

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

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

Ξ^0 MASS

The fit uses the Ξ^0 , Ξ^- , and Ξ^+ mass and mass difference measurements.

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1314.83±0.20 OUR FIT				
1314.82±0.20 OUR AVERAGE				
1314.82±0.06±0.20	3120	FANTI	00 NA48	p Be, 450 GeV
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^+ mass and mass difference measurements.

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
6.48±0.24 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

<u>VALUE (10^{-10} s)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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)	Scale factor/ Confidence level
$\Gamma_1 \Lambda\pi^0$	(99.522 ± 0.032) %	S=1.7
$\Gamma_2 \Lambda\gamma$	(1.18 ± 0.30) × 10 ⁻³	S=2.0
$\Gamma_3 \Sigma^0\gamma$	(3.33 ± 0.10) × 10 ⁻³	
$\Gamma_4 \Sigma^+ e^- \bar{\nu}_e$	(2.7 ± 0.4) × 10 ⁻⁴	
$\Gamma_5 \Sigma^+ \mu^- \bar{\nu}_\mu$	< 1.1 × 10 ⁻³	CL=90%

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

$\Gamma_6 \Sigma^- e^+ \nu_e$	SQ	< 9	× 10 ⁻⁴	CL=90%
$\Gamma_7 \Sigma^- \mu^+ \nu_\mu$	SQ	< 9	× 10 ⁻⁴	CL=90%
$\Gamma_8 p\pi^-$	S2	< 4	× 10 ⁻⁵	CL=90%
$\Gamma_9 p e^- \bar{\nu}_e$	S2	< 1.3	× 10 ⁻³	
$\Gamma_{10} p \mu^- \bar{\nu}_\mu$	S2	< 1.3	× 10 ⁻³	

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 4.4$ for 3 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	-94		
x_3	-31	-1	
x_4	-12	0	0
	x_1	x_2	x_3

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>
1.19±0.30 OUR FIT Error includes scale factor of 2.0.				
1.19±0.30 OUR AVERAGE Error includes scale factor of 2.0.				
1.91±0.34±0.19	31	³ FANTI	00 NA48	p Be, 450 GeV
1.06±0.12±0.11	116	JAMES	90 SPEC	FNAL hyperons

³FANTI 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.

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

Γ_3/Γ_1

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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	⁴ FANTI	00 NA48	p Be, 450 GeV
3.56±0.42±0.10	85	TEIGE	89 SPEC	FNAL hyperons

⁴FANTI 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_4/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2.7 ±0.4 OUR FIT				
2.71±0.22±0.31	176	AFFOLDER	99 KTEV	p nucleus 800 GeV

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

Γ_5/Γ_1

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

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

Γ_6/Γ_1

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
Test of $\Delta S = \Delta Q$ rule.					
<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

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
Test of $\Delta S = \Delta Q$ rule.					
<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	

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

Γ_8/Γ_1

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.6	90		GEWENIGER	75	SPEC
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<180	90	0	YEH	74	HBC Effective denom.=1300
< 90			DAUBER	69	HBC
<500			HUBBARD	66	HBC

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

Γ_9/Γ_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

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

Γ_{10}/Γ_1

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

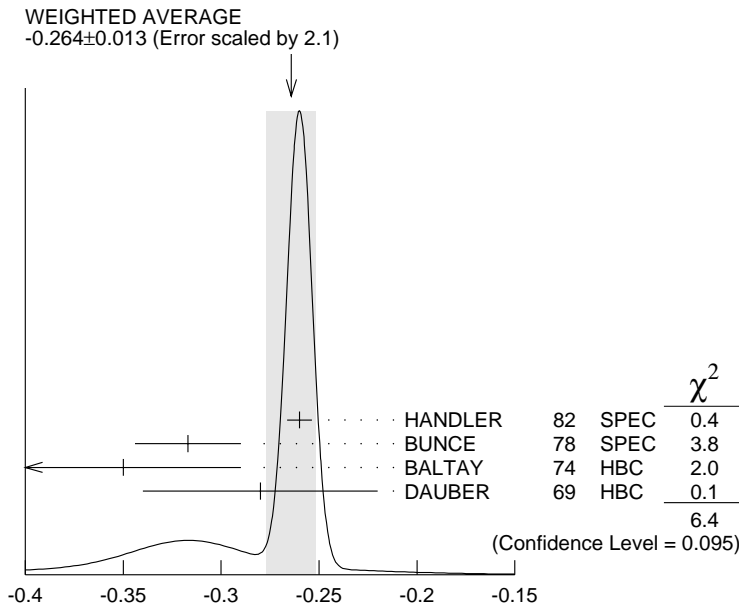
VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.3			DAUBER	69	HBC
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<3.5	90	0	YEH	74	HBC Effective denom.=664
<6			HUBBARD	66	HBC

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.
$-0.260 \pm 0.004 \pm 0.005$	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



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

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	⁵ DAUBER	69	HBC
- 8±30	146	⁶ BERGE	66	HBC

⁵ DAUBER 69 uses $\alpha_\Lambda = 0.647 \pm 0.020$.

⁶ The errors have been multiplied by 1.2 due to approximations used for the Ξ polarization; see DAUBER 69 for a discussion.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
+0.43±0.44	87	⁷ JAMES	90	SPEC FNAL hyperons

⁷ The correctness of the sign of this JAMES 90 result has been questioned by members of the KTeV experiment.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$-0.63 \pm 0.08 \pm 0.05$	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	⁸ TEIGE	89 SPEC	FNAL hyperons
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⁸See ALAVI-HARATI 01C, which claims that this TEIGE 89 result is seriously in error.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$+1.32^{+0.21}_{-0.17} \pm 0.05$	487	⁹ ALAVI-HARATI01i	KTEV	p nucleus, 800 GeV

⁹ALAVI-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
$-1.7^{+2.1}_{-2.0} \pm 0.5$	487	¹⁰ ALAVI-HARATI01i	KTEV	p nucleus, 800 GeV

¹⁰ALAVI-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
$2.0 \pm 1.2 \pm 0.5$	487	ALAVI-HARATI01i	KTEV	p nucleus, 800 GeV

Ξ^0 REFERENCES

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	73 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	65 Thesis	G.M. Pjerrou	(UCLA)
CARMONY	64B PRL 12 482	D.D. Carmony <i>et al.</i>	(UCLA)
HUBBARD	64 PR 135B 183	J.R. Hubbard <i>et al.</i>	(LRL)
JAUNEAU	63 PL 4 49	L. Jauneau <i>et al.</i>	(EPOL, CERN, LOUC+)
Also	63C Siena Conf. 1 1	L. Jauneau <i>et al.</i>	(EPOL, CERN, LOUC+)