Search for $^{6}_{\Lambda}$H hypernucleus by the (π^-, K^+) reaction at p_{π^-}=1.2GeV/c

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The study of neutron-rich hypernuclei is one of the most important topics in the strangeness nuclear physics. The glue-like role of the Λ hyperon expected to be 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 the addition of hyperons softens the Equation of State of matter at the core.

Furthermore, the neutron-rich hypernuclei are suitable for studying the effect of the ΛN-ΣN mixing. A non-zero isospin of the core nucleus is indispensable for a large mixing because the core nucleus is a buffer of the isospin to absorb the isospin difference between Λ and Σ hyperons. To study these effects, we selected the $^{6}_{\Lambda}$H hypernucleus which consists of one proton, four neutrons, and one Λ hyperon.

An experiment was proposed aiming at a precise spectroscopic investigation of the light neutron-rich Λ hypernucleus $^{6}_{\Lambda}$H via the (π^-, K^+) reaction at the π^- beam momentum of 1.2 GeV/c [1]. If more than 100 production events of $^{6}_{\Lambda}$H are observed, both the binding energy and the production cross section can be obtained in a good statistical accuracy. The information would be important in order to discuss the ΛN-ΣN mixing effect, quantitatively.

The experiment was performed at the K1.8 beam line of the J-PARC Hadron Experimental Facility. The K1.8 beam line spectrometer and the Superconducting Kaon Spectrometer (SKS) were used. Since the cross section of the (π^-,K^+) reaction is considerably small, roughly 10^{-3} of that of the non-charge-exchange (π^+,K^+) reaction, high intensity pion beams of 12-14 M/spill (2s spill) were used. Totally 1.4×10^{12} π^- were irradiated on a ^{6}Li (95.54% enriched) target of 3.5 g/cm^2 in thickness.

In this talk, details of the data analysis will be presented and the physical meaning of the first results [2] will be discussed.

References

[1] A. Sakaguchi et al., J-PARC Proposal E10 (2006).

[2] H. Sugimura et al., J-PARC E10 Collaboration, Phys. Lett. **B729** (2014) 39.