Ω^-

$I(J^P) = 0(\frac{3}{2}^+)$ Status: ****

The unambiguous discovery in both production and decay was by BARNES 64. The quantum numbers have not actually been measured, but follow from the assignment of the particle to the baryon decuplet. DEUTSCHMANN 78 and BAUBILLIER 78 rule out $J = 1/2$ and find consistency with $J = 3/2$.

We have omitted some results that have been superseded by later experiments. See our earlier editions.

Ω^- MASS

The fit assumes the Ω^- and $\overline{\Omega}^+$ masses are the same.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1672.45±0.29 OUR FIT					
1672.43±0.32 OUR AVERAGE					
1673 ±1	100	HARTOUNI	85	SPEC	80–280 GeV K^0_L C
1673.0 ±0.8	41	BAUBILLIER	78	HBC	8.25 GeV/c $K^- p$
1671.7 ±0.6	27	HEMINGWAY	78	HBC	4.2 GeV/c $K^- p$
1673.4 ±1.7	4	[1] DIBIANCA	75	DBC	4.9 GeV/c $K^- d$
1673.3 ±1.0	3	PALMER	68	HBC	$K^- p$ 4.6, 5 GeV/c
1671.8 ±0.8	3	SCHULTZ	68	HBC	$K^- p$ 5.5 GeV/c
1674.2 ±1.6	5	SCOTTER	68	HBC	$K^- p$ 6 GeV/c
1672.1 ±1.0	1	[2] FRY	55	EMUL	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1671.43±0.78	13	[3] DEUTSCH...	73	HBC	$K^- p$ 10 GeV/c
1671.9 ±1.2	6	[3] SPETH	69	HBC	See DEUTSCHMANN 73
1673.0 ±8.0	1	ABRAMS	64	HBC	$\rightarrow \Xi^- \pi^0$
1670.6 ±1.0	1	[2] FRY	55B	EMUL	
1615	1	[4] EISENBERG	54	EMUL	

[1] DIBIANCA 75 gives a mass for each event. We quote the average.

[2] The FRY 55 and FRY 55B events were identified as Ω^- by ALVAREZ 73. The masses assume decay to ΛK^- at rest. For FRY 55B, decay from an atomic orbit could Doppler shift the K^- energy and the resulting Ω^- mass by several MeV. This shift is negligible for FRY 55 because the Ω decay is approximately perpendicular to its orbital velocity, as is known because the Λ strikes the nucleus (L.Alvarez, private communication 1973). We have calculated the error assuming that the orbital n is 4 or larger.

[3] Excluded from the average; the Ω^- lifetimes measured by the experiments differ significantly from other measurements.

[4] The EISENBERG 54 mass was calculated for decay in flight. ALVAREZ 73 has shown that the Ω interacted with an Ag nucleus to give $K^- \Xi$ Ag.

$\overline{\Omega}^+$ MASS

The fit assumes the Ω^- and $\overline{\Omega}^+$ masses are the same.

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1672.45±0.29 OUR FIT					
1672.5 ±0.7 OUR AVERAGE					
1672 ±1	72	HARTOUNI	85	SPEC	80–280 GeV K^0_L C
1673.1 ±1.0	1	FIRESTONE	71B	HBC	12 GeV/c $K^+ d$

$(m_{\Omega^-} - m_{\overline{\Omega}^+}) / m_{\text{average}}$

A test of *CPT* invariance. Calculated from the *average* Ω^- and $\overline{\Omega}^+$ masses, above.

VALUE	DOCUMENT ID
(0±5) × 10^{-4} OUR EVALUATION	

Ω^- MEAN LIFE

Measurements with an error > 0.1×10^{-10} s have been omitted.

VALUE (10^{-10} s)	EVTS	DOCUMENT ID		TECN	COMMENT
0.822±0.012 OUR AVERAGE					
0.811±0.037	1096	LUK	88	SPEC	pBe 400 GeV
0.823±0.013	12k	BOURQUIN	84	SPEC	SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.822±0.028	2437	BOURQUIN	79B	SPEC	See BOURQUIN 84

Ω^- MAGNETIC MOMENT

VALUE (μ_N)	EVTS	DOCUMENT ID		TECN	COMMENT
−2.02 ±0.05 OUR AVERAGE					
−2.024±0.056	235k	WALLACE	95	SPEC	Ω^- 300–550 GeV
−1.94 ±0.17 ±0.14	25k	DIEHL	91	SPEC	Spin-transfer production

Ω^- DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	ΛK^-	(67.8±0.7) %	
Γ_2	$\Xi^0 \pi^-$	(23.6±0.7) %	
Γ_3	$\Xi^- \pi^0$	(8.6±0.4) %	
Γ_4	$\Xi^- \pi^+ \pi^-$	$(4.3^{+3.4}_{-1.3}) \times 10^{-4}$	
Γ_5	$\Xi(1530)^0 \pi^-$	$(6.4^{+5.1}_{-2.0}) \times 10^{-4}$	
Γ_6	$\Xi^0 e^- \overline{\nu}_e$	$(5.6 \pm 2.8) \times 10^{-3}$	
Γ_7	$\Xi^- \gamma$	$< 4.6 \times 10^{-4}$	90%

$\Delta S = 2$ forbidden ($S2$) modes

Γ_8	$\Lambda\pi^-$	$S2$	$<$	1.9	$\times 10^{-4}$	90%

Ω^- BRANCHING RATIOS

The BOURQUIN 84 values (which include results of BOURQUIN 79B, a separate experiment) are much more accurate than any other results, and so the other results have been omitted.

