



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

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

Ξ^0 MASS

The fit uses the Ξ^0 , Ξ^- , and Ξ^+ masses and the $\Xi^- - \Xi^0$ 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 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 Ξ^+ masses and the $\Xi^- - \Xi^0$ 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

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

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
$\Gamma_1 \Lambda\pi^0$	$(99.524 \pm 0.012) \%$	
$\Gamma_2 \Lambda\gamma$	$(1.17 \pm 0.07) \times 10^{-3}$	
$\Gamma_3 \Lambda e^+ e^-$	$(7.6 \pm 0.6) \times 10^{-6}$	
$\Gamma_4 \Sigma^0 \gamma$	$(3.33 \pm 0.10) \times 10^{-3}$	
$\Gamma_5 \Sigma^+ e^- \bar{\nu}_e$	$(2.52 \pm 0.08) \times 10^{-4}$	
$\Gamma_6 \Sigma^+ \mu^- \bar{\nu}_\mu$	$(2.33 \pm 0.35) \times 10^{-6}$	

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

$\Gamma_7 \Sigma^- e^+ \nu_e$	SQ	< 9	$\times 10^{-4}$	90%
$\Gamma_8 \Sigma^- \mu^+ \nu_\mu$	SQ	< 9	$\times 10^{-4}$	90%
$\Gamma_9 \rho\pi^-$	S2	< 8	$\times 10^{-6}$	90%
$\Gamma_{10} \rho e^- \bar{\nu}_e$	S2	< 1.3	$\times 10^{-3}$	
$\Gamma_{11} \rho \mu^- \bar{\nu}_\mu$	S2	< 1.3	$\times 10^{-3}$	

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 11 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 7.5$ for 7 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, 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_6	0	0	0	1
	x_1	x_2	x_4	x_5

Ξ^0 BRANCHING RATIOS $\Gamma(\Lambda\gamma)/\Gamma(\Lambda\pi^0)$ Γ_2/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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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

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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7.6±0.4±0.5	397 ± 21	⁵ BATLEY	07C NA48	p Be, 400 GeV
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⁵ This BATLEY 07C result is consistent with internal bremsstrahlung.

 $\Gamma(\Sigma^0\gamma)/\Gamma(\Lambda\pi^0)$ Γ_4/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.52±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.

 $\Gamma(\Sigma^+ \mu^- \bar{\nu}_\mu)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.3 ±0.4 OUR FIT**2.17±0.32±0.17** 66 ⁸ BATLEY 13 NA48 p Be, 400 GeV

⁸ BATLEY 13 used $\Xi^0 \rightarrow \Sigma^+ e^- \bar{\nu}_e$ decay as a normalization mode and its branching fraction value of $(2.51 \pm 0.03 \pm 0.09) \times 10^{-4}$ from BATLEY 07.

$$\Gamma(\Sigma^+ \mu^- \bar{\nu}_\mu) / \Gamma(\Sigma^+ e^- \bar{\nu}_e) \quad \Gamma_6 / \Gamma_5$$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.0092 ± 0.0015 OUR FIT					
0.018 $^{+0.007}_{-0.005}$ ± 0.002		9	ABOUZAID	05	KTEV <i>p</i> nucleus 800 GeV

$$\Gamma(\Sigma^- e^+ \nu_e) / \Gamma(\Lambda \pi^0) \quad \Gamma_7 / \Gamma_1$$
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

$$\Gamma(\Sigma^- \mu^+ \nu_\mu) / \Gamma(\Lambda \pi^0) \quad \Gamma_8 / \Gamma_1$$
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

$$\Gamma(p \pi^-) / \Gamma(\Lambda \pi^0) \quad \Gamma_9 / \Gamma_1$$
 $\Delta S=2$. Forbidden in first-order weak interaction.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 8.2	90		WHITE	05	HYCP <i>p</i> 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

$$\Gamma(p e^- \bar{\nu}_e) / \Gamma(\Lambda \pi^0) \quad \Gamma_{10} / \Gamma_1$$
 $\Delta S=2$. 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

$$\Gamma(p \mu^- \bar{\nu}_\mu) / \Gamma(\Lambda \pi^0) \quad \Gamma_{11} / \Gamma_1$$
 $\Delta S=2$. 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.

