



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

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

Ξ⁰ MASS

The fit uses the Ξ⁰, Ξ⁻, and Ξ⁺ masses and the Ξ⁻ - Ξ⁰ mass difference. It assumes that the Ξ⁻ and Ξ⁺ 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 <i>p</i> 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 Ξ⁰, Ξ⁻, and Ξ⁺ masses and the Ξ⁻ - Ξ⁰ mass difference. It assumes that the Ξ⁻ and Ξ⁺ 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

Ξ⁰ 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/ <i>c</i> <i>K</i> ⁻ <i>p</i>
2.90 ^{+0.32} _{-0.27}	157	² MAYEUR	72	HLBC 2.1 GeV/ <i>c</i> <i>K</i> ⁻
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

¹The 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.
²The 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) × 10 ⁻³	
Γ_3 $\Lambda e^+ e^-$	(7.6 ± 0.6) × 10 ⁻⁶	
Γ_4 $\Sigma^0\gamma$	(3.33 ± 0.10) × 10 ⁻³	
Γ_5 $\Sigma^+ e^- \bar{\nu}_e$	(2.53 ± 0.08) × 10 ⁻⁴	
Γ_6 $\Sigma^+ \mu^- \bar{\nu}_\mu$	(4.6 ^{+1.8} _{-1.4}) × 10 ⁻⁶	

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

Γ_7 $\Sigma^- e^+ \nu_e$	SQ	< 9	× 10 ⁻⁴	90%
Γ_8 $\Sigma^- \mu^+ \nu_\mu$	SQ	< 9	× 10 ⁻⁴	90%
Γ_9 $p\pi^-$	S2	< 8	× 10 ⁻⁶	90%
Γ_{10} $p e^- \bar{\nu}_e$	S2	< 1.3	× 10 ⁻³	
Γ_{11} $p \mu^- \bar{\nu}_\mu$	S2	< 1.3	× 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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-57		
x_4	-82	0	
x_5	-7	0	0
	x_1	x_2	x_4

Ξ^0 BRANCHING RATIOS

$\Gamma(\Lambda\gamma)/\Gamma(\Lambda\pi^0)$

Γ_2/Γ_1

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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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 $\Xi^0 \rightarrow \Lambda\pi^0$ branching fraction to get $\Gamma(\Xi^0 \rightarrow \Lambda\gamma)/\Gamma_{\text{total}} = (1.16 \pm 0.05 \pm 0.06) \times 10^{-3}$. We adjust slightly to go back to what was directly measured.

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

$\Gamma(\Lambda e^+ e^-)/\Gamma_{\text{total}}$

Γ_3/Γ

<u>VALUE (units 10^{-6})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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7.6±0.4±0.5 397 ± 21 ⁵ BATLEY 07C NA48 p Be, 400 GeV

⁵ This BATLEY 07C result is consistent with internal bremsstrahlung.

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

Γ_4/Γ_1

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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3.35±0.10 OUR FIT

3.35±0.10 OUR AVERAGE

3.34±0.05±0.09	4045	ALAVI-HARATI01C	KTEV	p nucleus, 800 GeV
3.16±0.76±0.32	17	⁶ FANTI	00 NA48	p Be, 450 GeV
3.56±0.42±0.10	85	TEIGE	89 SPEC	FNAL hyperons

⁶ FANTI 00 used our 1998 value of 99.5% for the $\Xi^0 \rightarrow \Lambda\pi^0$ branching fraction to get $\Gamma(\Xi^0 \rightarrow \Sigma^0\gamma)/\Gamma_{\text{total}} = (3.14 \pm 0.76 \pm 0.32) \times 10^{-3}$. We adjust slightly to go back to what was directly measured.

$\Gamma(\Sigma^+ e^- \bar{\nu}_e)/\Gamma_{\text{total}}$

Γ_5/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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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	⁷ BATLEY	07 NA48	p Be, 400 GeV
2.71±0.22±0.31	176	AFFOLDER	99 KTEV	p nucleus, 800 GeV

⁷ This BATLEY 07 result is for $\Xi^0 \rightarrow \bar{\Sigma}^- e^+ \nu_e$ events.

