Ξ^0

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

The parity has not actually been measured, but + is of course expected.

Ξ^0 MASS

The fit uses the Ξ^0, Ξ^-, and $\overline{\Xi}^+$ masses and the $\Xi^- - \Xi^0$ mass difference. It assumes that the Ξ^- and $\overline{\Xi}^+$ masses are the same.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1314.86±0.20 OUR FIT					
1314.82±0.06±0.20	3120	FANTI	00	NA48	p Be, 450 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1315.2 ±0.92	49	WILQUET	72	HLBC	
1313.4 ±1.8	1	PALMER	68	HBC	

$m_{\Xi^-} - m_{\Xi^0}$

The fit uses the Ξ^0, Ξ^-, and $\overline{\Xi}^+$ masses and the $\Xi^- - \Xi^0$ mass difference. It assumes that the Ξ^- and $\overline{\Xi}^+$ masses are the same.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
6.85±0.21 OUR FIT					
6.3 ±0.7 OUR AVERAGE					
6.9 ±2.2	29	LONDON	66	HBC	
6.1 ±0.9	88	PJERROU	65B	HBC	
6.8 ±1.6	23	JAUNEAU	63	FBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.1 ±1.6	45	CARMONY	64B	HBC	See PJERROU 65B

Ξ^0 MEAN LIFE

VALUE (10^{-10} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.90±0.09 OUR AVERAGE					
2.83±0.16	6300	[1] ZECH	77	SPEC	Neutral hyperon beam
$2.88^{+0.21}_{-0.19}$	652	BALTAY	74	HBC	1.75 GeV/c $K^- p$
$2.90^{+0.32}_{-0.27}$	157	[2] MAYEUR	72	HLBC	2.1 GeV/c K^-
$3.07^{+0.22}_{-0.20}$	340	DAUBER	69	HBC	
3.0 ±0.5	80	PJERROU	65B	HBC	
$2.5^{+0.4}_{-0.3}$	101	HUBBARD	64	HBC	
$3.9^{+1.4}_{-0.8}$	24	JAUNEAU	63	FBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.5^{+1.0}_{-0.8}$	45	CARMONY	64B	HBC	See PJERROU 65B

[1] The ZECH 77 result is $\tau_{\Xi^0} = [2.77-(\tau_\Lambda-2.69)] \times 10^{-10}$ s, in which we use $\tau_\Lambda = 2.63 \times 10^{-10}$ s.
[2] The MAYEUR 72 value is modified by the erratum.

Ξ^0 MAGNETIC MOMENT

See the "Note on Baryon Magnetic Moments" in the Λ Listings.

VALUE (μ_N)	*EVTS*	*DOCUMENT ID*		*TECN*
−1.250±0.014 OUR AVERAGE				
−1.253±0.014	270k	COX	81	SPEC
−1.20 ±0.06	42k	BUNCE	79	SPEC

Ξ^0 DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Confidence level
Γ_1	$\Lambda\pi^0$		(99.525±0.012) %	
Γ_2	$\Lambda\gamma$		(1.17 ±0.07) $\times 10^{-3}$	
Γ_3	$\Sigma^0\gamma$		(3.33 ±0.10) $\times 10^{-3}$	
Γ_4	$\Sigma^+ e^- \overline{\nu}_e$		(2.53 ±0.08) $\times 10^{-4}$	
Γ_5	$\Sigma^+ \mu^- \overline{\nu}_\mu$		(4.6 $^{+1.8}_{-1.4}$) $\times 10^{-6}$	
	$\Delta S = \Delta Q$ (SQ) violating modes or $\Delta S = 2$ forbidden ($S2$) modes			
Γ_6	$\Sigma^- e^+ \nu_e$	*SQ*	< 9 $\times 10^{-4}$	90%
Γ_7	$\Sigma^- \mu^+ \nu_\mu$	*SQ*	< 9 $\times 10^{-4}$	90%
Γ_8	$p\pi^-$	*S2*	< 8 $\times 10^{-6}$	90%
Γ_9	$p e^- \overline{\nu}_e$	*S2*	< 1.3 $\times 10^{-3}$	
Γ_{10}	$p \mu^- \overline{\nu}_\mu$	*S2*	< 1.3 $\times 10^{-3}$	

