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The Production and Decay Dynamics of the Charmed Baryon Λ_c^+ in e^+e^- Annihilations near Threshold

The study of the charmed baryons is crucial for investigating the strong and weak interactions in the Standard Model and for gaining insights into the internal structure of baryons. In an e^+e^- experiment the lightest charmed baryon, Λ_c^+, can be produced in pairs through the single photon annihilation process. This process can be described by two complex electromagnetic form factors. The presence of a non-zero relative phase between these form factors gives rise to a transverse polarization of the charmed baryon and provides additional constraints on the dynamic parameters in the decays. In this article, we present the first observation of the transverse polarization of Λ_c^+ in the reaction $e^+e^- \to \Lambda_c^+\bar{\Lambda}_c^-$, based on 6.4fb^{-1} of e^+e^-annihilation data collected at center-of-mass energies between 4600 MeV and 4951 MeV with the BESIII detector. The decay asymmetry parameters and strong phase shift in the decays $\Lambda_c^+ \to pK_S^0, \Lambda\pi^+, \Sigma^0\pi^+, \Sigma^+\pi^0$ are also simultaneously extracted from the joint angular distributions. These results are vital for understanding CP violation and its role in the matter-antimatter asymmetry of the Universe.

Primary authors: Dr SUN, Hao (UCAS); Dr WANG, Hongjian (Lanzhou University); Dr HAN, Kunlin (University of Chinese Academy of Sciences); Prof. LI, Peirong (Lanzhou University); Prof. PING, Ronggang (IHEP); MA, Hailong (IHEP); Prof. LYU, Xiao-Rui (University of Chinese Academy of Sciences); ZHENG, Yangheng (University of Chinese Academy of Sciences)

Presenter: Dr SUN, Hao (UCAS)

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