$\Gamma(\Sigma^+ \mu^- \bar{\nu}_\mu)/\Gamma(\Sigma^+ e^- \bar{\nu}_e)$

Γ_6/Γ_5

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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0.018^{+0.007}_{-0.005} ± 0.002 9 ABOUZAIID 05 KTEV p nucleus 800 GeV

$\Gamma(\Sigma^+ \mu^- \bar{\nu}_\mu) / \Gamma(\Lambda \pi^0)$ Γ_6 / Γ_1

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • 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_7 / Γ_1

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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<0.9	90	0	YEH	74	HBC Effective denom.=2500
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• • • 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_8 / Γ_1

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

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

<1.5			DAUBER	69	HBC
<6			HUBBARD	66	HBC

$\Gamma(\rho \pi^-) / \Gamma(\Lambda \pi^0)$ Γ_9 / Γ_1

$\Delta S=2$. Forbidden in first-order weak interaction.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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< 8.2	90		WHITE	05	HYCP p Cu, 800 GeV
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• • • 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

$\Gamma(\rho e^- \bar{\nu}_e) / \Gamma(\Lambda \pi^0)$ Γ_{10} / Γ_1

$\Delta S=2$. Forbidden in first-order weak interaction.

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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<1.3			DAUBER	69	HBC
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• • • 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

$\Gamma(\rho \mu^- \bar{\nu}_\mu) / \Gamma(\Lambda \pi^0)$ Γ_{11} / Γ_1

$\Delta S=2$. Forbidden in first-order weak interaction.

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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<1.3			DAUBER	69	HBC
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• • • 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.

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.264 ± 0.013 OUR AVERAGE		Error includes scale factor of 2.1.		
$-0.260 \pm 0.004 \pm 0.005$	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 $\alpha(\Xi^0)$.

<u>VALUE</u>	<u>DOCUMENT ID</u>
-0.411 ± 0.022 OUR EVALUATION	Error includes scale factor of 2.1.

ϕ ANGLE FOR $\Xi^0 \rightarrow \Lambda \pi^0$

($\tan \phi = \beta/\gamma$)

<u>VALUE (°)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
21 ± 12 OUR AVERAGE				
16 ± 17	652	BALTAY	74	HBC 1.75 GeV/c $K^- p$
38 ± 19	739	⁸ DAUBER	69	HBC
-8 ± 30	146	⁹ BERGE	66	HBC

⁸ DAUBER 69 uses $\alpha_\Lambda = 0.647 \pm 0.020$.

⁹ 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.”

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.73 ± 0.17 OUR AVERAGE				
$-0.78 \pm 0.18 \pm 0.06$	672	LAI	04A	NA48 p Be, 450 GeV
-0.43 ± 0.44	87	¹⁰ JAMES	90	SPEC FNAL hyperons

¹⁰ The sign has been changed; see the erratum, JAMES 02.

α FOR $\Xi^0 \rightarrow \Lambda e^+ e^-$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.8 ± 0.2	397 ± 21	¹¹ BATLEY	07C	NA48 p Be, 400 GeV

¹¹ This BATLEY 07C result is consistent with the asymmetry α for $\Xi^0 \rightarrow \Lambda \gamma$, as expected if the mechanism is internal bremsstrahlung.

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

See the note above on “Radiative Hyperon Decays.”

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$-0.63 \pm 0.08 \pm 0.05$	4045	ALAVI-HARATI01C	KTEV	p nucleus, 800 GeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

$+0.20 \pm 0.32 \pm 0.05$	85	¹² TEIGE	89	SPEC FNAL hyperons
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¹² This result has been withdrawn, due to an error. See the erratum, TEIGE 02.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.21 ± 0.05 OUR AVERAGE				
+1.20 ± 0.04 ± 0.03	6520	¹³ BATLEY 07	NA48	p Be, 400 GeV
+1.32 ^{+0.21} _{-0.17} ± 0.05	487	¹⁴ ALAVI-HARATI01i	KTEV	p nucleus, 800 GeV

¹³ This BATLEY 07 result uses our 2006 value of V_{US} from semileptonic kaon decays as input.

