Σ^0

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

The spin and parity have not been measured directly. They are of course assumed to be the same as for the Σ^+ and Σ^-.

Σ^0 MASS

The fit uses Σ^+, Σ^0, Σ^-, and Λ mass and mass-difference measurements.

VALUE (MeV)	DOCUMENT ID
1192.55±0.08 OUR FIT	Error includes scale factor of 1.2.

$m_{\Sigma^-} - m_{\Sigma^0}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
4.88±0.08 OUR FIT	Error includes scale factor of 1.2.				
4.86±0.08 OUR AVERAGE	Error includes scale factor of 1.2.				
4.87±0.12	37	DOSCH	65	HBC	
5.01±0.12	12	SCHMIDT	65	HBC	See note with Λ mass
4.75±0.1	18	BURNSTEIN	64	HBC	

$m_{\Sigma^0} - m_{\Lambda}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
76.87±0.08 OUR FIT	Error includes scale factor of 1.2.				
76.55±0.25 OUR AVERAGE					
76.23±0.55	109	COLAS	75	HLBC	$\Sigma^0 \rightarrow \Lambda\gamma$
76.63±0.28	208	SCHMIDT	65	HBC	See note with Λ mass

Σ^0 MEAN LIFE

These lifetimes are deduced from measurements of the cross sections for the Primakoff process $\Lambda \rightarrow \Sigma^0$ in nuclear Coulomb fields. An alternative expression of the same information is the Σ^0-Λ transition magnetic moment given in the following section. The relation is $(\mu_{\Sigma\Lambda}/\mu_N)^2\ \tau = 1.92951 \times 10^{-19}$ s (see DEVLIN 86).

VALUE (10^{-20} s)	DOCUMENT ID		TECN	COMMENT
7.4±0.7 OUR EVALUATION	Using $\mu_{\Sigma\Lambda}$ (see the above note).			
$6.5^{+1.7}_{-1.1}$	[1] DEVLIN	86	SPEC	Primakoff effect
7.6±0.5±0.7	[2] PETERSEN	86	SPEC	Primakoff effect
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.8±1.3	[1] DYDAK	77	SPEC	See DEVLIN 86

[1] DEVLIN 86 is a recalculation of the results of DYDAK 77 removing a numerical approximation made in that work.
[2] An additional uncertainty of the Primakoff formalism is estimated to be < 5%.

$|\mu(\Sigma^0 \rightarrow \Lambda)|$ TRANSITION MAGNETIC MOMENT

See the note in the Σ^0 mean-life section above. Also, see the Note on Baryon Magnetic Moments in the Λ Listings.

VALUE (μ_N)	DOCUMENT ID		TECN	COMMENT
1.61±0.08 OUR AVERAGE				
$1.72^{+0.17}_{-0.19}$	[3] DEVLIN	86	SPEC	Primakoff effect
1.59±0.05±0.07	[4] PETERSEN	86	SPEC	Primakoff effect
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.82^{+0.25}_{-0.18}$	[3] DYDAK	77	SPEC	See DEVLIN 86

[3] DEVLIN 86 is a recalculation of the results of DYDAK 77 removing a numerical approximation made in that work.
[4] An additional uncertainty of the Primakoff formalism is estimated to be < 2.5%.

Σ^0 DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$\Lambda\gamma$	100 %	
Γ_2	$\Lambda\gamma\gamma$	$<$ 3 %	90%
Γ_3	$\Lambda e^+ e^-$	[a] 5×10^{-3}	

[a] A theoretical value using QED.

Σ^0 BRANCHING RATIOS

$\Gamma(\Lambda\gamma\gamma)/\Gamma_{total}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID		TECN
<0.03	90	COLAS	75	HLBC

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

VALUE	DOCUMENT ID		COMMENT
0.00545	FEINBERG	58	Theoretical QED calculation

Σ^0 REFERENCES

DEVLIN	86	PR D34 1626	+Petersen, Beretvas	(RUTG)
PETERSEN	86	PRL 57 949	+Beretvas, Devlin, Luk+	(RUTG, WISC, MICH, MINN)
DYDAK	77	NP B118 1	+Navarria, Overseth, Steffen+	(CERN, DORT, HEIDH)
COLAS	75	NP B91 253	+Farwell, Ferrer, Six	(ORSAY)
DOSCH	65	PL 14 239	+Engelmann, Filthuth, Hepp, Kluge+	(HEID)
SCHMIDT	65	PR 140B 1328		(COLU)
BURNSTEIN	64	PRL 13 66	+Day, Kehoe, Zorn, Snow	(UMD)
FEINBERG	58	PR 109 1019		(BNL)