Observation of the doubly charmed baryon Ξ_{cc}^{++}

LHCb collaboration, arXiv:1707.01621

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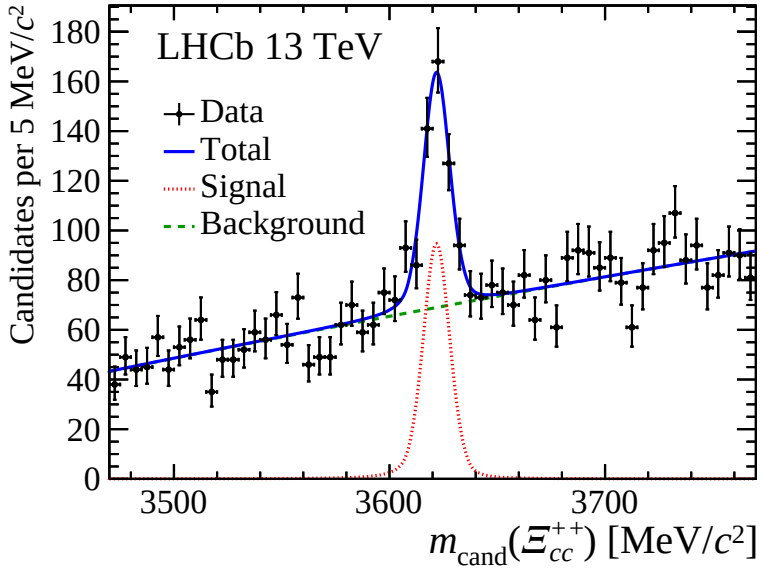
Contents

1 Summary

- A doubly charmed baryon Ξ_{cc}^{++} is discovered by LHCb experiment
- Ξ_{cc}^{++} mass is consistent with our lattice QCD prediction
  - ♢ $m_{\Xi_{cc}} = 3621(1)$ MeV by LHCb(2017)
  - ♢ $m_{\Xi_{cc}} = 3603(22)$ MeV by Namekawa et al.(2013)

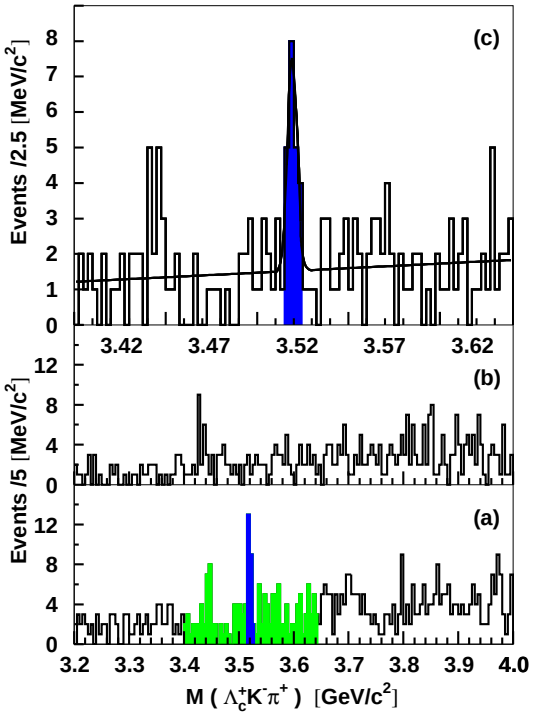


2 History

- 2002 year : $m_{\Xi_{cc}} = 3519(2)$ MeV(6.3σ significance for $\Xi_{cc} \to \Lambda_c K \pi$) by SELEX experiment
- 2003 year : No signal at SELEX value by FOCUS experiment
- 2005 year : $m_{\Xi_{cc}} = 3518(3)$ MeV(4.8σ significance for $\Xi_{cc} \to pDK$) by SELEX experiment
- 2006 year : No signal at SELEX value by BaBar, Belle experiment
- 2013 year : No signal at SELEX value by LHCb experiment
- 2017 year : $m_{\Xi_{cc}} = 3621(1)$ MeV(12σ significance for $\Xi_{cc} \to \Lambda_c K \pi \pi$) by LHCb experiment

