$\Sigma_c(2455)$

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

The angular distribution of $B^- \to \Sigma_c(2455)^0 \overline{p}$ favors $J = 1/2$ (as the quark model predicts). $J = 3/2$ is excluded by more than four σ see AUBERT 08BN.

$\Sigma_c(2455)$ MASSES

The masses are obtained from the mass-difference measurements that follow.

$\Sigma_c(2455)^{++}$ MASS

VALUE (MeV)	DOCUMENT ID
2453.97±0.14 OUR FIT	

$\Sigma_c(2455)^{+}$ MASS

VALUE (MeV)	DOCUMENT ID
2452.9±0.4 OUR FIT	

$\Sigma_c(2455)^{0}$ MASS

VALUE (MeV)	DOCUMENT ID
2453.75±0.14 OUR FIT	

$\Sigma_c(2455) - \Lambda_c^+$ MASS DIFFERENCES

$m_{\Sigma_c^{++}} - m_{\Lambda_c^+}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
167.510± 0.017 OUR FIT					
167.510± 0.022 OUR AVERAGE					
167.51 ± 0.01 ±0.02	36k	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
167.44 ± 0.04 ±0.12	13.8k	AALTONEN	11H	CDF	$p\overline{p}$ at 1.96 TeV
167.4 ± 0.1 ±0.2	2k	ARTUSO	02	CLE2	$e^+e^- \approx \Upsilon(4S)$
167.35 ± 0.19 ±0.12	461	LINK	00C	FOCS	γ A, $\overline{E}_\gamma$ 180 GeV
167.76 ± 0.29 ±0.15	122	AITALA	96B	E791	$\pi^- N$, 500 GeV
167.6 ± 0.6 ±0.6	56	FRABETTI	96	E687	γBe, $\overline{E}_\gamma \approx$ 220 GeV
168.2 ± 0.3 ±0.2	126	CRAWFORD	93	CLE2	$e^+e^- \approx \Upsilon(4S)$
167.8 ± 0.4 ±0.3	54	BOWCOCK	89	CLEO	e^+e^- 10 GeV
168.2 ± 0.5 ±1.6	92	ALBRECHT	88D	ARG	e^+e^- 10 GeV
167.4 ± 0.5 ±2.0	46	DIESBURG	87	SPEC	nA $\sim$ 600 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
167 ± 1	2	JONES	87	HBC	νp in BEBC
166 ± 1	1	BOSETTI	82	HBC	See JONES 87
168 ± 3	6	BALTAY	79	HLBC	ν Ne-H in 15-ft
166 ±15	1	CAZZOLI	75	HBC	νp in BNL 7-ft

$m_{\Sigma_c^+} - m_{\Lambda_c^+}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
166.4±0.4 OUR FIT					
166.4±0.2±0.3	661	AMMAR	01	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
168.5±0.4±0.2	111	CRAWFORD	93	CLE2	See AMMAR 01
168 ±3	1	CALICCHIO	80	HBC	νp in BEBC-TST

$m_{\Sigma_c^0} - m_{\Lambda_c^+}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
167.290±0.017 OUR FIT					
167.290±0.022 OUR AVERAGE					
167.29 ±0.01 ±0.02	32k	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
167.28 ±0.03 ±0.12	15.9k	AALTONEN	11H	CDF	$p\overline{p}$ at 1.96 TeV
167.2 ±0.1 ±0.2	2k	ARTUSO	02	CLE2	$e^+e^- \approx \Upsilon(4S)$
167.38 ±0.21 ±0.13	362	LINK	00C	FOCS	γ A, $\overline{E}_\gamma$ 180 GeV
167.38 ±0.29 ±0.15	143	AITALA	96B	E791	$\pi^- N$, 500 GeV
167.8 ±0.6 ±0.2		ALEEV	96	SPEC	n nucleus, 50 GeV/c
166.6 ±0.5 ±0.6	69	FRABETTI	96	E687	γBe, $\overline{E}_\gamma \approx$ 220 GeV
167.1 ±0.3 ±0.2	124	CRAWFORD	93	CLE2	$e^+e^- \approx \Upsilon(4S)$
168.4 ±1.0 ±0.3	14	ANJOS	89D	E691	γBe 90–260 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
167.9 ±0.5 ±0.3	48	[1] BOWCOCK	89	CLEO	e^+e^- 10 GeV
167.0 ±0.5 ±1.6	70	[1] ALBRECHT	88D	ARG	e^+e^- 10 GeV
178.2 ±0.4 ±2.0	85	[2] DIESBURG	87	SPEC	nA ~ 600 GeV
163 ±2	1	AMMAR	86	EMUL	νA

[1] This result enters the fit through $m_{\Sigma_c^{++}} - m_{\Sigma_c^0}$ given below.

[2] See the note on DIESBURG 87 in the $m_{\Sigma_c^{++}} - m_{\Sigma_c^0}$ section below.

