

Ξ BARYONS

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

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

NODE=BXXX030

Ξ⁰

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

NODE=S023

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 $\mu = -1.250 \pm 0.014 \mu_N$

NODE=S023M;DTYPE=M

NODE=S023D;DTYPE=D

NODE=S023T;DTYPE=T

NODE=S023CTA;DTYPE=C;OUR EVAL

NODE=S023MM;DTYPE=m

CLUMP=D

NODE=S023A;DTYPE=d;CLUMP=D;OUR

EVAL
NODE=S023A03;DTYPE=d;CLUMP=D

NODE=S023F;DTYPE=d;CLUMP=D

NODE=S023A01;DTYPE=d;CLUMP=D

NODE=S023A02;DTYPE=d;CLUMP=D

NODE=S023A00;DTYPE=d;CLUMP=D

NODE=S023GD;DTYPE=d;CLUMP=D;OUR

EVAL;→ UNCHECKED ←

NODE=S023DD;DTYPE=d;CLUMP=D;OUR

EVAL;UNCHECKED ←
NODE=S023LG;DTYPE=d;CLUMP=D

NODE=S023LEE;DTYPE=d;CLUMP=D

NODE=S023AG;DTYPE=d;CLUMP=D

NODE=S023AH;DTYPE=d;CLUMP=D

NODE=S023AJ;DTYPE=d;CLUMP=D

Decay parameters

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

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

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

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

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

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

" $\gamma = 0.85$ [a]

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

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

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

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

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

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

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

NODE=S023225;DESIG=1

DESIG=9

DESIG=12

DESIG=10

DESIG=4

DESIG=6

ΔS = ΔQ (SQ) violating modes or ΔS = 2 forbidden (S2) modes

NODE=S023;CLUMP=A

$\Sigma^- e^+ \nu_e$	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

DESIG=5

DESIG=7

DESIG=2

DESIG=3

DESIG=8

Ξ⁻

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

NODE=S022

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

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

NODE=S022M;DTYPE=M

NODE=S022DMM;DTYPE=D

NODE=S022T;DTYPE=T

NODE=S022CTA;DTYPE=C;OUR EVAL

NODE=S022DT;DTYPE=i

NODE=S022MM;DTYPE=m

NODE=S022MMD;DTYPE=i;OUR EVAL;
→ UNCHECKED ←

Decay parameters

$$\Lambda\pi^- \quad \alpha = -0.385 \pm 0.008 \quad (S = 2.4)$$

$$\bar{\Lambda}\pi^+ \quad \bar{\alpha} = 0.374^{+0.005}_{-0.006}$$

$$(\alpha + \bar{\alpha}) / (\alpha - \bar{\alpha}) \text{ for } \Xi^- \rightarrow \Lambda\pi^-, \Xi^+ \rightarrow \bar{\Lambda}\pi^+ = (-9^{+11}_{-8}) \times 10^{-3}$$

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

$$\Lambda\pi^- \quad \phi_- = (-1.5 \pm 0.6)^\circ$$

$$" \quad \gamma = 0.89 [a]$$

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

$$\bar{\Lambda}\pi^+ \quad \phi_+ = (0.6^{+0.7}_{-1.0})^\circ$$

$$\Delta\phi_{CP} = (\phi_- + \phi_+)/2 = (-0.2^{+0.5}_{-0.6})^\circ$$

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

CLUMP=D

NODE=S022A;DTYPE=d;CLUMP=D

NODE=S022A00;DTYPE=d;CLUMP=D

NODE=S022A01;DTYPE=d;CLUMP=D

NODE=S022ACP;DTYPE=d;CLUMP=D

NODE=S022F;DTYPE=d;CLUMP=D

NODE=S022GD;DTYPE=d;CLUMP=D;OUR

EVAL;→ UNCHECKED ←

NODE=S022DD;DTYPE=d;CLUMP=D;OUR

EVAL;→ UNCHECKED ←

NODE=S022F00;DTYPE=d;CLUMP=D

NODE=S022A02;DTYPE=d;CLUMP=D

NODE=S022AV;DTYPE=d;CLUMP=D

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
$\Xi^0 e^- \bar{\nu}_e$	< 2.59 × 10 ⁻⁴	90%	7

NODE=S022235;DESIG=1

DESIG=9

DESIG=2

DESIG=4

DESIG=5

DESIG=6

DESIG=13

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

$n\pi^-$	$S2$	< 1.9 × 10 ⁻⁵	90%	304
$ne^- \bar{\nu}_e$	$S2$	< 3.2 × 10 ⁻³	90%	327
$n\mu^- \bar{\nu}_\mu$	$S2$	< 1.5 %	90%	314
$p\pi^- \pi^-$	$S2$	< 4 × 10 ⁻⁴	90%	223
$p\pi^- e^- \bar{\nu}_e$	$S2$	< 4 × 10 ⁻⁴	90%	305
$p\pi^- \mu^- \bar{\nu}_\mu$	$S2$	< 4 × 10 ⁻⁴	90%	251
$p\mu^- \mu^-$	L	< 4 × 10 ⁻⁸	90%	272

NODE=S022;CLUMP=A

DESIG=3

DESIG=7

DESIG=8

DESIG=10

DESIG=11

DESIG=12

DESIG=14

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

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

$$\Xi(1530)^0 \text{ mass } m = 1531.80 \pm 0.32 \text{ MeV } (S = 1.3)$$

$$\Xi(1530)^- \text{ mass } m = 1535.0 \pm 0.6 \text{ MeV}$$

$$\Xi(1530)^0 \text{ full width } \Gamma = 9.1 \pm 0.5 \text{ MeV}$$

$$\Xi(1530)^- \text{ full width } \Gamma = 9.9^{+1.7}_{-1.9} \text{ MeV}$$

NODE=B049

NODE=B049M0;DTYPE=M

NODE=B049M-;DTYPE=M

NODE=B049W0;DTYPE=G

NODE=B049W-;DTYPE=G

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

NODE=B049225;DESIG=1;OUR EST

DESIG=2

 $\Xi(1690)$

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

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

$$\text{Full width } \Gamma = 20 \pm 15 \text{ MeV}$$

NODE=B105

NODE=B105M;DTYPE=M;OUR EST;

→ UNCHECKED ←

NODE=B105W;DTYPE=G;OUR EST;

→ UNCHECKED ←

$\Xi(1690)$ 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

NODE=B105215;DESIG=2
DESIG=1;OUR EST
DESIG=3;OUR EST
DESIG=6

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

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

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

NODE=B050

NODE=B050M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B050W;DTYPE=G;OUR EST;
→ UNCHECKED ←

$\Xi(1820)$ 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

NODE=B050215;DESIG=1;OUR EST
DESIG=3;OUR EST
DESIG=2;OUR EST
DESIG=4;OUR EST

$\Xi(1950)$

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

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

NODE=B052

NODE=B052M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B052W;DTYPE=G;OUR EST;
→ UNCHECKED ←

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

NODE=B052215;DESIG=7;OUR EST
DESIG=6
DESIG=1;OUR EST

$\Xi(2030)$

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

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

NODE=B068

NODE=B068M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B068W;DTYPE=G;OUR EST;
→ UNCHECKED ←

$\Xi(2030)$ 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

NODE=B068215;DESIG=2;OUR EST
DESIG=3;OUR EST
DESIG=1;OUR EST
DESIG=4;OUR EST
DESIG=6;OUR EST
DESIG=7;OUR EST

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.

LINKAGE=SBE

[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.

LINKAGE=SBD

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

LINKAGE=BH