$\Gamma(\Lambda K^-)/\Gamma_{total}$ — Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.678±0.007	14k	BOURQUIN	84	SPEC	SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.686±0.013	1920	BOURQUIN	79B	SPEC	See BOURQUIN 84

$\Gamma(\Xi^0\pi^-)/\Gamma_{total}$ — Γ_2/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.236±0.007	1947	BOURQUIN	84	SPEC	SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.234±0.013	317	BOURQUIN	79B	SPEC	See BOURQUIN 84

$\Gamma(\Xi^-\pi^0)/\Gamma_{total}$ — Γ_3/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.086±0.004	759	BOURQUIN	84	SPEC	SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.080±0.008	145	BOURQUIN	79B	SPEC	See BOURQUIN 84

$\Gamma(\Xi^-\pi^+\pi^-)/\Gamma_{total}$ — Γ_4/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{4.3^{+3.4}_{-1.3}}$	4	BOURQUIN	84	SPEC	SPS hyperon beam

$\Gamma(\Xi(1530)^0\pi^-)/\Gamma_{total}$ — Γ_5/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{6.4^{+5.1}_{-2.0}}$	4	[5] BOURQUIN	84	SPEC	SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 20	1	BOURQUIN	79B	SPEC	See BOURQUIN 84

[5] The same 4 events as in the previous mode, with the isospin factor to take into account $\Xi(1530)^0 \rightarrow \Xi^0\pi^0$ decays included.

$\Gamma(\Xi^0 e^-\overline{\nu}_e)/\Gamma_{total}$ — Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
5.6±2.8	14	BOURQUIN	84	SPEC	SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 10	3	BOURQUIN	79B	SPEC	See BOURQUIN 84

$\Gamma(\Xi^-\gamma)/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 4.6	90	0	ALBUQUERQ..	94	E761	Ω^- 375 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<22	90	9	BOURQUIN	84	SPEC	SPS hyperon beam
<31	90	0	BOURQUIN	79B	SPEC	See BOURQUIN 84

$\Gamma(\Lambda\pi^-)/\Gamma_{total}$ — Γ_8/Γ

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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 1.9	90	0	BOURQUIN	84	SPEC	SPS hyperon beam
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<13	90	0	BOURQUIN	79B	SPEC	See BOURQUIN 84

Ω^- DECAY PARAMETERS

α FOR $\Omega^- \to \Lambda K^-$

Some early results have been omitted.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.026±0.026 OUR AVERAGE					
−0.034±0.079	1743	LUK	88	SPEC	pBe 400 GeV
−0.025±0.028	12k	BOURQUIN	84	SPEC	SPS hyperon beam

α FOR $\Omega^- \to \Xi^0\pi^-$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
+0.09±0.14	1630	BOURQUIN	84	SPEC	SPS hyperon beam

α FOR $\Omega^- \to \Xi^-\pi^0$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
+0.05±0.21	614	BOURQUIN	84	SPEC	SPS hyperon beam

Ω^- REFERENCES

We have omitted some papers that have been superseded by later experiments. See our earlier editions.

WALLACE 95 PRL 74 3732 +Border+ (MINN, ARIZ, MICH, FNAL)
ALBUQUERQ... 94 PR D50 R18 Albuquerque, Bondar, Carrigan+ (FNAL E761 Collab.)
DIEHL 91 PRL 67 804 +Teige, Thompson, Zou+ (RUTG, FNAL, MICH, MINN)
LUK 88 PR D38 19 +Beretvas, Deck+ (RUTG, WISC, MICH, MINN)
HARTOUNI 85 PRL 54 628 +Atiya, Holmes, Knapp, Lee+ (COLU, ILL, FNAL)
BOURQUIN 84 NP B241 1 + (BRIS, GEVA, HEIDP, LALO, RAL, STRB)
Also 79 PL 87B 297 Bourquin+ (BRIS, GEVA, HEIDP, ORSAY, RHEL, STRB)
BOURQUIN 79B PL 88B 192 + (BRIS, GEVA, HEIDP, LALO, RAL)
BAUBILLIER 78 PL 78B 342 + (BIRM, CERN, GLAS, MSU, CURIN, PARIN) J
DEUTSCH... 78 PL 73B 96 Deutschmann+ (AACH3, BERL, CERN, INNS, LOIC+) J
HEMINGWAY 78 NP B142 205 +Armenteros+ (CERN, ZEEM, NIJM, OXF)
DIBIANCA 75 NP B98 137 +Endorf (CMU)
ALVAREZ 73 PR D8 702 (LBL)

DEUTSCH...	73	NP B61 102	Deutschmann, Kaufmann, Besliv+	(ABCLV Collab.)
FIRESTONE	71B	PRL 26 410	+Goldhaber, Lissauer, Sheldon, Trilling	(LRL)
SPETH	69	PL 29B 252	+	(AACH, BERL, CERN, LOIC, VIEN)
PALMER	68	PL 26B 323	+Radojicic, Rau, Richardson+	(BNL, SYRA)
SCHULTZ	68	PR 168 1509	+	(ILL, ANL, NWES, WISC)
SCOTTER	68	PL 26B 474	+	(BIRM, GLAS, LOIC, MUNI, OXF)
ABRAMS	64	PRL 13 670	+Burnstein, Glasser+	(UMD, NRL)
BARNES	64	PRL 12 204	+Connolly, Crennell, Culwick+	(BNL)
FRY	55	PR 97 1189	+Schneps, Swami	(WISC)
FRY	55B	NC 2 346	+Schneps, Swami	(WISC)
EISENBERG	54	PR 96 541		(CORN)