

$\Xi_c(2970)$

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

was $\Xi_c(2980)$

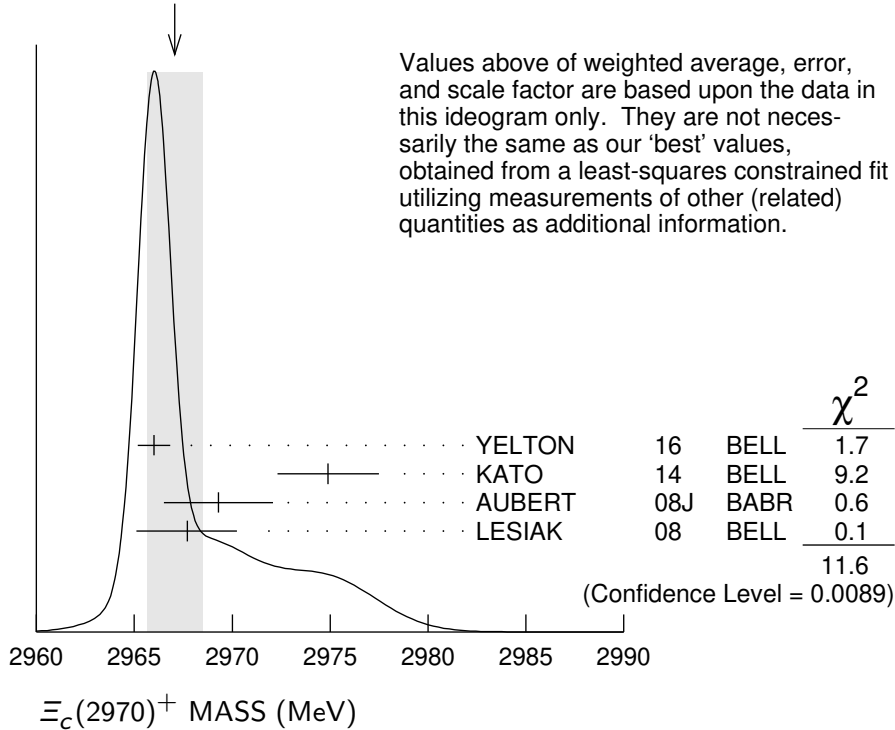
$J^P = 1/2^+$ is favored by MOON 21.

$\Xi_c(2970)$ MASSES

$\Xi_c(2970)^+$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2964.3±1.5 OUR FIT	Error includes scale factor of 3.9.			
2967.1±1.4 OUR AVERAGE	Error includes scale factor of 2.0. See the ideogram below.			
2966.0±0.8±0.2	0.9k	YELTON	16 BELL	$e^+e^- \rightarrow \Upsilon(4S), \Upsilon(5S)$ and continuum
2974.9±1.5±2.1	244 ± 39	KATO	14 BELL	$e^+e^- \Upsilon(1S)$ to $\Upsilon(5S)$
2969.3±2.2±1.7	756 ± 206	AUBERT	08J BABR	$e^+e^- \approx 10.58 \text{ GeV}$
2967.7±2.3 ^{+1.1} _{-1.2}	78 ± 13	LESIK	08 BELL	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2978.5±2.1±2.0	405 ± 51	CHISTOV	06 BELL	See KATO 14

WEIGHTED AVERAGE
2967.1±1.4 (Error scaled by 2.0)



$\Xi_c(2970)^0$ MASS

The evidence is statistically weaker for this charge state.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2967.1 ±1.7 OUR FIT				Error includes scale factor of 6.7.
2965.9 ±2.2 OUR AVERAGE				Error includes scale factor of 7.4.
2964.88 ±0.26 ±0.20	11.7k	¹ AAIJ	20X LHCB	pp at 13 TeV
2970.8 ±0.7 ±0.2	1.4k	YELTON	16 BELL	$e^+e^- \rightarrow \Upsilon(4S), \Upsilon(5S), \text{continuum}$
2972.9 ±4.4 ±1.6	67 ± 44	AUBERT	08J BABR	$e^+e^- \approx 10.58 \text{ GeV}$
2965.7 ±2.4 $\begin{smallmatrix} +1.1 \\ -1.2 \end{smallmatrix}$	57 ± 13	LESLIAK	08 BELL	$e^+e^- \approx \Upsilon(4S)$
2977.1 ±8.8 ±3.5	42 ± 24	CHISTOV	06 BELL	$e^+e^- \approx \Upsilon(4S)$

¹ AAIJ 20X reports $2964.88 \pm 0.26 \pm 0.14 \pm 0.14 \text{ MeV}$ where the last uncertainty is due to the Λ_c^+ mass. Further studies are required to establish whether the narrow resonance at 2965 MeV is a different baryon from the narrow resonance at 2970 MeV seen by YELTON 16.

