

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.

$$\text{Mass } m = 1314.86 \pm 0.20 \text{ MeV}$$

$$m_{\Xi^-} - m_{\Xi^0} = 6.85 \pm 0.21 \text{ MeV}$$

$$\text{Mean life } \tau = (2.90 \pm 0.09) \times 10^{-10} \text{ s}$$

$$c\tau = 8.71 \text{ cm}$$

$$\text{Magnetic moment } \mu = -1.250 \pm 0.014 \mu_N$$

Decay parameters

$$\Lambda\pi^0 \quad \alpha = -0.348 \pm 0.009$$

$$\alpha \text{ FOR } \Xi^0 \rightarrow \bar{\Lambda}\pi^0 = 0.379 \pm 0.004$$

$$" \quad \phi = (0.3 \pm 0.6)^\circ$$

$$\phi \text{ ANGLE FOR } \Xi^0 \rightarrow \bar{\Lambda}\pi^0 \text{ with } \tan\phi = \beta/\gamma = -0.3 \pm 0.6 \text{ degrees}$$

$$\Delta\phi_{CP}(\Xi^0) = (\phi_{\Xi^0} + \phi_{\Xi^0})/2 = 0.0 \pm 0.4 \text{ degrees}$$

$$A_{CP} \text{ FOR } \Xi^0 \rightarrow \Lambda\pi^0, \Xi^0 \rightarrow \bar{\Lambda}\pi^0 = (-5 \pm 7) \times 10^{-3}$$

$$" \quad \gamma = 0.85 [a]$$

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

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

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

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

$$\Sigma^+ e^- \bar{\nu}_e \quad g_1(0)/f_1(0) = 1.22 \pm 0.05$$

$$\Sigma^+ e^- \bar{\nu}_e \quad f_2(0)/f_1(0) = 2.0 \pm 0.9$$

Ξ^0 DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\Lambda\pi^0$	$(99.524 \pm 0.012) \%$		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
$\Sigma^+ e^- \bar{\nu}_e$	$(2.52 \pm 0.08) \times 10^{-4}$		120
$\Sigma^+ \mu^- \bar{\nu}_\mu$	$(2.33 \pm 0.35) \times 10^{-6}$		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
$p e^- \bar{\nu}_e$	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.

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

Decay parameters

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

Ξ^- DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	ρ (MeV/c)
$\Lambda\pi^-$	$(99.887\pm0.035)\%$		140
$\Sigma^-\gamma$	$(1.27\pm0.23)\times10^{-4}$		118
$\Lambda e^-\bar{\nu}_e$	$(5.63\pm0.31)\times10^{-4}$		190
$\Lambda\mu^-\bar{\nu}_\mu$	$(3.5^{+3.5}_{-2.2})\times10^{-4}$		163
$\Sigma^0 e^-\bar{\nu}_e$	$(8.7\pm1.7)\times10^{-5}$		123
$\Sigma^0\mu^-\bar{\nu}_\mu$	< 8	$\times10^{-4}$ 90%	70
$\Xi^0 e^-\bar{\nu}_e$	< 2.59	$\times10^{-4}$ 90%	7

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

$n\pi^-$	$S2$	< 1.9	$\times10^{-5}$	90%	304
$ne^-\bar{\nu}_e$	$S2$	< 3.2	$\times10^{-3}$	90%	327
$n\mu^-\bar{\nu}_\mu$	$S2$	< 1.5	%	90%	314
$p\pi^-\pi^-$	$S2$	< 4	$\times10^{-4}$	90%	223
$p\pi^-e^-\bar{\nu}_e$	$S2$	< 4	$\times10^{-4}$	90%	305
$p\pi^-\mu^-\bar{\nu}_\mu$	$S2$	< 4	$\times10^{-4}$	90%	251
$p\mu^-\mu^-$	L	< 4	$\times10^{-8}$	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	ρ (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)
$\Lambda \bar{K}$	seen	240
$\Sigma \bar{K}$	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)
$\Lambda \bar{K}$	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] Our estimate. See the Particle Listings for details.