Exploring the doubly charmed baryon

The doubly charmed baryon, like the proton and neutron, is formed by three quarks. However, they are different, as such a baryon consists of two heavy quarks (charm-quark) and one light quark, while the proton and neutron respectively contain three light quarks. Therefore the doubly charmed baryon is expected to have different internal structures and properties. For example, its mass is 3-4 times higher than those of the proton and neutron. Studying the doubly charmed baryons can provide important information to understand the three-body bound system, the hadronic interaction and the quark model.

Recently, the LHCb collaboration [1] reported the observation of the doubly charmed baryon Ξ_{cc}^{++} (quark content: ccu) via its decay to $\Lambda_c^+ K^- \pi^+ \pi^+$ final states and measured its mass. The LHCb collaboration also measured the Ξ_{cc}^{++} lifetime [2], and established the weak decay nature of the doubly charmed baryon. The observation of the Ξ_{cc}^{++} baryon has been confirmed in another decay mode $\Xi_{cc}^{++} \rightarrow \Xi_c^+ \pi^+$ by the LHCb collaboration [3].

In the current work [4], the LHCb collaboration reported the results of a search for the doubly charmed baryon Ξ_{cc}^+ (quark content ccd), which is the isospin partner of the Ξ_{cc}^{++} baryon. They have observed some piece of evidence (hint) of the signal at the same place of the Ξ_{cc}^{++} mass with a local (global) significance of 3.1σ (1.7σ). They reported the most stringent upper limits on the ratio of the production rate of the Ξ_{cc}^+ baryon relative to that of the Ξ_{cc}^{++} baryon and the singly charmed baryon Λ_c^+ . This is an important milestone to the observation of the singly charged Ξ_{cc}^+ .

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