)\alpha_+(\bar{\Lambda})] / [\text{sum}] = (0 \pm 7) \times 10^{-4}$$

$$" \quad \phi = (-2.1 \pm 0.8)^\circ$$

$$" \quad \gamma = 0.89 \text{ [a]}$$

$$" \quad \Delta = (175.9 \pm 1.5)^\circ \text{ [a]}$$

$$\Lambda e^- \bar{\nu}_e \quad g_A/g_V = -0.25 \pm 0.05 \text{ [b]}$$

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
$\Lambda e^- \bar{\nu}_e$	(5.63 ±0.31) × 10 ⁻⁴		190
$\Lambda\mu^- \bar{\nu}_\mu$	(3.5 ^{+3.5} / _{-2.2}) × 10 ⁻⁴		163
$\Sigma^0 e^- \bar{\nu}_e$	(8.7 ±1.7) × 10 ⁻⁵		123
$\Sigma^0 \mu^- \bar{\nu}_\mu$	< 8 × 10 ⁻⁴	90%	70
$\Xi^0 e^- \bar{\nu}_e$	< 2.3 × 10 ⁻³	90%	7

$\Delta S = 2$ forbidden (S_2) modes

$n\pi^-$	S_2	< 1.9 × 10 ⁻⁵	90%	304
$ne^- \bar{\nu}_e$	S_2	< 3.2 × 10 ⁻³	90%	327
$n\mu^- \bar{\nu}_\mu$	S_2	< 1.5 %	90%	314
$\rho\pi^- \pi^-$	S_2	< 4 × 10 ⁻⁴	90%	223
$\rho\pi^- e^- \bar{\nu}_e$	S_2	< 4 × 10 ⁻⁴	90%	305
$\rho\pi^- \mu^- \bar{\nu}_\mu$	S_2	< 4 × 10 ⁻⁴	90%	251
$\rho\mu^- \mu^-$	L	< 4 × 10 ⁻⁸	90%	272

$\Xi(1530) P_{13}$

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

$\Xi(1530)^0$ 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
$\Xi \gamma$	<4 %	90%	202

$\Xi(1690)$

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

Mass $m = 1690 \pm 10$ MeV [c]

Full width $\Gamma < 30$ MeV

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

$\Xi(1820) D_{13}$

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

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)
$\Lambda \bar{K}$	large	402
$\Sigma \bar{K}$	small	324
$\Xi \pi$	small	421
$\Xi(1530) \pi$	small	237

$\Xi(1950)$

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

Mass $m = 1950 \pm 15$ MeV [c]

Full width $\Gamma = 60 \pm 20$ MeV [c]

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

$\Xi(2030)$

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

Mass $m = 2025 \pm 5$ MeV [c]

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

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

NOTES

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

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

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