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 $\overline{\Xi}^+$ masses and the $\Xi^- - \Xi^0$ mass difference. It assumes that the Ξ^- and $\overline{\Xi}^+$ 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 $\overline{\Xi}^+$ masses and the $\Xi^- - \Xi^0$ mass difference. It assumes that the Ξ^- and $\overline{\Xi}^+$ 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

[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 "Quark Model" review.

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	$\Lambda\pi^0$			(99.524±0.012) %		
Γ_2	$\Lambda\gamma$			(1.17 ±0.07)	$\times 10^{-3}$	
Γ_3	$\Lambda e^+ e^-$			(7.6 ±0.6)	$\times 10^{-6}$	
Γ_4	$\Sigma^0\gamma$			(3.33 ±0.10)	$\times 10^{-3}$	
Γ_5	$\Sigma^+ e^- \overline{\nu}_e$			(2.52 ±0.08)	$\times 10^{-4}$	
Γ_6	$\Sigma^+ \mu^- \overline{\nu}_\mu$			(2.33 ±0.35)	$\times 10^{-6}$	
	$\Delta S = \Delta Q$ (SQ) violating modes or $\Delta S = 2$ forbidden ($S2$) modes					
Γ_7	$\Sigma^- e^+ \nu_e$	*SQ*	<	1.6	$\times 10^{-4}$	90%
Γ_8	$\Sigma^- \mu^+ \nu_\mu$	*SQ*	<	9	$\times 10^{-4}$	90%
Γ_9	$p\pi^-$	*S2*	<	8	$\times 10^{-6}$	90%
Γ_{10}	$p e^- \overline{\nu}_e$	*S2*	<	1.3	$\times 10^{-3}$	
Γ_{11}	$p \mu^- \overline{\nu}_\mu$	*S2*	<	1.3	$\times 10^{-3}$	
Γ_{12}	$K^- e^+$					
Γ_{13}	$K^+ e^-$					

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 $\langle\delta x_i \delta x_j\rangle/(\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\rm total}$. 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
1.17±0.07 OUR FIT					
1.17±0.07 OUR AVERAGE					
1.17±0.05±0.06	672	[1] LAI	04A	NA48	p Be, 450 GeV
1.91±0.34±0.19	31	[2] FANTI	00	NA48	p Be, 450 GeV
1.06±0.12±0.11	116	JAMES	90	SPEC	FNAL hyperons

[1] LAI 04A used our 2002 value of 99.5% for the $\Xi^0 \to \Lambda\pi^0$ branching fraction to get $\Gamma(\Xi^0 \to \Lambda\gamma)/\Gamma_{total} = (1.16 \pm 0.05 \pm 0.06) \times 10^{-3}$. We adjust slightly to go back to what was directly measured.

[2] 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.

$\Gamma(\Lambda e^+ e^-)/\Gamma_{total}$ — Γ_3/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
7.6±0.4±0.5	397 ± 21	[1] BATLEY	07C	NA48	p Be, 400 GeV

[1] 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
3.35±0.10 OUR FIT					
3.35±0.10 OUR AVERAGE					
3.34±0.05±0.09	4045	ALAVI-HARATI	01C	KTEV	p nucleus, 800 GeV
3.16±0.76±0.32	17	[1] FANTI	00	NA48	p Be, 450 GeV
3.56±0.42±0.10	85	TEIGE	89	SPEC	FNAL hyperons

[1] 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.

$\Gamma(\Sigma^+ e^- \overline{\nu}_e)/\Gamma_{total}$ — Γ_5/Γ

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

[1] This BATLEY 07 result is for $\overline{\Xi}^0 \to \overline{\Sigma}^- e^+ \nu_e$ events.

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

VALUE (units 10^{-6})	EVTS	DOCUMENT ID		TECN	COMMENT
2.3 ±0.4 OUR FIT					
2.17±0.32±0.17	66	[1] BATLEY	13	NA48	p Be, 400 GeV

[1] BATLEY 13 used $\Xi^0 \rightarrow \Sigma^+ e^- \overline{\nu}_e$ 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.

$\Gamma(\Sigma^+ \mu^- \overline{\nu}_\mu)/\Gamma(\Sigma^+ e^- \overline{\nu}_e)$ — Γ_6/Γ_5

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

$\Gamma(\Sigma^- e^+ \nu_e)/\Gamma_{total}$ — Γ_7/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.6 × 10^{-4}	90	ABLIKIM	23B	BES3	$J/\psi \rightarrow \Xi^0 \overline{\Xi}^0$

$\Gamma(\Sigma^- e^+ \nu_e)/\Gamma(\Lambda \pi^0)$ — Γ_7/Γ_1

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.9	90	YEH	74	HBC	Effective denom.=2500
<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%	DOCUMENT ID		TECN	COMMENT
<0.9	90	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_9/Γ_1

ΔS=2. Forbidden in first-order weak interaction.

