

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 $m = 1314.83 \pm 0.20$ MeV

$m_{\Xi^-} - m_{\Xi^0} = 6.48 \pm 0.24$ 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

$\Lambda\pi^0 \quad \alpha = -0.411 \pm 0.022 \quad (S = 2.1)$

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

" $\gamma = 0.85 [h]$

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

$\Lambda\gamma \quad \alpha = 0.4 \pm 0.4$

$\Sigma^0\gamma \quad \alpha = -0.63 \pm 0.09$

$\Sigma^+ e^- \bar{\nu}_e \quad g_1(0)/f_1(0) = 1.32_{-0.18}^{+0.22}$

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

Ξ^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Lambda\pi^0$	(99.522±0.032) %	S=1.7	135
$\Lambda\gamma$	(1.18 ±0.30) × 10 ⁻³	S=2.0	184
$\Sigma^0\gamma$	(3.33 ±0.10) × 10 ⁻³		117
$\Sigma^+ e^- \bar{\nu}_e$	(2.7 ±0.4) × 10 ⁻⁴		120
$\Sigma^+ \mu^- \bar{\nu}_\mu$	< 1.1 × 10 ⁻³	CL=90%	64

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

$\Sigma^- e^+ \nu_e$	SQ	< 9	× 10 ⁻⁴	CL=90%	112
$\Sigma^- \mu^+ \nu_\mu$	SQ	< 9	× 10 ⁻⁴	CL=90%	49
$p\pi^-$	S2	< 4	× 10 ⁻⁵	CL=90%	299
$pe^- \bar{\nu}_e$	S2	< 1.3	× 10 ⁻³		323
$p\mu^- \bar{\nu}_\mu$	S2	< 1.3	× 10 ⁻³		309



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

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

Mass $m = 1321.31 \pm 0.13$ MeV

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

$c\tau = 4.91$ cm

Magnetic moment $\mu = -0.6507 \pm 0.0025 \mu_N$

Decay parameters

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

$[\alpha(\Xi^-)\alpha_-(\Lambda) - \alpha(\Xi^+)\alpha_+(\bar{\Lambda})]/[\alpha(\Xi^-)\alpha_-(\Lambda) + \alpha(\Xi^+)\alpha_+(\bar{\Lambda})]$
 $= 0.012 \pm 0.014$

" $\phi = (4 \pm 4)^\circ$

" $\gamma = 0.89 [h]$

" $\Delta = (188 \pm 8)^\circ [h]$

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

Ξ^- DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$\Lambda\pi^-$	(99.887±0.035) %		139
$\Sigma^-\gamma$	(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		122
$\Sigma^0 \mu^- \bar{\nu}_\mu$	< 8 × 10 ⁻⁴	90%	70
$\Xi^0 e^- \bar{\nu}_e$	< 2.3 × 10 ⁻³	90%	6

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

$n\pi^-$	S_2	< 1.9 × 10 ⁻⁵	90%	303
$ne^- \bar{\nu}_e$	S_2	< 3.2 × 10 ⁻³	90%	327
$n\mu^- \bar{\nu}_\mu$	S_2	< 1.5 %	90%	314
$p\pi^-\pi^-$	S_2	< 4 × 10 ⁻⁴	90%	223
$p\pi^- e^- \bar{\nu}_e$	S_2	< 4 × 10 ⁻⁴	90%	304
$p\pi^- \mu^- \bar{\nu}_\mu$	S_2	< 4 × 10 ⁻⁴	90%	250
$p\mu^- \mu^-$	L	< 4 × 10 ⁻⁴	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 %		152
$\Xi \gamma$	<4 %	90%	200

$\Xi(1690)$

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

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

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	51
$\Xi \pi$	seen	—
$\Xi^- \pi^+ \pi^-$	possibly seen	214

$\Xi(1820) D_{13}$

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

Mass $m = 1823 \pm 5$ MeV [j]

Full width $\Gamma = 24^{+15}_{-10}$ MeV [j]

$\Xi(1820)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda \bar{K}$	large	400
$\Sigma \bar{K}$	small	320
$\Xi \pi$	small	413
$\Xi(1530)\pi$	small	234

$\Xi(1950)$

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

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

$\Xi(1950)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda \bar{K}$	seen	522
$\Sigma \bar{K}$	possibly seen	460
$\Xi \pi$	seen	518

$\Xi(2030)$

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

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

$\Xi(2030)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda \bar{K}$	$\sim 20\%$	589
$\Sigma \bar{K}$	$\sim 80\%$	533
$\Xi \pi$	small	573
$\Xi(1530)\pi$	small	421
$\Lambda \bar{K} \pi$	small	501
$\Sigma \bar{K} \pi$	small	430