Ξ_c^+

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

According to the quark model, the Ξ_c^+ (quark content usc) and Ξ_c^0 form an isospin doublet, and the spin-parity ought to be $J^P = 1/2^+$. None of I, J, or P has actually been measured.

Ξ_c^+ MASS

The fit uses the Ξ_c^+ and Ξ_c^0 mass and mass-difference measurements.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2466.3± 1.4 OUR FIT					
2466.4± 1.5 OUR AVERAGE					
2465.8± 1.9± 2.5	90	FRABETTI	98	E687	γ Be, $\overline{E}_\gamma$= 220 GeV
2467.0± 1.6± 2.0	147	EDWARDS	96	CLE2	$e^+e^- \approx \Upsilon(4S)$
2465.1± 3.6± 1.9	30	ALBRECHT	90F	ARG	e^+e^- at $\Upsilon(4S)$
2467 ± 3 ± 4	23	ALAM	89	CLEO	e^+e^- 10.6 GeV
2466.5± 2.7± 1.2	5	BARLAG	89C	ACCM	π^- Cu 230 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2464.4± 2.0± 1.4	30	FRABETTI	93B	E687	See FRABETTI 98
2459 ± 5 ±30	56	[1] COTEUS	87	SPEC	nA $\simeq$ 600 GeV
2460 ±25	82	BIAGI	83	SPEC	Σ^- Be 135 GeV

[1] Although COTEUS 87 claims to agree well with BIAGI 83 on the mass and width, there appears to be a discrepancy between the two experiments. BIAGI 83 sees a single peak (stated significance about 6 standard deviations) in the $\Lambda K^-\pi^+\pi^+$ mass spectrum. COTEUS 87 sees *two* peaks in the same spectrum, one at the Ξ_c^+ mass, the other 75 MeV lower. The latter is attributed to $\Xi_c^+ \rightarrow \Sigma^0 K^-\pi^+\pi^+ \rightarrow (\Lambda\gamma)K^-\pi^+\pi^+$, with the γ unseen. The *combined* significance of the double peak is stated to be 5.5 standard deviations. But the absence of any trace of a lower peak in BIAGI 83 seems to us to throw into question the interpretation of the lower peak of COTEUS 87.

Ξ_c^+ MEAN LIFE

VALUE (10^{-12} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$0.33^{+0.06}_{-0.04}$ OUR AVERAGE					
$0.34^{+0.07}_{-0.05}\pm0.02$	56	FRABETTI	98	E687	γ Be, $\overline{E}_\gamma$= 220 GeV
$0.20^{+0.11}_{-0.06}$	6	BARLAG	89C	ACCM	π^- (K^-) Cu 230 GeV
$0.40^{+0.18}_{-0.12}\pm0.10$	102	COTEUS	87	SPEC	nA $\simeq$ 600 GeV
$0.48^{+0.21+0.20}_{-0.15-0.10}$	53	BIAGI	85C	SPEC	Σ^- Be 135 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.41^{+0.11}_{-0.08}\pm0.02$	30	FRABETTI	93B	E687	See FRABETTI 98

Ξ_c^+ DECAY MODES

No absolute branching fractions have been measured. The following are branching *ratios* relative to $\Xi^-\pi^+\pi^+$.

	Mode		Fraction (Γ_i/Γ)	Confidence level
Γ_1	$\Lambda K^-\pi^+\pi^+$	[a]	0.58 ± 0.18	
Γ_2	$\Lambda\overline{K}^*(892)^0\pi^+$	[a,b]	<0.29	90%
Γ_3	$\Sigma(1385)^+K^-\pi^+$	[a,b]	<0.41	90%
Γ_4	$\Sigma^+K^-\pi^+$	[a]	1.18 ± 0.31	
Γ_5	$\Sigma^+\overline{K}^*(892)^0$	[a,b]	0.92 ± 0.30	
Γ_6	$\Sigma^0K^-\pi^+\pi^+$	[a]	0.49 ± 0.26	
Γ_7	$\Xi^0\pi^+$	[a]	0.55 ± 0.16	
Γ_8	$\Xi^-\pi^+\pi^+$	[a]	$\equiv 1.0$	
Γ_9	$\Xi(1530)^0\pi^+$	[a,b]	<0.2	90%
Γ_{10}	$\Xi^0\pi^+\pi^0$	[a]	2.34 ± 0.68	
Γ_{11}	$\Xi^0\pi^+\pi^+\pi^-$	[a]	1.74 ± 0.50	
Γ_{12}	$\Xi^0 e^+\nu_e$	[a]	$2.3\ ^{+0.7}_{-0.9}$	
Γ_{13}	$pK^-\pi^+$	[a]	0.20 ± 0.05	

[a] No absolute branching fractions have been measured. The following are branching *ratios* relative to $\Xi^-\pi^+\pi^+$.

[b] This branching fraction includes all the decay modes of the final-state resonance.

Ξ_c^+ BRANCHING RATIOS

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	56	COTEUS	87	SPEC	$nA\simeq$ 600 GeV
seen	82	[2] BIAGI	83	SPEC	Σ^- Be 135 GeV

[2] BIAGI 85B looks for but does not see the Ξ_c^+ in $pK^-\overline{K}^0\pi^+$ ($\Gamma(pK^-\overline{K}^0\pi^+)$ / $\Gamma(\Lambda K^-\pi^+\pi^+)$ <0.08 with 90% CL), $p2K^-2\pi^+$ ($\Gamma(p2K^-2\pi^+)$ / $\Gamma(\Lambda K^-\pi^+\pi^+)$ <0.03, 90% CL), $\Omega^-K^+\pi^+$, $\Lambda K^{*0}\pi^+$, and $\Sigma(1385)^+K^-\pi^+$.