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN	COMMENT
< 8.2	90	WHITE	05	HYCP	p Cu, 800 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 36	90	GEWENIGER	75	SPEC	
<1800	90	YEH	74	HBC	Effective denom.=1300
< 900		DAUBER	69	HBC	
<5000		HUBBARD	66	HBC	

$\Gamma(p e^- \overline{\nu}_e)/\Gamma(\Lambda \pi^0)$ — Γ_{10}/Γ_1

ΔS=2. Forbidden in first-order weak interaction.

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<1.3		DAUBER	69	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.4	90	YEH	74	HBC	Effective denom.=670
<6		HUBBARD	66	HBC	

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

ΔS=2. Forbidden in first-order weak interaction.

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

$\Gamma(K^-e^+)/\Gamma_{total}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.6\times10^{-6}$	90	[1] ABLIKIM	23AP	BES3	$J/\psi \to \Xi^0\overline{\Xi}^0$

[1] This decay mode violates baryon and lepton number conservation with Δ(B−L) = 0.

$\Gamma(K^+e^-)/\Gamma_{total}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.9\times10^{-6}$	90	[1] ABLIKIM	23AP	BES3	$J/\psi \to \Xi^0\overline{\Xi}^0$

[1] This decay mode violates baryon and lepton number conservation with $|\Delta$(B-L)$|$=2.

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 $\Xi^0 \to \Lambda\pi^0$ and $\Lambda \to p\pi^-$ asymmetries.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.261±0.006 OUR AVERAGE					
−0.276±0.001±0.035	4M	BATLEY	10B	NA48	p Be, 400 GeV
−0.260±0.004±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 $\Xi^0 \to \Lambda\pi^0$

The PDG 22 average $\alpha(\Xi^0)\alpha_-(\Lambda) = -0.261 \pm 0.006$ divided by the PDG 22 average $\alpha_-(\Lambda) = 0.748 \pm 0.007$ gives $\alpha(\Xi^0) = -0.349 \pm 0.009$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.349 ±0.009 OUR EVALUATION					
−0.3750±0.0034±0.0016	327k	ABLIKIM	23AU	BES3	$J/\psi \to \Xi^0\overline{\Xi}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−0.358 ±0.042 ±0.013	1.9k	ABLIKIM	23AD	BES3	$\psi(2S) \to \Xi^0\overline{\Xi}^0$

α FOR $\overline{\Xi}^0 \to \overline{\Lambda}\pi^0$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.3790±0.0034±0.0021	327k	ABLIKIM	23AU	BES3	$J/\psi \to \Xi^0\overline{\Xi}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.363 ±0.042 ±0.013	1.9k	ABLIKIM	23AD	BES3	$\psi(2S) \to \Xi^0\overline{\Xi}^0$

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

VALUE (°)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.292± 0.550±0.103	327k	[1] ABLIKIM	23AU	BES3	$J/\psi \rightarrow \Xi^0 \overline{\Xi}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.55 ± 6.70 ±0.63	1.9k	ABLIKIM	23AD	BES3	$\psi(2S) \rightarrow \Xi^0 \overline{\Xi}^0$
16 ±17	652	BALTAY	74	HBC	1.75 GeV/c $K^- p$
38 ±19	739	[2] DAUBER	69	HBC	
− 8 ±30	146	[3] BERGE	66	HBC	

[1] Converted from radians to degrees.

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

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

ϕ ANGLE FOR $\overline{\Xi}^0 \rightarrow \overline{\Lambda}\pi^0$ with $\tan\phi = \beta/\gamma$

VALUE (degrees)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
− 0.304±0.556±0.109	327k	ABLIKIM	23AU	BES3	$J/\psi \rightarrow \Xi^0 \overline{\Xi}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−10.60 ±6.65 ±0.97	1.9k	ABLIKIM	23AD	BES3	$\psi(2S) \rightarrow \Xi^0 \overline{\Xi}^0$

$\Delta\phi_{CP}(\Xi^0) = (\phi_{\Xi^0} + \phi_{\overline{\Xi}^0})/2$

VALUE (degrees)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
−0.006±0.395±0.052	327k	[1] ABLIKIM	23AU	BES3	$J/\psi \rightarrow \Xi^0 \overline{\Xi}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−4.53 ±4.70 ±0.57	1.9k	[1] ABLIKIM	23AD	BES3	$\psi(2S) \rightarrow \Xi^0 \overline{\Xi}^0$

[1] Converted from radians to degrees.