[SELEX(2002) experiment]

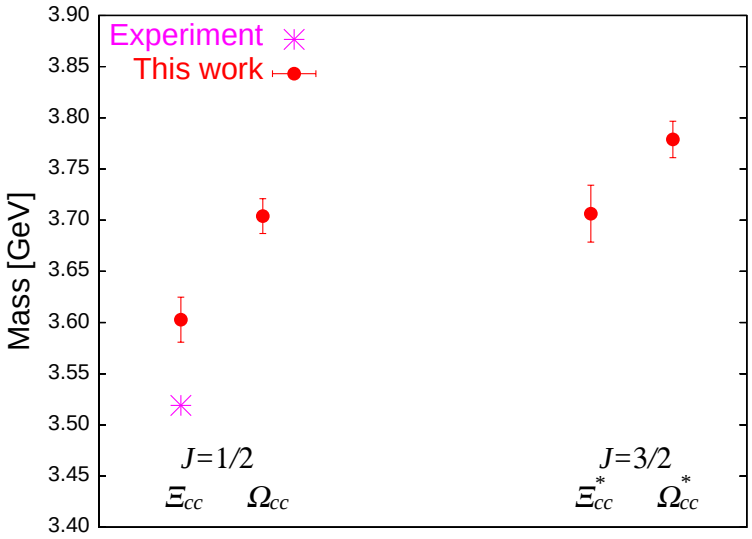
- Clear signal at $m_{\Xi_{cc}} = 3519(2)$ MeV(6.3σ significance for $\Xi_{cc} \to \Lambda_c K\pi$)

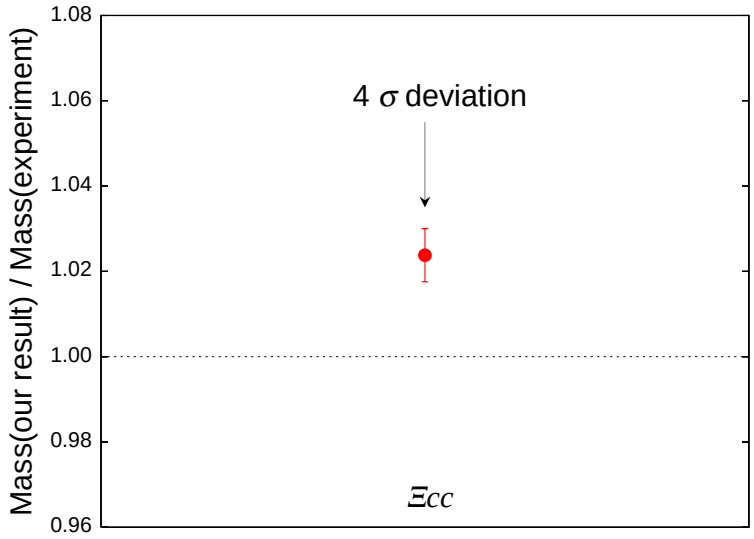


3 Our lattice QCD result

Physical point configuration(very realistic simulation) PACS-CS(2010)
+ Relativistic heavy quark(reducing lattice artifacts) Aoki,Kuramashi,Tominaga(2003)

- Our result does not agree with the experimental value of Ξ_{cc}.
  - ♢ Our result for Ξ_{cc} is higher than SELEX value by 100 MeV (4σ deviation).