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 9 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 =$ 4.6 for 6 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle\delta x_i \delta x_j\right\rangle/(\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\rm total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	−57		
x_3	−82	0	
x_4	−7	0	0
	x_1	x_2	x_3

Ξ^0 BRANCHING RATIOS

$\Gamma(\Lambda\gamma)/\Gamma(\Lambda\pi^0)$ — Γ_2/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.17±0.07 OUR FIT					
1.17±0.07 OUR AVERAGE					
1.17±0.05±0.06	672	[3] LAI	04A	NA48	p Be, 450 GeV
1.91±0.34±0.19	31	[4] FANTI	00	NA48	p Be, 450 GeV
1.06±0.12±0.11	116	JAMES	90	SPEC	FNAL hyperons

[3] LAI 04A used our 2002 value of 99.5% for the $\Xi^0 \to \Lambda\pi^0$ branching fraction to get $\Gamma(\Xi^0 \to \Lambda\gamma)/\Gamma_{total} = (1.16 \pm 0.05 \pm 0.06) \times 10^{-3}$. We adjust slightly to go back to what was directly measured.

[4] FANTI 00 used our 1998 value of 99.5% for the $\Xi^0 \to \Lambda\pi^0$ branching fraction to get $\Gamma(\Xi^0 \to \Lambda\gamma)/\Gamma_{total} = (1.90 \pm 0.34 \pm 0.19) \times 10^{-3}$. We adjust slightly to go back to what was directly measured.

$\Gamma(\Sigma^0\gamma)/\Gamma(\Lambda\pi^0)$ — Γ_3/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.35±0.10 OUR FIT					
3.35±0.10 OUR AVERAGE					
3.34±0.05±0.09	4045	ALAVI-HARATI	01C	KTEV	p nucleus, 800 GeV
3.16±0.76±0.32	17	[5] FANTI	00	NA48	p Be, 450 GeV
3.56±0.42±0.10	85	TEIGE	89	SPEC	FNAL hyperons

[5] FANTI 00 used our 1998 value of 99.5% for the $\Xi^0 \to \Lambda\pi^0$ branching fraction to get $\Gamma(\Xi^0 \to \Sigma^0\gamma)/\Gamma_{total} = (3.14 \pm 0.76 \pm 0.32) \times 10^{-3}$. We adjust slightly to go back to what was directly measured.

$\Gamma(\Sigma^+ e^- \overline{\nu}_e)/\Gamma_{total}$ — Γ_4/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
2.53±0.08 OUR FIT					
2.53±0.08 OUR AVERAGE					
2.51±0.03±0.09	6101	BATLEY	07	NA48	p Be, 400 GeV
2.55±0.14±0.10	419	[6] BATLEY	07	NA48	p Be, 400 GeV
2.71±0.22±0.31	176	AFFOLDER	99	KTEV	p nucleus, 800 GeV

[6] This BATLEY 07 result is for $\overline{\Xi}^0 \to \overline{\Sigma}^- e^+ \nu_e$ events.

$\Gamma(\Sigma^+ \mu^- \overline{\nu}_\mu)/\Gamma(\Sigma^+ e^- \overline{\nu}_e)$ — Γ_5/Γ_4

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.018^{+0.007}_{-0.005}\pm0.002$	9	ABOUZAID	05	KTEV	p nucleus 800 GeV

$\Gamma(\Sigma^+ \mu^- \overline{\nu}_\mu)/\Gamma(\Lambda\pi^0)$ — Γ_5/Γ_1

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<1.1	90	0	YEH	74	HBC	Effective denom.=2100
<1.5			DAUBER	69	HBC	
<7			HUBBARD	66	HBC	

$\Gamma(\Sigma^- e^+ \nu_e)/\Gamma(\Lambda\pi^0)$ — Γ_6/Γ_1

Test of $\Delta S = \Delta Q$ rule.