A_{CP} FOR $\Xi^0 \rightarrow \Lambda\pi^0$, $\overline{\Xi}^0 \rightarrow \overline{\Lambda}\pi^0$

$A_{CP} = (\alpha + \overline{\alpha}) \;/\; (\alpha - \overline{\alpha})$

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
−5.4± 6.5± 3.1	327k	[1] ABLIKIM	23AU	BES3	$J/\psi \rightarrow \Xi^0 \overline{\Xi}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−7 ±82 ±25	1.9k	[1] ABLIKIM	23AD	BES3	$\psi(2S) \rightarrow \Xi^0 \overline{\Xi}^0$

[1] Probing *CP* symmetry and weak phases with entangled double-strange baryons.

RADIATIVE HYPERON DECAYS

Revised July 2011 by J.D. Jackson (LBNL).

The weak radiative decays of spin-1/2 hyperons, $B_i \rightarrow B_f\gamma$, yield information about matrix elements (form factors) similar to that gained from weak hadronic decays. For a polarized spin-1/2 hyperon decaying radiatively via a $\Delta Q = 0$, $\Delta S = 1$ transition, the angular distribution of the direction $\hat{\mathbf{p}}$ of the final spin-1/2 baryon in the hyperon rest frame is

$$\frac{dN}{d\Omega} = \frac{N}{4\pi}\left(1 + \alpha_\gamma\, \mathbf{P}_i \cdot \hat{\mathbf{p}}\right) . \quad (1)$$

Here $\mathbf{P}_i$ is the polarization of the decaying hyperon, and α_γ is the asymmetry parameter. In terms of the form factors $F_1(q^2)$, $F_2(q^2)$, and $G(q^2)$ of the effective hadronic weak electromagnetic vertex,

$$F_1(q^2)\gamma_\lambda + iF_2(q^2)\sigma_{\lambda\mu}q^\mu + G(q^2)\gamma_\lambda\gamma_5 \ ,$$

α_γ is

$$\alpha_\gamma = \frac{2\,\mathrm{Re}[G(0)F_M^*(0)]}{|G(0)|^2 + |F_M(0)|^2} \ , \quad (2)$$

where $F_M = (m_i - m_f)[F_2 - F_1/(m_i + m_f)]$. If the decaying hyperon is unpolarized, the decay baryon has a longitudinal polarization given by $P_f = -\alpha_\gamma$ [1].

The angular distribution for the weak hadronic decay, $B_i \to B_f\pi$, has the same form as Eq. (1), but of course with a different asymmetry parameter, α_π. Now, however, if the decaying hyperon is unpolarized, the decay baryon has a longitudinal polarization given by $P_f = +\alpha_\pi$ [2,3]. The difference of sign is because the spins of the pion and photon are different.

$\Xi^0 \to \Lambda\gamma$ decay—The radiative decay $\Xi^0 \to \Lambda\gamma$ of an unpolarized Ξ^0 uses the hadronic decay $\Lambda \to p\pi^-$ as the analyzer. As noted above, the longitudinal polarization of the Λ will be $P_\Lambda = -\alpha_{\Xi\Lambda\gamma}$. Let α_- be the $\Lambda \to p\pi^-$ asymmetry parameter and $\theta_{\Lambda p}$ be the angle, as seen in the Λ rest frame, between the Λ line of flight and the proton momentum. Then the hadronic version of Eq. (1) applied to the $\Lambda \to p\pi^-$ decay gives

$$\frac{dN}{d\cos\theta_{\Lambda p}} = \frac{N}{2}\left(1 - \alpha_{\Xi\Lambda\gamma}\,\alpha_-\cos\theta_{\Lambda p}\right) \quad (3)$$

for the angular distribution of the proton in the Λ frame. Our current value, from the CERN NA48/1 experiment [4], is $\alpha_{\Xi\Lambda\gamma} = -0.704 \pm 0.019 \pm 0.064$.

$\Xi^0 \to \Sigma^0\gamma$ decay—The asymmetry parameter here, $\alpha_{\Xi\Sigma\gamma}$, is measured by following the decay chain $\Xi^0 \to \Sigma^0\gamma$, $\Sigma^0 \to \Lambda\gamma$, $\Lambda \to p\pi^-$. Again, for an unpolarized Ξ^0, the longitudinal polarization of the Σ^0 will be $P_\Sigma = -\alpha_{\Xi\Sigma\gamma}$. In the $\Sigma^0 \to \Lambda\gamma$ decay, a parity-conserving magnetic-dipole transition, the polarization of the Σ^0 is transferred to the Λ, as may be seen as follows. Let $\theta_{\Sigma\Lambda}$ be the angle seen in the Σ^0 rest frame between the Σ^0 line of flight and the Λ momentum. For Σ^0 helicity $+1/2$, the probability amplitudes for positive and negative spin states of the Σ^0 *along the* Λ *momentum* are $\cos(\theta_{\Sigma\Lambda}/2)$ and $\sin(\theta_{\Sigma\Lambda}/2)$. Then the amplitude for a negative helicity photon and a negative helicity Λ is $\cos(\theta_{\Sigma\Lambda}/2)$, while the amplitude for positive helicities for the photon and Λ is $\sin(\theta_{\Sigma\Lambda}/2)$. For Σ^0 helicity $-1/2$, the amplitudes are interchanged. If the Σ^0 has longitudinal polarization P_Σ, the probabilities for Λ helicities $\pm 1/2$ are therefore