$\Gamma(\Lambda K^-\pi^+\pi^+)/\Gamma(\Xi^-\pi^+\pi^+)$ Γ_1/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.58\pm0.16\pm0.07$	61	BERGFELD	96	CLE2	$e^+e^-\approx\ \Upsilon(4S)$

$\Gamma(\Lambda\overline{K}^*(892)^0\pi^+)/\Gamma(\Lambda K^-\pi^+\pi^+)$ Γ_2/Γ_1

Unseen decay modes of the $\overline{K}^*(892)^0$ are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.5	90	BERGFELD	96	CLE2	$e^+e^-\approx\ \Upsilon(4S)$

$\Gamma(\Sigma(1385)^+ K^- \pi^+)/\Gamma(\Lambda K^- \pi^+ \pi^+)$ Γ_3/Γ_1

Unseen decay modes of the $\Sigma(1385)^+$ are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.7	90	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^+ K^- \pi^+)/\Gamma(\Xi^- \pi^+ \pi^+)$ Γ_4/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.18±0.26±0.17	119	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.92 \pm 0.20 \pm 0.07$		[3] JUN	00	SELX	Σ^- nucleus, 600 GeV
$0.09^{+0.13+0.03}_{-0.06-0.02}$	5	BARLAG	89C	ACCM	2 $\Sigma^+ K^- \pi^+$, 3 $\Xi^- \pi^+ \pi^+$

[3] This JUN 00 result is redundant with other results given below.

$\Gamma(\Sigma^+ \overline{K}^*(892)^0)/\Gamma(\Xi^- \pi^+ \pi^+)$ Γ_5/Γ_8

Unseen decay modes of the $\overline{K}^*(892)^0$ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.92±0.27±0.14	61	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	59	AVERY	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Sigma^0 K^- \pi^+ \pi^+)/\Gamma(\Lambda K^- \pi^+ \pi^+)$ Γ_6/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.84±0.36	47	[4] COTEUS	87	SPEC	$nA \simeq$ 600 GeV

[4] See, however, the note on the COTEUS 87 Ξ_c^+ mass measurement.

$\Gamma(\Xi^0 \pi^+)/\Gamma(\Xi^- \pi^+ \pi^+)$ Γ_7/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.55±0.13±0.09	39	EDWARDS	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Xi^- \pi^+ \pi^+)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	131	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$
seen	160	AVERY	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$
seen	30	FRABETTI	93B	E687	γ Be, $\overline{E}_\gamma =$ 220 GeV
seen	30	ALBRECHT	90F	ARG	$e^+ e^-$ at $\Upsilon(4S)$
seen	23	ALAM	89	CLEO	$e^+ e^-$ 10.6 GeV

$\Gamma(\Xi(1530)^0 \pi^+)/\Gamma(\Xi^- \pi^+ \pi^+)$ Γ_9/Γ_8

Unseen decay modes of the $\Xi(1530)^0$ are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.2	90	BERGFELD	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Xi^0 \pi^+ \pi^0)/\Gamma(\Xi^- \pi^+ \pi^+)$ Γ_{10}/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
2.34±0.57±0.37	81	EDWARDS	96	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\Xi(1530)^0\pi^+)/\Gamma(\Xi^0\pi^+\pi^0)$ Γ_9/Γ_{10}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.3	90	EDWARDS	96	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi^0\pi^+\pi^+\pi^-)/\Gamma(\Xi^-\pi^+\pi^+)$ Γ_{11}/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$1.74\pm0.42\pm0.27$	57	EDWARDS	96	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi^0 e^+\nu_e)/\Gamma(\Xi^-\pi^+\pi^+)$ Γ_{12}/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$2.3\pm0.6^{+0.3}_{-0.6}$	41	ALEXANDER	95B	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(pK^-\pi^+)/\Gamma(\Sigma^+K^-\pi^+)$ Γ_{13}/Γ_4

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.22\pm0.06\pm0.03$	76	JUN	00	SELX	Σ^- nucleus, 600 GeV

$\Gamma(pK^-\pi^+)/\Gamma(\Xi^-\pi^+\pi^+)$ Γ_{13}/Γ_8

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.20\pm0.04\pm0.02$	76	JUN	00	SELX	Σ^- nucleus, 600 GeV

Ξ_c^+ REFERENCES

JUN	00	PRL 84 1857	S.Y. Jun *et al.*	(FNAL SELEX Collab.)
FRABETTI	98	PL B427 211	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
BERGFELD	96	PL B365 431	T. Bergfeld *et al.*	(CLEO Collab.)
EDWARDS	96	PL B373 261	K.W. Edwards *et al.*	(CLEO Collab.)
ALEXANDER	95B	PRL 74 3113	J. Alexander *et al.*	(CLEO Collab.)
Also	95E	PRL 75 4155 (erratum)	J. Alexander *et al.*	(CLEO Collab.)
AVERY	95	PRL 75 4364	P. Avery *et al.*	(CLEO Collab.)
FRABETTI	93B	PRL 70 1381	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ALBRECHT	90F	PL B247 121	H. Albrecht *et al.*	(ARGUS Collab.)
ALAM	89	PL B226 401	M.S. Alam *et al.*	(CLEO Collab.)
BARLAG	89C	PL B233 522	S. Barlag *et al.*	(ACCMOR Collab.)
COTEUS	87	PRL 59 1530	P. Coteus *et al.*	(FNAL E400 Collab.)
BIAGI	85B	ZPHY C28 175	S.F. Biagi *et al.*	(CERN WA62 Collab.)
BIAGI	85C	PL 150B 230	S.F. Biagi *et al.*	(CERN WA62 Collab.)
BIAGI	83	PL 122B 455	S.F. Biagi *et al.*	(CERN WA62 Collab.)