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<0.9	90	0	YEH	74	HBC	Effective denom.=2500
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<1.5			DAUBER	69	HBC	
<6			HUBBARD	66	HBC	

$\Gamma(\Sigma^- \mu^+ \nu_\mu)/\Gamma(\Lambda\pi^0)$ — Γ_7/Γ_1

Test of $\Delta S = \Delta Q$ rule.

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<0.9	90	0	YEH	74	HBC	Effective denom.=2500
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<1.5			DAUBER	69	HBC	
<6			HUBBARD	66	HBC	

$\Gamma(p\pi^-)/\Gamma(\Lambda\pi^0)$ — Γ_8/Γ_1

ΔS=2. Forbidden in first-order weak interaction.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 8.2	90		WHITE	05	HYCP	p Cu, 800 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 36	90		GEWENIGER	75	SPEC	
<1800	90	0	YEH	74	HBC	Effective denom.=1300
< 900			DAUBER	69	HBC	
<5000			HUBBARD	66	HBC	

$\Gamma(p e^- \overline{\nu}_e)/\Gamma(\Lambda\pi^0)$ — Γ_9/Γ_1

ΔS=2. Forbidden in first-order weak interaction.

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<1.3			DAUBER	69	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.4	90	0	YEH	74	HBC	Effective denom.=670
<6			HUBBARD	66	HBC	

$\Gamma(p \mu^- \overline{\nu}_\mu)/\Gamma(\Lambda\pi^0)$ — Γ_{10}/Γ_1

ΔS=2. Forbidden in first-order weak interaction.

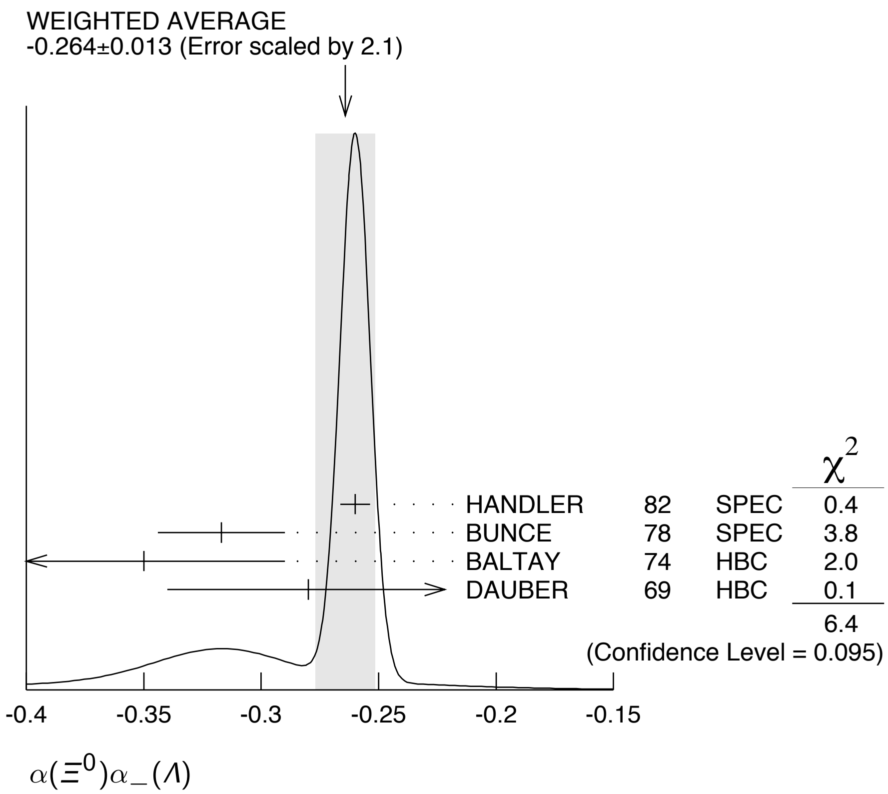
VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<1.3			DAUBER	69	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.5	90	0	YEH	74	HBC	Effective denom.=664
<6			HUBBARD	66	HBC	

Ξ^0 DECAY PARAMETERS

See the "Note on Baryon Decay Parameters" in the neutron Listings.

