

# $\Xi$ BARYONS

## ( $S = -2, I = 1/2$ )

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

 $\Xi^0$ 

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

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

$$\text{Mass } m = 1314.83 \pm 0.20 \text{ MeV}$$

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

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

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

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

### Decay parameters

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

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

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

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

$$\Lambda\gamma \quad \alpha = -0.73 \pm 0.17$$

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

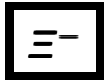
$$\Sigma^+ e^- \bar{\nu}_e \quad g_1(0)/f_1(0) = 1.32_{-0.18}^{+0.22}$$

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

$\Xi^0$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$P$ (MeV/c)
$\Lambda\pi^0$	(99.523±0.013) %		135
$\Lambda\gamma$	( 1.17 ±0.07 ) × 10 <sup>-3</sup>		184
$\Sigma^0\gamma$	( 3.33 ±0.10 ) × 10 <sup>-3</sup>		117
$\Sigma^+ e^- \bar{\nu}_e$	( 2.7 ±0.4 ) × 10 <sup>-4</sup>		119
$\Sigma^+ \mu^- \bar{\nu}_\mu$	( 4.9 $_{-1.6}^{+2.1}$ ) × 10 <sup>-6</sup>		64

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

$\Sigma^- e^+ \nu_e$	SQ < 9	× 10 <sup>-4</sup>	90%	112
$\Sigma^- \mu^+ \nu_\mu$	SQ < 9	× 10 <sup>-4</sup>	90%	49
$\rho\pi^-$	S2 < 8	× 10 <sup>-6</sup>	90%	299
$\rho e^- \bar{\nu}_e$	S2 < 1.3	× 10 <sup>-3</sup>		323
$\rho\mu^- \bar{\nu}_\mu$	S2 < 1.3	× 10 <sup>-3</sup>		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**

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

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

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

"  $\gamma = 0.89$  [a]

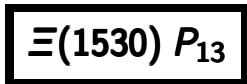
"  $\Delta = (175.9 \pm 1.5)^\circ$  [a]

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

$\Xi^-$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$P$ (MeV/c)
$\Lambda\pi^-$	$(99.887 \pm 0.035) \%$		139
$\Sigma^- \gamma$	$(1.27 \pm 0.23) \times 10^{-4}$		118
$\Lambda e^- \bar{\nu}_e$	$(5.63 \pm 0.31) \times 10^{-4}$		190
$\Lambda\mu^- \bar{\nu}_\mu$	$(3.5^{+3.5}_{-2.2}) \times 10^{-4}$		163
$\Sigma^0 e^- \bar{\nu}_e$	$(8.7 \pm 1.7) \times 10^{-5}$		122
$\Sigma^0 \mu^- \bar{\nu}_\mu$	$< 8 \times 10^{-4}$	90%	70
$\Xi^0 e^- \bar{\nu}_e$	$< 2.3 \times 10^{-3}$	90%	6

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

$n\pi^-$	$S_2$	$< 1.9 \times 10^{-5}$	90%	303
$ne^- \bar{\nu}_e$	$S_2$	$< 3.2 \times 10^{-3}$	90%	327
$n\mu^- \bar{\nu}_\mu$	$S_2$	$< 1.5 \%$	90%	313
$p\pi^- \pi^-$	$S_2$	$< 4 \times 10^{-4}$	90%	223
$p\pi^- e^- \bar{\nu}_e$	$S_2$	$< 4 \times 10^{-4}$	90%	304
$p\pi^- \mu^- \bar{\nu}_\mu$	$S_2$	$< 4 \times 10^{-4}$	90%	250
$p\mu^- \mu^-$	$L$	$< 4 \times 10^{-8}$	90%	272



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

$\Xi(1530)^0$  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 ( $\Gamma_i/\Gamma$ )	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 ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda\bar{K}$	seen	240
$\Sigma\bar{K}$	seen	70
$\Xi\pi$	seen	311
$\Xi^-\pi^+\pi^-$	possibly seen	214

### $\Xi(1820) D_{13}$

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

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

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

$\Xi(1820)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (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 ( $\Gamma_i/\Gamma$ )	$p$ (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  $\Gamma = 20_{-5}^{+15}$  MeV [c]

<b><math>\Xi(2030)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (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  $\gamma$  and  $\Delta$  are calculated from  $\alpha$  and  $\phi$  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  $\phi_{AV}$  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.