$\boxed{\Xi^0}$ $I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$ Status: ✱✱✱✱

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

Ξ^0 MASS

The fit uses the Ξ^0, Ξ^-, and $\overline{\Xi}^+$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
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 $\overline{\Xi}^+$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
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

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
$-1.20\ \pm0.06$	42k	BUNCE	79	SPEC

Ξ^0 DECAY MODES

	Mode	Fraction (Γ_i/Γ)		Scale factor/ Confidence level
Γ_1	$\Lambda\pi^0$	(99.51 ± 0.05) %		S=1.2
Γ_2	$\Lambda\gamma$	$(1.18\pm0.30)\times 10^{-3}$		S=2.0
Γ_3	$\Sigma^0\gamma$	$(3.5\ \pm0.4\ )\times 10^{-3}$		
Γ_4	$\Sigma^+ e^-\overline{\nu}_e$	$(2.7\ \pm0.4\ )\times 10^{-4}$		
Γ_5	$\Sigma^+\mu^-\overline{\nu}_\mu$	$<\ 1.1$	$\times 10^{-3}$	CL=90%

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

	Mode		Fraction (Γ_i/Γ)		
Γ_6	$\Sigma^- e^+\nu_e$	SQ	$<\ 9$	$\times 10^{-4}$	CL=90%
Γ_7	$\Sigma^-\mu^+\nu_\mu$	SQ	$<\ 9$	$\times 10^{-4}$	CL=90%
Γ_8	$p\pi^-$	S2	$<\ 4$	$\times 10^{-5}$	CL=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 5 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 4.2$ for 2 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, $x_i \equiv \Gamma_i/\Gamma_{total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-62		
x_3	-78	0	
x_4	-8	0	0
	x_1	x_2	x_3

Ξ^0 BRANCHING RATIOS

$\Gamma(\Lambda\gamma)/\Gamma(\Lambda\pi^0)$ $\hfill \Gamma_2/\Gamma_1$

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

[3] 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.

$\Gamma(\Sigma^0\gamma)/\Gamma(\Lambda\pi^0)$ $\hfill \Gamma_3/\Gamma_1$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.5 ±0.4 OUR FIT					
3.5 ±0.4 OUR AVERAGE					
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

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

$\Gamma(\Sigma^+ e^- \overline{\nu}_e)/\Gamma_{total}$ $\hfill \Gamma_4/\Gamma$

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

$\Gamma(\Sigma^+ \mu^- \overline{\nu}_\mu)/\Gamma(\Lambda\pi^0)$ $\hfill \Gamma_5/\Gamma_1$

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

$\Gamma(\Sigma^- e^+ \nu_e)/\Gamma(\Lambda\pi^0)$ $\hfill \Gamma_6/\Gamma_1$
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	

$\Gamma(\Sigma^- \mu^+ \nu_\mu)/\Gamma(\Lambda\pi^0)$ $\hfill \Gamma_7/\Gamma_1$
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	

$\Gamma(p\pi^-)/\Gamma(\Lambda\pi^0)$ $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ 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	

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

$\Gamma(p \mu^- \overline{\nu}_\mu)/\Gamma(\Lambda\pi^0)$ $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ 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±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

WEIGHTED AVERAGE
-0.264±0.013 (Error scaled by 2.1)

			χ^2
HANDLER	82	SPEC	0.4
BUNCE	78	SPEC	3.8
BALTAY	74	HBC	2.0
DAUBER	69	HBC	0.1
			6.4

(Confidence Level = 0.095)

-0.4   -0.35   -0.3   -0.25   -0.2   -0.15

$$\alpha(\Xi^0)\alpha_-(\Lambda)$$
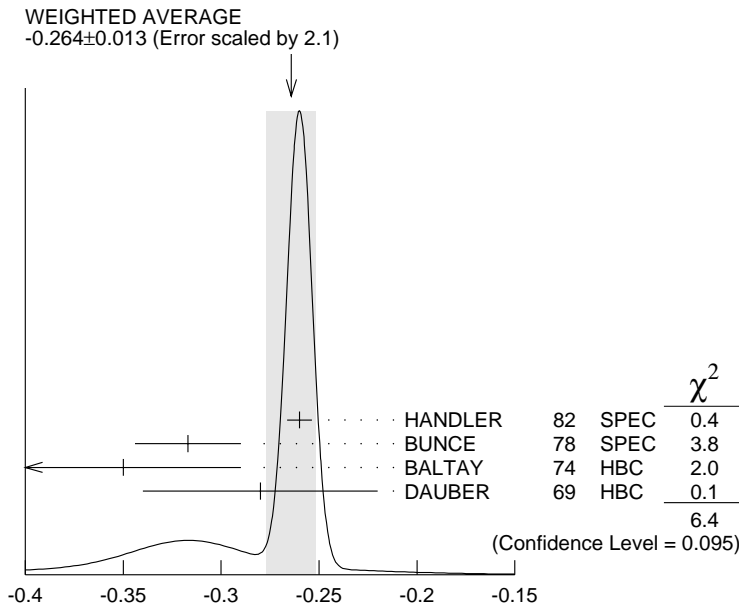
α FOR $\Xi^0 \rightarrow \Lambda\pi^0$

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 $\Xi^0 \rightarrow \Lambda\pi^0$ $\qquad$ (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	JAMES	90 SPEC	FNAL hyperons

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
+0.20±0.32±0.05	85	TEIGE	89 SPEC	FNAL hyperons

Ξ^0 REFERENCES

FANTI	00	EPJ C12 69	V. Fanti *et al.*	(CERN NA48 Collab.)
AFFOLDER	99	PRL 82 3751	A. Affolder *et al.*	(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	73	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	65	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	63C	Siena Conf. 1 1	L. Jauneau *et al.*	(EPOL, CERN, LOUC+)