$\Lambda_c(2593)^+$

$I(J^P) = 0(\frac{1}{2}^-)$ Status: ***

Seen in $\Lambda_c^+ \pi^+ \pi^-$ but not in $\Lambda_c^+ \pi^0$, so this is indeed an excited Λ_c^+ rather than a Σ_c^+. The $\Lambda_c^+ \pi^+ \pi^-$ mode is largely, and perhaps entirely, $\Sigma_c \pi$, which is just at threshold; thus (assuming, as has not yet been proven, that the Σ_c has $J^P = 1/2^+$) the J^P here is almost certainly $1/2^-$. This result is in accord with the theoretical expectation that this is the charm counterpart of the strange $\Lambda(1405)$.

$\Lambda_c(2593)^+$ MASS

The value is obtained from the $m_{\Lambda_c(2593)^+} - m_{\Lambda_c^+}$ mass-difference measurement below.

VALUE (MeV)	DOCUMENT ID
2593.6±1.0 OUR FIT Error includes scale factor of 1.2.	

$m_{\Lambda_c(2593)^+} - m_{\Lambda_c^+}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
308.6±0.8 OUR FIT Error includes scale factor of 1.3.					
308.6±0.8 OUR AVERAGE Error includes scale factor of 1.3.					
309.2±0.7±0.3	14	[1] FRABETTI	96	E687	γBe, $\overline{E}_\gamma \approx$ 220 GeV
307.5±0.4±1.0	112	[2] EDWARDS	95	CLEO	$e^+e^- \approx$ 10.5 GeV

[1] FRABETTI 96 claims a signal of 13.9 ± 4.5 events.
[2] EDWARDS 95 claims a signal of 112.5 ± 16.5 events in $\Lambda_c^+ \pi^+ \pi^-$.

$\Lambda_c(2593)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$3.9^{+1.4+2.0}_{-1.2-1.0}$	112	EDWARDS	95	CLEO	$e^+e^- \approx$ 10.5 GeV

$\Lambda_c(2593)^+$ DECAY MODES

$\Lambda_c^+ \pi\pi$ and $\Sigma_c(2455)\pi$ — the latter just barely — are the only strong decays allowed to an excited Λ_c^+ having this mass; and the $\Lambda_c^+ \pi^+ \pi^-$ mode seems to be largely via $\Sigma_c^{++} \pi^-$ or $\Sigma_c^0 \pi^+$.

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\Lambda_c^+ \pi^+ \pi^-$	seen
Γ_2	$\Sigma_c(2455)^{++} \pi^-$	large
Γ_3	$\Sigma_c(2455)^0 \pi^+$	large
Γ_4	$\Lambda_c^+ \pi^+ \pi^-$ 3-body	small
Γ_5	$\Lambda_c^+ \pi^0$	not seen
Γ_6	$\Lambda_c^+ \gamma$	not seen

$\Lambda_c(2593)^+$ BRANCHING RATIOS

$\Gamma(\Sigma_c(2455)^{++}\pi^-)/\Gamma(\Lambda_c^+\pi^+\pi^-)$ Γ_2/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.36±0.09±0.09	EDWARDS	95	CLEO	$e^+e^- \approx$ 10.5 GeV

$\Gamma(\Sigma_c(2455)^0\pi^+)/\Gamma(\Lambda_c^+\pi^+\pi^-)$ Γ_3/Γ_1

VALUE	DOCUMENT ID		TECN	COMMENT
0.42±0.09±0.09	EDWARDS	95	CLEO	$e^+e^- \approx$ 10.5 GeV

$[\Gamma(\Sigma_c(2455)^{++}\pi^-) + \Gamma(\Sigma_c(2455)^0\pi^+)]/\Gamma(\Lambda_c^+\pi^+\pi^-)$ $(\Gamma_2+\Gamma_3)/\Gamma_1$

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>0.51	90	[3] FRABETTI	96	E687	γBe, $\overline{E}_\gamma \approx$ 220 GeV

[3] The results of FRABETTI 96 are consistent with this ratio being 100%.

$\Gamma(\Lambda_c^+\pi^0)/\Gamma(\Lambda_c^+\pi^+\pi^-)$ Γ_5/Γ_1

$\Lambda_c^+\pi^0$ decay is forbidden by isospin conservation if this state is in fact a Λ_c.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.53	90	EDWARDS	95	CLEO	e^+e^- ≈ 10.5 GeV

$\Gamma(\Lambda_c^+\gamma)/\Gamma(\Lambda_c^+\pi^+\pi^-)$ Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.98	90	EDWARDS	95	CLEO	e^+e^- ≈ 10.5 GeV

$\Lambda_c(2593)^+$ REFERENCES

FRABETTI	96	PL B365 461	+Cheung, Cumalat+	(FNAL E687 Collab.)
EDWARDS	95	PRL 74 3331	+Ogg, Bellerive, Britton+	(CLEO Collab.)