$$p(\pm 1/2) = \frac{1}{2}(1 \mp P_\Sigma)\cos^2(\theta_{\Sigma\Lambda}/2) + \frac{1}{2}(1 \pm P_\Sigma)\sin^2(\theta_{\Sigma\Lambda}/2)\ , \quad (4)$$

and the longitudinal polarization of the Λ is

$$P_\Lambda = -P_\Sigma \cos\theta_{\Sigma\Lambda} = +\alpha_{\Xi\Sigma\gamma}\cos\theta_{\Sigma\Lambda}\ . \quad (5)$$

Using Eq. (1) for the $\Lambda \to p\pi^-$ decay again, we get for the joint angular distribution of the $\Sigma^0 \to \Lambda\gamma$, $\Lambda \to p\pi^-$ chain,

$$\frac{d^2N}{d\cos\theta_{\Sigma\Lambda}\, d\cos\theta_{\Lambda p}} = \frac{N}{4}\left(1 + \alpha_{\Xi\Sigma\gamma}\cos\theta_{\Sigma\Lambda}\,\alpha_-\cos\theta_{\Lambda p}\right)\ . \quad (6)$$

Our current average for $\alpha_{\Xi\Sigma\gamma}$ is -0.69 ± 0.06 [4,5].

References

1. R.E. Behrends, Phys. Rev. **111**, 1691 (1958); see Eq. (7) or (8).
2. In ancient times, the signs of the asymmetry term in the angular distributions of radiative and hadronic decays of polarized hyperons were sometimes opposite. For roughly 50 years, however, the overwhelming convention has been to make them the same. The aim, not always achieved, is to remove ambiguities.
3. For the definition of α_π, see the note on "Baryon Decay Parameters" in the Neutron Listings.
4. J.R. Batley *et al.*, Phys. Lett. **B693**, 241 (2010).
5. A. Alavi-Harati *et al.*, Phys. Rev. Lett. **86**, 3239 (2001).

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

See the note above on "Radiative Hyperon Decays."

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.704±0.019±0.064	52k	[1] BATLEY	10B	NA48	p Be, 400 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−0.78 ±0.18 ±0.06	672	LAI	04A	NA48	See BATLEY 10B
−0.43 ±0.44	87	[2] JAMES	90	SPEC	FNAL hyperons

[1] BATLEY 10B also measured the $\overline{\Xi}^0 \rightarrow \overline{\Lambda}\gamma$ asymmetry to be -0.798 ± 0.064 (no systematic error given) with 4769 events.

[2] The sign has been changed; see the erratum, JAMES 02.

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.8±0.2	397 ± 21	[1] BATLEY	07C	NA48	p Be, 400 GeV

[1] 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±0.030±0.076	15k	[1] BATLEY	10B	NA48	p Be, 400 GeV
−0.63 ±0.08 ±0.05	4045	ALAVI-HARATI	01C	KTEV	p nucleus, 800 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
+0.20 ±0.32 ±0.05	85	[2] TEIGE	89	SPEC	FNAL hyperons

[1] BATLEY 10B also measured the $\overline{\Xi}^0 \rightarrow \overline{\Sigma}^0\gamma$ asymmetry to be -0.786 ± 0.104 (no systematic error given) with 1404 events.

[2] This result has been withdrawn, due to an error. See the erratum, TEIGE 02.

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.22±0.05 OUR AVERAGE					
1.21±0.05		BATLEY	13	NA48	p Be, 400 GeV
$1.32^{+0.21}_{-0.17}\pm0.05$	487	[1] ALAVI-HARATI	01I	KTEV	p nucleus, 800 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.20±0.04±0.03	6520	[2] BATLEY	07	NA48	See BATLEY 13

[1] ALAVI-HARATI 01I assumes here that the second-class current is zero and that the weak-magnetism term takes its exact SU(3) value.

[2] This BATLEY 07 result uses our 2006 value of V_{us} from semileptonic kaon decays as input.

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{-1.7^{+2.1}_{-2.0}\pm0.5}$	487	[1] ALAVI-HARATI	01I	KTEV	p nucleus, 800 GeV

[1] ALAVI-HARATI 01I thus assumes that $g_2 = 0$ in calculating g_1/f_1, above.

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

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±1.2±0.5	487	ALAVI-HARATI	01I	KTEV	p nucleus, 800 GeV

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