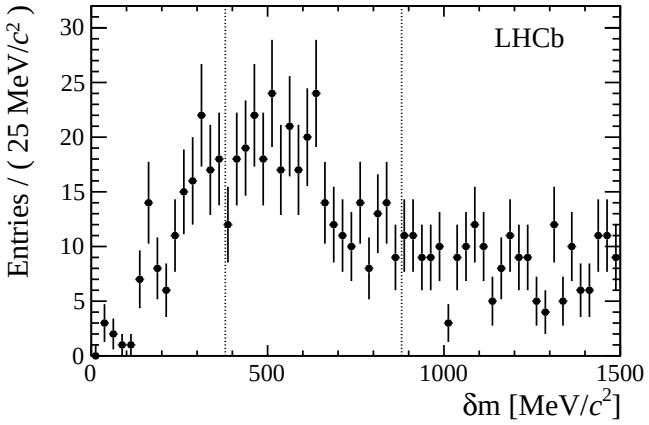
4 LHCb experiment

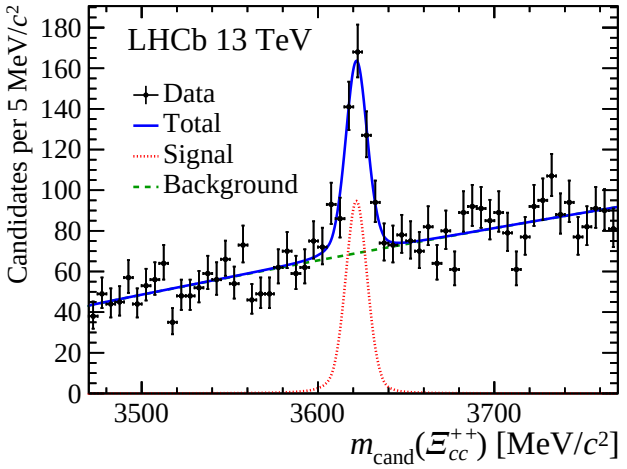
- No signal for $\Xi_{cc} \to \Lambda_c K\pi$ by LHCb(7TeV,0.65fb^{-1},2013)

$$\delta m := m_{\Xi_{cc}} - m_{\Lambda_c} - m_K - m_\pi = m_{\Xi_{cc}} - 2.9\text{GeV}$$

- Signal is found for $\Xi_{cc} \to \Lambda_c K\pi\pi$ by LHCb(13TeV,1.7fb^{-1},2017)

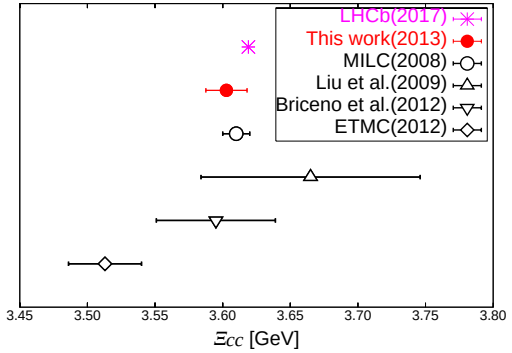
  ♢ $m_{\Xi_{cc}} = 3621(1)$ MeV ($\delta m = 700$ MeV)





[Comparison of lattice QCD results]

- Lattice QCD predictions agree with LHCb value, except for that by ETMC(2012)



5 Summary(again)

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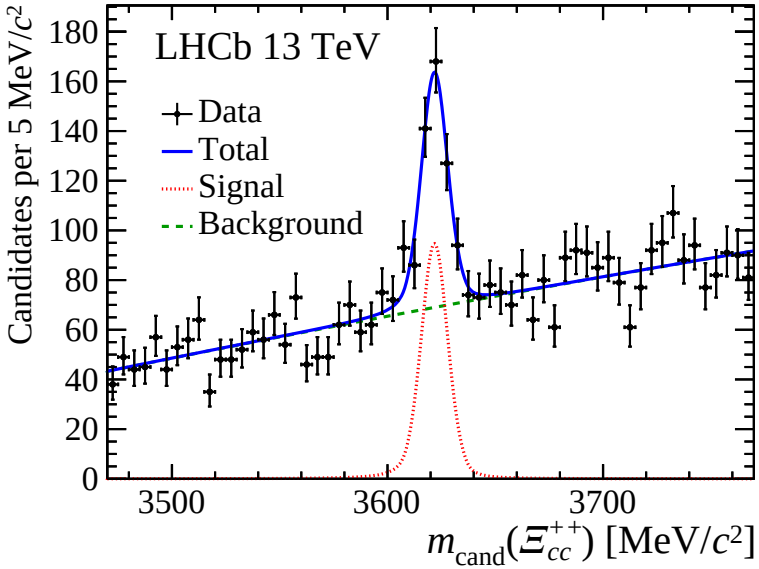

Appendix