$\alpha(\Xi^0)\ \alpha_-(\Lambda)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.264±0.013 OUR AVERAGE	Error includes scale factor of 2.1. See the ideogram below.				
−0.260±0.004±0.005	300k	HANDLER	82	SPEC	FNAL hyperons
−0.317±0.027	6075	BUNCE	78	SPEC	FNAL hyperons
−0.35 ±0.06	505	BALTAY	74	HBC	$K^- p$ 1.75 GeV/c
−0.28 ±0.06	739	DAUBER	69	HBC	$K^- p$ 1.7–2.6 GeV/c



α FOR $\Xi^0 \rightarrow \Lambda\pi^0$

The above average, $\alpha(\Xi^0)\alpha_-(\Lambda) = -0.264 \pm 0.013$, where the error includes a scale factor of 2.1, divided by our current average $\alpha_-(\Lambda) = 0.642 \pm 0.013$, gives the following value for $\alpha(\Xi^0)$.

VALUE	DOCUMENT ID
−0.411±0.022 OUR EVALUATION	Error includes scale factor of 2.1.

ϕ ANGLE FOR $\Xi^0 \rightarrow \Lambda\pi^0$ $(\tan\phi = \beta/\gamma)$

VALUE (°)	EVTS	DOCUMENT ID		TECN	COMMENT
21±12 OUR AVERAGE					
16±17	652	BALTAY	74	HBC	1.75 GeV/c $K^- p$
38±19	739	[7] DAUBER	69	HBC	
− 8±30	146	[8] BERGE	66	HBC	

[7] DAUBER 69 uses $\alpha_\Lambda = 0.647 \pm 0.020$.
[8] The errors have been multiplied by 1.2 due to approximations used for the Ξ polarization; see DAUBER 69 for a discussion.

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α FOR $\Xi^0 \rightarrow \Lambda\gamma$

See the note above on "Radiative Hyperon Decays."

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
−0.73±0.17 OUR AVERAGE					
−0.78±0.18±0.06	672	LAI	04A	NA48	*p* Be, 450 GeV
−0.43±0.44	87	[9] JAMES	90	SPEC	FNAL hyperons

[9] The sign has been changed; see the erratum, JAMES 02.

α FOR $\Xi^0 \rightarrow \Sigma^0\gamma$

See the note above on "Radiative Hyperon Decays."

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
−0.63±0.08±0.05	4045	ALAVI-HARATI	01C	KTEV	*p* nucleus, 800 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
+0.20±0.32±0.05	85	[10] TEIGE	89	SPEC	FNAL hyperons

[10] This result has been withdrawn, due to an error. See the erratum, TEIGE 02.

$g_1(0)/f_1(0)$ FOR $\Xi^0 \rightarrow \Sigma^+ e^- \overline{\nu}_e$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.21±0.05 OUR AVERAGE					
+1.20±0.04±0.03		[11] BATLEY	07	NA48	*p* Be, 400 GeV
$+1.32^{+0.21}_{-0.17}\pm0.05$	487	[12] ALAVI-HARATI	01I	KTEV	*p* nucleus, 800 GeV

[11] This BATLEY 07 result uses our 2006 value of V_{us} from semileptonic kaon decays as input.
[12] ALAVI-HARATI 01I assumes here that the second-class current is zero and that the weak-magnetism term takes its exact SU(3) value.

$g_2(0)/f_1(0))$ FOR $\Xi^0 \rightarrow \Sigma^+ e^- \overline{\nu}_e$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{-1.7^{+2.1}_{-2.0}\pm0.5}$	487	[13] ALAVI-HARATI	01I	KTEV	*p* nucleus, 800 GeV

[13] ALAVI-HARATI 01I thus assumes that $g_2 = 0$ in calculating g_1/f_1, above.