¹⁴ 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 $\Xi^0 \rightarrow \Sigma^+ e^- \bar{\nu}_e$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-1.7 ^{+2.1} _{-2.0} ± 0.5	487	¹⁵ ALAVI-HARATI01i	KTEV	p nucleus, 800 GeV

¹⁵ ALAVI-HARATI 01i thus assumes that $g_2 = 0$ in calculating g_1/f_1 , above.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
2.0 ± 1.2 ± 0.5	487	ALAVI-HARATI01i	KTEV	p nucleus, 800 GeV

Ξ^0 REFERENCES

BATLEY	07	PL B645 36	J.R. Batley <i>et al.</i>	(CERN NA48/1 Collab.)
BATLEY	07C	PL B650 1	J.R. Batley <i>et al.</i>	(CERN NA48 Collab.)
ABOUZAIID	05	PRL 95 081801	E. Abouzaid <i>et al.</i>	(FNAL KTeV Collab.)
WHITE	05	PRL 94 101804	C.G. White <i>et al.</i>	(FNAL HyperCP Collab.)
LAI	04A	PL B584 251	A. Lai <i>et al.</i>	(CERN NA48 Collab.)
JAMES	02	PRL 89 169901 (erratum)	C. James <i>et al.</i>	(MINN, MICH, WISC, RUTG)
TEIGE	02	PRL 89 169902 (erratum)	S. Teige <i>et al.</i>	(RUTG, MICH, MINN)
ALAVI-HARATI	01C	PRL 86 3239	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
ALAVI-HARATI	01i	PRL 87 132001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
FANTI	00	EPJ C12 69	V. Fanti <i>et al.</i>	(CERN NA48 Collab.)
AFFOLDER	99	PRL 82 3751	A. Affolder <i>et al.</i>	(FNAL KTeV Collab.)
JAMES	90	PRL 64 843	C. James <i>et al.</i>	(MINN, MICH, WISC, RUTG)
TEIGE	89	PRL 63 2717	S. Teige <i>et al.</i>	(RUTG, MICH, MINN)
HANDLER	82	PR D25 639	R. Handler <i>et al.</i>	(WISC, MICH, MINN+)
COX	81	PRL 46 877	P.T. Cox <i>et al.</i>	(MICH, WISC, RUTG, MINN+)
BUNCE	79	PL 86B 386	G.R.M. Bunce <i>et al.</i>	(BNL, MICH, RUTG+)
BUNCE	78	PR D18 633	G.R.M. Bunce <i>et al.</i>	(WISC, MICH, RUTG)
ZECH	77	NP B124 413	G. Zech <i>et al.</i>	(SIEG, CERN, DORT, HEIDH)
GEWENIGER	75	PL 57B 193	C. Geweniger <i>et al.</i>	(CERN, HEIDH)
BALTAY	74	PR D9 49	C. Baltay <i>et al.</i>	(COLU, BING) J
YEH	74	PR D10 3545	N. Yeh <i>et al.</i>	(BING, COLU)
MAYEUR	72	NP B47 333	C. Mayeur <i>et al.</i>	(BRUX, CERN, TUFTS, LOUC)
Also		NP B53 268 (erratum)	C. Mayeur	
WILQUET	72	PL 42B 372	G. Wilquet <i>et al.</i>	(BRUX, CERN, TUFTS+)
DAUBER	69	PR 179 1262	P.M. Dauber <i>et al.</i>	(LRL)
PALMER	68	PL 26B 323	R.B. Palmer <i>et al.</i>	(BNL, SYRA)
BERGE	66	PR 147 945	J.P. Berge <i>et al.</i>	(LRL)
HUBBARD	66	Thesis UCRL 11510	J.R. Hubbard	(LRL)
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA)
PJERROU	65B	PRL 14 275	G.M. Pjerrou <i>et al.</i>	(UCLA)
Also		Thesis	G.M. Pjerrou	(UCLA)
CARMONY	64B	PRL 12 482	D.D. Carmony <i>et al.</i>	(UCLA)
HUBBARD	64	PR 135 B183	J.R. Hubbard <i>et al.</i>	(LRL)
JAUNEAU	63	PL 4 49	L. Jauneau <i>et al.</i>	(EPOL, CERN, LOUC+)
Also		Siena Conf. 1 1	L. Jauneau <i>et al.</i>	(EPOL, CERN, LOUC+)