

$\Lambda_c(2595)^+$ $I(J^P) = 0(\frac{1}{2}^-)$ Status: ***

The $\Lambda_c^+ \pi^+ \pi^-$ mode is largely, and perhaps entirely, $\Sigma_c \pi$, which is just at threshold; since 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 $\Lambda(1405)$.

$\Lambda_c(2595)^+$ MASS

The mass is obtained from the $\Lambda_c(2595)^+ - \Lambda_c^+$ mass-difference measurements below.

VALUE (MeV)	DOCUMENT ID
2592.25 ± 0.28 OUR FIT	

$\Lambda_c(2595)^+ - \Lambda_c^+$ MASS DIFFERENCE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
305.79 ± 0.24 OUR FIT				
305.79 ± 0.14 ± 0.20	3.5k	AALTONEN	11H CDF	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
305.6 ± 0.3		¹ BLECHMAN	03	Threshold shift
309.7 ± 0.9 ± 0.4	19	ALBRECHT	97 ARG	$e^+ e^- \approx 10$ GeV
309.2 ± 0.7 ± 0.3	14 ± 4.5	FRABETTI	96 E687	γ Be, $\bar{E}_\gamma \approx 220$ GeV
307.5 ± 0.4 ± 1.0	112 ± 17	EDWARDS	95 CLE2	$e^+ e^- \approx 10.5$ GeV

¹ BLECHMAN 03 finds that a more sophisticated treatment than a simple Breit-Wigner for the proximity of the threshold of the dominant decay, $\Sigma_c(2455)\pi$, lowers the $\Lambda_c(2595)^+ - \Lambda_c^+$ mass difference by 2 or 3 MeV. The analysis of AALTONEN 11H bears this out.

$\Lambda_c(2595)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.59 ± 0.30 ± 0.47	3.5k	² AALTONEN	11H CDF	$p\bar{p}$ at 1.96 TeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.9 $\begin{smallmatrix} +2.9 & +1.8 \\ -2.1 & -1.4 \end{smallmatrix}$	19	ALBRECHT	97 ARG	$e^+ e^- \approx 10$ GeV
3.9 $\begin{smallmatrix} +1.4 & +2.0 \\ -1.2 & -1.0 \end{smallmatrix}$	112 ± 17	EDWARDS	95 CLE2	$e^+ e^- \approx 10.5$ GeV

² AALTONEN 11H treats the three charged modes $\Lambda_c(2595)^+ \rightarrow \Sigma_c(2455)^{++} \pi^-$, $\Sigma_c(2455)^+ \pi^0$, $\Sigma_c(2455)^0 \pi^+$ separately in terms of a common coupling constant h_2 and obtains $h_2^2 = 0.36 \pm 0.08$. From this the width is determined.

$\Lambda_c(2595)^+$ DECAY MODES

$\Lambda_c^+ \pi \pi$ and its submode $\Sigma_c(2455) \pi$ — the latter just barely — are the only strong decays allowed to an excited Λ_c^+ having this mass; and the submode seems to dominate.

Mode	Fraction (Γ_i/Γ)
Γ_1 $\Lambda_c^+ \pi^+ \pi^-$	[a] —
Γ_2 $\Sigma_c(2455)^{++} \pi^-$	24 ± 7 %
Γ_3 $\Sigma_c(2455)^0 \pi^+$	24 ± 7 %
Γ_4 $\Lambda_c^+ \pi^+ \pi^-$ 3-body	18 ± 10 %
Γ_5 $\Lambda_c^+ \pi^0$	[b] not seen
Γ_6 $\Lambda_c^+ \gamma$	not seen

[a] See AALTONEN 11H, Fig. 8, for the calculated ratio of $\Lambda_c^+ \pi^0 \pi^0$ and $\Lambda_c^+ \pi^+ \pi^-$ partial widths as a function of the $\Lambda_c(2595)^+ - \Lambda_c^+$ mass difference. At our value of the mass difference, the ratio is about 4.

[b] A test that the isospin is indeed 0, so that the particle is indeed a Λ_c^+ .

 $\Lambda_c(2595)^+$ BRANCHING RATIOS

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.36 ± 0.10 OUR AVERAGE			
$0.37 \pm 0.12 \pm 0.13$	ALBRECHT 97	ARG	$e^+ e^- \approx 10$ GeV
$0.36 \pm 0.09 \pm 0.09$	EDWARDS 95	CLE2	$e^+ e^- \approx 10.5$ GeV

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.37 ± 0.10 OUR AVERAGE			
$0.29 \pm 0.10 \pm 0.11$	ALBRECHT 97	ARG	$e^+ e^- \approx 10$ GeV
$0.42 \pm 0.09 \pm 0.09$	EDWARDS 95	CLE2	$e^+ e^- \approx 10.5$ 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. • • •				

$0.66^{+0.13}_{-0.16} \pm 0.07$		ALBRECHT 97	ARG	$e^+ e^- \approx 10$ GeV
> 0.51	90	³ FRABETTI 96	E687	γ Be, $\bar{E}_\gamma \approx 220$ 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	CLE2	$e^+ e^- \approx 10.5$ GeV

$\Gamma(\Lambda_c^+ \gamma) / \Gamma(\Lambda_c^+ \pi^+ \pi^-)$					Γ_6 / Γ_1
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<0.98	90	EDWARDS	95	CLE2	$e^+ e^- \approx 10.5$ GeV

$\Lambda_c(2595)^+$ REFERENCES

AALTONEN	11H	PR D84 012003	T. Aaltonen <i>et al.</i>	(CDF Collab.)
BLECHMAN	03	PR D67 074033	A.E. Blechman <i>et al.</i>	(JHU, FLOR)
ALBRECHT	97	PL B402 207	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
FRABETTI	96	PL B365 461	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
EDWARDS	95	PRL 74 3331	K.W. Edwards <i>et al.</i>	(CLEO Collab.)