$\Xi_c(2970) - \Xi_c$ MASS DIFFERENCES

$m_{\Xi_c(2970)^+} - m_{\Xi_c^+}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
496.6 ±1.5 OUR FIT				Error includes scale factor of 3.7.
498.1 ±0.8 ±0.2	916	YELTON	16 BELL	e^+e^- , Υ regions

$m_{\Xi_c(2970)^0} - m_{\Xi_c^0}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
496.7 ±1.8 OUR FIT				Error includes scale factor of 5.3.
499.9 ±0.7 ±0.2	1.4k	YELTON	16 BELL	e^+e^- , Υ regions

$\Xi_c(2970)^+ - \Xi_c(2970)^0$ MASS DIFFERENCE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-2.8 ±1.9 OUR FIT			Error includes scale factor of 4.8.
-4.8 ±0.1 ±0.5	YELTON	16 BELL	916 and 1443 evts

$\Xi_c(2970)$ WIDTHS

$\Xi_c(2970)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.9 $\begin{smallmatrix} +2.4 \\ -3.5 \end{smallmatrix}$ OUR AVERAGE				Error includes scale factor of 1.2.
28.1 ±2.4 $\begin{smallmatrix} +1.0 \\ -5.0 \end{smallmatrix}$	916	YELTON	16 BELL	e^+e^- , Υ regions
14.8 ±2.5 ±4.1	244 ± 39	KATO	14 BELL	$e^+e^- \Upsilon(1S) \text{ to } \Upsilon(5S)$
27 ±8 ±2	756 ± 206	AUBERT	08J BABR	$e^+e^- \approx 10.58 \text{ GeV}$
18 ±6 ±3	78 ± 13	LESLIAK	08 BELL	$e^+e^- \approx \Upsilon(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
43.5 ±7.5 ±7.0	405 ± 51	CHISTOV	06 BELL	See KATO 14

$\Xi_c(2970)^0$ WIDTH

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
14.1±0.9±1.3	11.7k	¹ AAIJ	20X LHCb	pp at 13 TeV
30.3±2.3 ^{+1.0} _{-1.8}	1443	YELTON	16 BELL	e^+e^- , Υ regions

• • • We do not use the following data for averages, fits, limits, etc. • • •

31 ±7 ±8	67 ± 44	AUBERT	08J BABR	$e^+e^- \approx 10.58$ GeV
15 ±6 ±3	57 ± 13	LESIAK	08 BELL	$e^+e^- \approx \Upsilon(4S)$

¹ Further studies are required to establish whether the narrow resonance at 2965 MeV is a different baryon from the narrow resonance at 2970 MeV seen by YELTON 16.

$\Xi_c(2970)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \Lambda_c^+ \bar{K} \pi$	seen
$\Gamma_2 \Sigma_c(2455) \bar{K}$	seen
$\Gamma_3 \Lambda_c^+ \bar{K}$	not seen
$\Gamma_4 \Lambda_c^+ K^-$	seen
$\Gamma_5 \Xi_c 2\pi$	seen
$\Gamma_6 \Xi_c' \pi$	seen
$\Gamma_7 \Xi_c(2645) \pi$	seen

$\Xi_c(2970)$ BRANCHING RATIOS

$\Gamma(\Lambda_c^+ \bar{K} \pi)/\Gamma_{\text{total}}$	Γ_1/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
seen	AUBERT 08J BABR $e^+e^- \approx \Upsilon(4S)$
seen	CHISTOV 06 BELL $e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Lambda_c^+ K^-)/\Gamma_{\text{total}}$	Γ_4/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
seen	11.7k ¹ AAIJ 20X LHCb pp at 13 TeV

¹ Further studies are required to establish whether the narrow resonance at 2965 MeV is a different baryon from the narrow resonance at 2970 MeV seen by YELTON 16.

$\Gamma(\Sigma_c(2455) \bar{K})/\Gamma(\Lambda_c^+ \bar{K} \pi)$	Γ_2/Γ_1
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
0.55±0.07±0.13	AUBERT 08J BABR $e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi_c' \pi)/\Gamma_{\text{total}}$	Γ_6/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
seen	YELTON 16 BELL e^+e^- , Υ regions

$\Gamma(\Xi_c(2645) \pi)/\Gamma_{\text{total}}$	Γ_7/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u> <u>TECN</u> <u>COMMENT</u>
seen	LESIAK 08 BELL $e^+e^- \approx \Upsilon(4S)$

$\Gamma(\Xi_c' \pi) / \Gamma(\Xi_c(2645)\pi)$					Γ_6 / Γ_7
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$1.67 \pm 0.29 \pm_{-0.09}^{+0.15} \pm 0.25$	778	¹ MOON	21	BELL $e^+ e^-$ at $\Upsilon(nS)$	

¹ Measurement of the ratio of $\Xi_c(2970)^+ \rightarrow \Xi_c(2645)^0 \pi^+$ versus $\Xi_c(2970)^+ \rightarrow \Xi_c^0 \pi^+$. The last uncertainty is from possible isospin-symmetry-breaking effects. MOON 21 determines from an angular analysis of the $\Xi_c^+ \pi^+ \pi^-$ final state that the spin of the $\Xi_c(2970)^+$ is strongly compatible with $J = 1/2$, assuming domination by the lowest partial wave in $\Xi_c(2970)^+ \rightarrow \Xi_c(2645)^0 \pi^+$. When further combined with the size of this ratio, MOON 21 determines from heavy quark symmetry that the spin-parity of the $\Xi_c(2970)^+$ is favored to be $J^P = 1/2^+$, with light degrees of freedom in the 0^+ state.

$\Xi_c(2970)$ REFERENCES

MOON	21	PR D103 L111101	T.J. Moon <i>et al.</i>	(BELLE Collab.) JP
AAIJ	20X	PRL 124 222001	R. Aaij <i>et al.</i>	(LHCb Collab.)
YELTON	16	PR D94 052011	J. Yelton <i>et al.</i>	(BELLE Collab.)
KATO	14	PR D89 052003	Y. Kato <i>et al.</i>	(BELLE Collab.)
AUBERT	08J	PR D77 012002	B. Aubert <i>et al.</i>	(BABAR Collab.)
LESIK	08	PL B665 9	T. Lesiak <i>et al.</i>	(BELLE Collab.)
CHISTOV	06	PRL 97 162001	R. Chistov <i>et al.</i>	(BELLE Collab.)