Study of Λn Interaction via FSI in $\gamma + d$ reaction

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We, the NKS2 collaboration, had been investigating the strangeness photoproduction in $\gamma + d$ reaction near the threshold at ELPH-TOHOKU. One of the most important future plan of NKS2 is Λn interaction study via K^+ measurement in $\gamma + d$ reaction.

The ΛN interaction had been studied in mainly light-heavy hypernuclei. There is a discrepancy in Λ binding energy of ${}^{4}_{\Lambda}$H and ${}^{4}_{\Lambda}$He between experimental data and theoretical calculations. It is problem of the charge symmetry breaking (CSB) in ΛN interaction. The recent report of precise measurement of ${}^{4}_{\Lambda}$He in MAMI [1] supports that there is the ΛN CSB.

One of key issues to understand the ΛN CSB is a comparison of Λp with Λn interaction by direct measurement. There are no data of Λn scattering because of difficulty of the experiment, while there are data of Λp interaction from scattering experiments. Therefore, even the Λn scattering length of S-wave is not defined. To obtain Λn interaction information, we propose a different kind of experiment from hypernucler study which needs not only the interaction but also nuclear structure discussion. The K^+ measurement of $\gamma + d$ reaction give us the important data in inelastic scattering and low energy region of Λn interaction.

Theoretical study shows that the cross-section of K^+ in $\gamma + d$ is different from $\gamma + p$ via final state interaction (FSI): (1) in the production threshold region, and (2) 10 times larger yield in forward and backward region in CM system.[2-5] The tagged photon beam line in ELPH-TOHOKU provide us maximum 1.25 GeV of photon beam and it is covered the threshold region of kaon photoproduction. The NKS2 spectrometer has large coverage of kinematic region of produced hadron including forward region.

We will present feasibility of NKS2 for the measurement of Λn interaction via FSI in $\gamma + d$ reaction, and a detector update plan for the new experiment.

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