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 $\overline{\Xi}^+$ mass and mass difference measurements.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*
1314.9±0.6 OUR FIT				
1314.8±0.8 OUR AVERAGE				
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*
6.4±0.6 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	$\Lambda\pi^0$		(99.54 ± 0.05) %	
Γ_2	$\Lambda\gamma$		$(1.06 \pm 0.16) \times 10^{-3}$	
Γ_3	$\Sigma^0\gamma$		$(3.5 \pm 0.4) \times 10^{-3}$	
Γ_4	$\Sigma^+ e^- \overline{\nu}_e$		$< 1.1 \times 10^{-3}$	90%
Γ_5	$\Sigma^+ \mu^- \overline{\nu}_\mu$		$< 1.1 \times 10^{-3}$	90%
	$\Delta S = \Delta Q$ (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	$p\pi^-$	$S2$	$< 4 \times 10^{-5}$	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 2 branching ratios uses 2 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.0$ for 0 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_1	x_2
x_2	-35	
x_3	-94	0

Ξ^0 BRANCHING RATIOS

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.06±0.16 OUR FIT					
1.06±0.12±0.11	116	JAMES	90	SPEC	FNAL hyperons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
5 ±5	1	YEH	74	HBC	Effective denom.=200

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
3.6 ±0.4 OUR FIT						
3.56±0.42±0.10		85	TEIGE	89	SPEC	FNAL hyperons
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 8	90		BENSINGER	88	MPS2	K^- W 6 GeV/c
<65	90	0–1	YEH	74	HBC	Effective denom.=60

$\Gamma(\Sigma^+ e^- \overline{\nu}_e)/\Gamma(\Lambda\pi^0)$ — Γ_4/Γ_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	

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

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

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

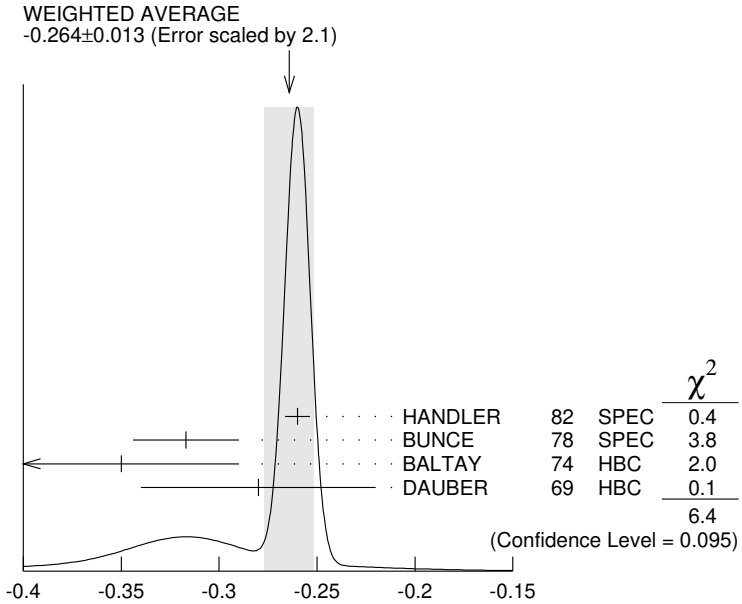
VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<1.3			DAUBER	69	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.5	90	0	YEH	74	HBC	Effective denom.=664
<6			HUBBARD	66	HBC	

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



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

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	[3] DAUBER	69	HBC	
− 8±30	146	[4] BERGE	66	HBC	

[3] DAUBER 69 uses $\alpha_\Lambda = 0.647 \pm 0.020$.

[4] 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

JAMES	90	PRL 64 843	+Heller, Border, Dworkin+ (MINN, MICH, WISC, RUTG)
TEIGE	89	PRL 63 2717	+Beretvas, Caracappa, Devlin+ (RUTG, MICH, MINN)
BENSINGER	88	PL B215 195	+Fortner, Kirsch, Piekarz+ (BRAN, DUKE, NDAM, MASD)
HANDLER	82	PR D25 639	+Grobel, Pondrom+ (WISC, MICH, MINN, RUTG)
COX	81	PRL 46 877	+Dworkin+ (MICH, WISC, RUTG, MINN, BNL)
BUNCE	79	PL 86B 386	+Overseth, Cox+ (BNL, MICH, RUTG, WISC)
BUNCE	78	PR D18 633	+Handler, March, Martin+ (WISC, MICH, RUTG)
ZECH	77	NP B124 413	+Dydak, Navarria+ (SIEG, CERN, DORT, HEIDH)
GEWENIGER	75	PL 57B 193	+Gjesdal, Presser+ (CERN, HEIDH)
BALTAY	74	PR D9 49	+Bridgewater, Cooper, Gershwin+ (COLU, BING) J
YEH	74	PR D10 3545	+Gaigalas, Smith, Zendle, Baltay+ (BING, COLU)
MAYEUR	72	NP B47 333	+VanBinst, Wilquet+ (BRUX, CERN, TUFTS, LOUC)
Also	73	NP B53 268 erratum	Mayeur
WILQUET	72	PL 42B 372	+Fliagine, Guy+ (BRUX, CERN, TUFTS, LOUC)
DAUBER	69	PR 179 1262	+Berge, Hubbard, Merrill, Miller (LRL)
PALMER	68	PL 26B 323	+Radojicic, Rau, Richardson+ (BNL, SYRA)
BERGE	66	PR 147 945	+Eberhard, Hubbard, Merrill+ (LRL)
HUBBARD	66	Thesis UCRL 11510	(LRL)
LONDON	66	PR 143 1034	+Rau, Goldberg, Lichtman+ (BNL, SYRA)
PJERROU	65B	PRL 14 275	+Schlein, Slater, Smith, Stork, Ticho (UCLA)
Also	65	Thesis	Pjerrou (UCLA)
CARMONY	64B	PRL 12 482	+Pjerrou, Schlein, Slater, Stork+ (UCLA)
HUBBARD	64	PR 135B 183	+Berge, Kalbfleisch, Shafer+ (LRL)
JAUNEAU	63	PL 4 49	+ (EPOL, CERN, LOUC, RHEL, BERG)
Also	63C	Siena Conf. 1 1	Jauneau+ (EPOL, CERN, LOUC, RHEL, BERG)