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Study on ${}^{6}_{\Lambda}$H hypernucleus by the (π^-, K^+) reaction at J-PARC

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One of the frontier topics in the strangeness nuclear physics is the study of neutron-rich Λ hypernuclei[1]. It is expected that the glue like role of the Λ hyperon is critical in nuclei beyond the neutron-drip line. The knowledge of the behavior of hyperons in a neutron-excess environment will significantly affect our understanding of neutron stars, because adding hyperons softens the Equation of State of matter at the core[2].

Motivated by these issues, we aimed to produce ${}^{6}_{\Lambda}$H hypernucleus because the hypernucleus has the largest neutron to proton ratio. The study would provide new information on the hypernuclear physics and the neutron star structures. Recently, the FINUDA collaboration reported observation of 3 candidate events for the production of the ${}^{6}_{\Lambda}$H hypernucleus[3]. The FINUDA result was suggesting a bound state of the ${}^{6}_{\Lambda}$H hypernucleus and was encouraging for us.

We carried out the ${}^{6}_{\Lambda}$H production experiment by the (π^-, K^+) double charge-exchange reaction on a ^{6}Li target at the pion beam momentum of 1.2GeV/c. Moreover, in order to calibrate the scale of the mass or Λ binding energy of the hypernucleus, we measured the ^{12}C(π^+, K^+)${}^{12}_{\Lambda}$C, p(π^-, K^+)Σ^- and p(π^+, K^+)Σ^+ reactions. In our experiment during December 2012 to January 2013 at the K1.8 beamline, Hadron Hall, J-PARC, the data have been collected for an integrated beam intensity of 1.65×10^{12} pions. The results of the ${}^{6}_{\Lambda}$H production experiment will be presented and discussed in this conference.

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