 $\alpha(\Xi^0) \alpha_-(\Lambda)$ This is a product of the $\Xi^0 \rightarrow \Lambda\pi^0$ and $\Lambda \rightarrow p\pi^-$ asymmetries.

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.261 ± 0.006 OUR AVERAGE				
$-0.276 \pm 0.001 \pm 0.035$	4M	BATLEY	10B NA48	p Be, 400 GeV
$-0.260 \pm 0.004 \pm 0.005$	300k	HANDLER	82 SPEC	FNAL hyperons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-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, $\alpha(\Xi^0)\alpha_-(\Lambda) = -0.261 \pm 0.006$, divided by our current average $\alpha_-(\Lambda) = 0.750 \pm 0.010$, gives the following value for $\alpha(\Xi^0)$:

<u>VALUE</u>	<u>DOCUMENT ID</u>
-0.347 ± 0.010 OUR EVALUATION	

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

<u>VALUE ($^\circ$)</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	⁹ DAUBER	69 HBC	
-8 ± 30	146	¹⁰ BERGE	66 HBC	

⁹ DAUBER 69 uses $\alpha_\Lambda = 0.647 \pm 0.020$.¹⁰ The errors have been multiplied by 1.2 due to approximations used for the Ξ polarization; see DAUBER 69 for a discussion.

See the related review(s):

[Radiative Hyperon Decays](#) **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>
$-0.704 \pm 0.019 \pm 0.064$	52k	¹¹ BATLEY	10B NA48	p Be, 400 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.78 \pm 0.18 \pm 0.06$	672	LAI	04A NA48	See BATLEY 10B
-0.43 ± 0.44	87	¹² JAMES	90 SPEC	FNAL hyperons

¹¹ BATLEY 10B also measured the $\Xi^0 \rightarrow \bar{\Lambda}\gamma$ asymmetry to be -0.798 ± 0.064 (no systematic error given) with 4769 events.¹² 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	¹³ BATLEY	07C NA48	p Be, 400 GeV

¹³ 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."

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.69 ± 0.06	OUR AVERAGE			
$-0.729 \pm 0.030 \pm 0.076$	15k	¹⁴ BATLEY	10B NA48	p Be, 400 GeV
$-0.63 \pm 0.08 \pm 0.05$	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	¹⁵ TEIGE	89 SPEC	FNAL hyperons
¹⁴ BATLEY 10B also measured the $\Xi^0 \rightarrow \Sigma^0 \gamma$ asymmetry to be -0.786 ± 0.104 (no systematic error given) with 1404 events.				
¹⁵ 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
1.22 ± 0.05	OUR AVERAGE			
1.21 ± 0.05		BATLEY	13 NA48	p Be, 400 GeV
$1.32^{+0.21}_{-0.17} \pm 0.05$	487	¹⁶ ALAVI-HARATI01I	KTEV	p nucleus, 800 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.20 \pm 0.04 \pm 0.03$	6520	¹⁷ BATLEY	07 NA48	See BATLEY 13
¹⁶ ALAVI-HARATI 01I assumes here that the second-class current is zero and that the weak-magnetism term takes its exact SU(3) value.				
¹⁷ This BATLEY 07 result uses our 2006 value of V_{US} from semileptonic kaon decays as input.				

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$-1.7^{+2.1}_{-2.0} \pm 0.5$	487	¹⁸ ALAVI-HARATI01I	KTEV	p nucleus, 800 GeV
¹⁸ 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 ± 0.9	OUR AVERAGE			
2.0 ± 1.3		BATLEY	13 NA48	p Be, 400 GeV
$2.0 \pm 1.2 \pm 0.5$	487	ALAVI-HARATI01I	KTEV	p nucleus, 800 GeV

Ξ^0 REFERENCES

BATLEY	13	PL B720 105	J.R. Batley <i>et al.</i>	(CERN NA48/1 Collab.)
BATLEY	10B	PL B693 241	J.R. Batley <i>et al.</i>	(CERN NA48/1 Collab.)
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.)
ABOUZAID	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 (err.)	C. James <i>et al.</i>	(MINN, MICH, WISC, RUTG)
TEIGE	02	PRL 89 169902 (err.)	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+)
