Charmed baryon spectroscopy experiment at J-PARC

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The heavy quark baryon spectroscopy is an essential ways to understand the hadron structure. In the case of the charmed baryon, two light quarks are isolated and form the diquark correlation due to the small color-magnetic interaction between the charm and lighter quarks. The excitation modes from the diquark correlation are reflected to the structure of the excited spectrum and the decay modes of excited states. In addition, by measuring the ratio of the cross section between the ground state Λ_c^+ and excited states, the information of the inside structure such as the configuration of the diquark correlation and the spin/isospin of excited states can be obtained [1]. From the systematic study of charmed baryons, the diquark correlation which is expectedly a degree of freedom to describe hadrons can be revealed.

We propose a spectroscopy experiment [2] to investigate excited states of charmed baryons at the J-PARC high-momentum beam line. The high-intensity secondary pion beams of more than 10^7 per pulse are used with a momentum of 20 GeV/c. The beam momentum can be measured with the resolution of 0.1% by using the momentum-dispersive optics. The excitation energy, width and production cross section are measured by the missing mass technique. The charmed baryons are produced via the $\pi^- + p \rightarrow Y_c^{*+} + D^{*-}$ reaction. The decay particles of the D^{*-} meson are detected by the forward magnetic spectrometer system which has a large acceptance and a high-momentum resolution. Due to the forward large acceptance of the spectrometer, the decay measurements of the produced charmed baryons can also be performed for determining the absolute decay branching ratio and the spin/parity of the excited states. The systematic measurement of the excitation energy, production rate and decay properties of charmed baryons are performed at J-PARC.

[1] S.H. Kim, A. Hosaka, H.C. Kim, H. Noumi, K. Shirotori, arXiv:1405.3445.
[2] H. Noumi *et al*., J-PARC E50 Proposal, 2012.