$f_2(0)/f_1(0)$ FOR $\Xi^0 \rightarrow \Sigma^+ e^- \overline{\nu}_e$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.0±1.2±0.5	487	ALAVI-HARATI	01I	KTEV	*p* nucleus, 800 GeV

Ξ^0 REFERENCES

BATLEY	07	PL B645 36	J.R. Batley *et al.*	(CERN NA48/1 Collab.)
ABOUZAID	05	PRL 95 081801	E. Abouzaid *et al.*	(FNAL KTeV Collab.)
WHITE	05	PRL 94 101804	C.G. White *et al.*	(FNAL HyperCP Collab.)
LAI	04A	PL B584 251	A. Lai *et al.*	(CERN NA48 Collab.)
JAMES	02	PRL 89 169901 (erratum)	C. James *et al.*	(MINN, MICH, WISC, RUTG)
TEIGE	02	PRL 89 169902 (erratum)	S. Teige *et al.*	(RUTG, MICH, MINN)
ALAVI-HARATI	01C	PRL 86 3239	A. Alavi-Harati *et al.*	(FNAL KTeV Collab.)
ALAVI-HARATI	01I	PRL 87 132001	A. Alavi-Harati *et al.*	(FNAL KTeV Collab.)
FANTI	00	EPJ C12 69	V. Fanti *et al.*	(CERN NA48 Collab.)
AFFOLDER	99	PRL 82 3751	A. Affolder *et al.*	(FNAL KTeV Collab.)
JAMES	90	PRL 64 843	C. James *et al.*	(MINN, MICH, WISC, RUTG)
TEIGE	89	PRL 63 2717	S. Teige *et al.*	(RUTG, MICH, MINN)
HANDLER	82	PR D25 639	R. Handler *et al.*	(WISC, MICH, MINN+)
COX	81	PRL 46 877	P.T. Cox *et al.*	(MICH, WISC, RUTG, MINN+)
BUNCE	79	PL 86B 386	G.R.M. Bunce *et al.*	(BNL, MICH, RUTG+)
BUNCE	78	PR D18 633	G.R.M. Bunce *et al.*	(WISC, MICH, RUTG)
ZECH	77	NP B124 413	G. Zech *et al.*	(SIEG, CERN, DORT, HEIDH)
GEWENIGER	75	PL 57B 193	C. Geweniger *et al.*	(CERN, HEIDH)
BALTAY	74	PR D9 49	C. Baltay *et al.*	(COLU, BING) J
YEH	74	PR D10 3545	N. Yeh *et al.*	(BING, COLU)
MAYEUR	72	NP B47 333	C. Mayeur *et al.*	(BRUX, CERN, TUFTS, LOUC)
Also		NP B53 268 (erratum)	C. Mayeur	
WILQUET	72	PL 42B 372	G. Wilquet *et al.*	(BRUX, CERN, TUFTS+)
DAUBER	69	PR 179 1262	P.M. Dauber *et al.*	(LRL)
PALMER	68	PL 26B 323	R.B. Palmer *et al.*	(BNL, SYRA)
BERGE	66	PR 147 945	J.P. Berge *et al.*	(LRL)
HUBBARD	66	Thesis UCRL 11510	J.R. Hubbard	(LRL)
LONDON	66	PR 143 1034	G.W. London *et al.*	(BNL, SYRA)
PJERROU	65B	PRL 14 275	G.M. Pjerrou *et al.*	(UCLA)
Also		Thesis	G.M. Pjerrou	(UCLA)
CARMONY	64B	PRL 12 482	D.D. Carmony *et al.*	(UCLA)
HUBBARD	64	PR 135B 183	J.R. Hubbard *et al.*	(LRL)
JAUNEAU	63	PL 4 49	L. Jauneau *et al.*	(EPOL, CERN, LOUC+)
Also		Siena Conf. 1 1	L. Jauneau *et al.*	(EPOL, CERN, LOUC+)