Σ_c(2455) MASS DIFFERENCES

$m_{\Sigma_c^{++}} - m_{\Sigma_c^0}$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
0.220±0.013 OUR FIT				
0.221±0.014 OUR AVERAGE				
0.22 ±0.01 ±0.01	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
0.2 ±0.1 ±0.1	ARTUSO	02	CLE2	$e^+e^- \approx \Upsilon(4S)$
− 0.03 ±0.28 ±0.11	LINK	00C	FOCS	γ A, $\overline{E}_\gamma$ 180 GeV
0.38 ±0.40 ±0.15	AITALA	96B	E791	$\pi^- N$, 500 GeV
1.1 ±0.4 ±0.1	CRAWFORD	93	CLE2	$e^+e^- \approx \Upsilon(4S)$
− 0.1 ±0.6 ±0.1	BOWCOCK	89	CLEO	e^+e^- 10 GeV
1.2 ±0.7 ±0.3	ALBRECHT	88D	ARG	$e^+e^- \sim$ 10 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−10.8 ±2.9	[3] DIESBURG	87	SPEC	nA ~ 600 GeV

[3] DIESBURG 87 is completely incompatible with the other experiments, which is surprising since it agrees with them about $m_{\Sigma_c(2455)^{++}} - m_{\Lambda_c^+}$. We go with the majority here.

$m_{\Sigma_c^+} - m_{\Sigma_c^0}$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
-0.9 ± 0.4 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.4\pm0.5\pm0.3$	CRAWFORD	93	CLE2	See AMMAR 01

$\Sigma_c(2455)$ WIDTHS

$\Sigma_c(2455)^{++}$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$1.89^{+0.09}_{-0.18}$ OUR AVERAGE	Error includes scale factor of 1.1.				
$1.84\pm0.04^{+0.07}_{-0.20}$	36k	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
$2.34\pm0.13\pm0.45$	13.8k	AALTONEN	11H	CDF	$p\overline{p}$ at 1.96 TeV
$2.3\ \pm0.2\ \pm0.3$	2k	ARTUSO	02	CLE2	$e^+e^- \approx\ \Upsilon(4S)$
$2.05^{+0.41}_{-0.38}\pm0.38$	1110	LINK	02	FOCS	γ A, $\overline{E}_\gamma \approx 180$ GeV

$\Sigma_c(2455)^{+}$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<4.6	90	661	AMMAR	01	CLE2	$e^+e^- \approx\ \Upsilon(4S)$

$\Sigma_c(2455)^{0}$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$1.83^{+0.11}_{-0.19}$ OUR AVERAGE	Error includes scale factor of 1.2.				
$1.76\pm0.04^{+0.09}_{-0.21}$	32k	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
$1.65\pm0.11\pm0.49$	15.9k	AALTONEN	11H	CDF	$p\overline{p}$ at 1.96 TeV
$2.6\ \pm0.5\ \pm0.3$		AUBERT	08BN	BABR	$B^- \to\ \overline{p}\Lambda_c^+\pi^-$
$2.5\ \pm0.2\ \pm0.3$	2k	ARTUSO	02	CLE2	$e^+e^- \approx\ \Upsilon(4S)$
$1.55^{+0.41}_{-0.37}\pm0.38$	913	LINK	02	FOCS	γ A, $\overline{E}_\gamma \approx 180$ GeV

$\Sigma_c(2455)$ DECAY MODES

$\Lambda_c^+\pi$ is the only strong decay allowed to a Σ_c having this mass.

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\Lambda_c^+\pi$	≈ 100 %

$\Sigma_c(2455)$ REFERENCES

LEE	14	PR D89 091102	S.-H. Lee *et al.*	(BELLE Collab.)
AALTONEN	11H	PR D84 012003	T. Aaltonen *et al.*	(CDF Collab.)
AUBERT	08BN	PR D78 112003	B. Aubert *et al.*	(BABAR Collab.)
ARTUSO	02	PR D65 071101	M. Artuso *et al.*	(CLEO Collab.)
LINK	02	PL B525 205	J.M. Link *et al.*	(FNAL FOCUS Collab.)
AMMAR	01	PRL 86 1167	R. Ammar *et al.*	(CLEO Collab.)
LINK	00C	PL B488 218	J.M. Link *et al.*	(FNAL FOCUS Collab.)
AITALA	96B	PL B379 292	E.M. Aitala *et al.*	(FNAL E791 Collab.)
ALEEV	96	JINRRC 3-77 31	A.N. Aleev *et al.*	(Serpukhov EXCHARM Collab.)
FRABETTI	96	PL B365 461	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
CRAWFORD	93	PRL 71 3259	G. Crawford *et al.*	(CLEO Collab.)
ANJOS	89D	PRL 62 1721	J.C. Anjos *et al.*	(FNAL E691 Collab.)
BOWCOCK	89	PRL 62 1240	T.J.V. Bowcock *et al.*	(CLEO Collab.)
ALBRECHT	88D	PL B211 489	H. Albrecht *et al.*	(ARGUS Collab.)
DIESBURG	87	PRL 59 2711	M. Diesburg *et al.*	(FNAL E400 Collab.)
JONES	87	ZPHY C36 593	G.T. Jones *et al.*	(CERN WA21 Collab.)
AMMAR	86	JETPL 43 515	R. Ammar *et al.*	(ITEP)
		Translated from ZETFP 43 401.		
BOSETTI	82	PL 109B 234	P.C. Bosetti *et al.*	(AACH3, BONN, CERN+)
CALICCHIO	80	PL 93B 521	M. Calicchio *et al.*	(BARI, BIRM, BRUX+)
BALTAY	79	PRL 42 1721	C. Baltay *et al.*	(COLU, BNL) I
CAZZOLI	75	PRL 34 1125	E.G. Cazzoli *et al.*	(BNL)