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High resolution spectroscopy of Ξ hypernuclei with Active Fiber Target

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Recently, a few Ξ-hypernuclear events have been reported from emulsion experiments. The Ξ-nucleus interaction was found to be attractive. However, the binding energies and their widths of Ξ hypernuclei are still uncertain based on the emulsion events, so energy spectra measured with higher statistics by spectroscopic experiments are needed.

We are going to perform a high-resolution spectroscopy of Ξ hypernuclei in a missing-mass method via the (K^-, K^+) reaction (J-PARC E70 experiment). The experiment will be carried out at the J-PARC K1.8 beamline, which provides a high-intensity K^- beam, with a newly constructed high resolution magnetic spectrometer S-2S. An active fiber target (AFT) will be used as an experimental target. The expected statistics and missing-mass resolutions are about 100 counts and 2 MeV/c^2 (FWHM), respectively, which enable us to investigate the structure of a Ξ hypernucleus with a higher signal sensitivity than previous experiments.

The AFT is composed of about 900 scintillation fibers, and the carbon nuclei contained in the scintillation fibers will be used as the target nuclei to produce ${}^{12}_{\Xi}$Be hypernuclei. 100 fibers per set are arranged orthogonally to the incident K^- beam (xx'yy'), for a total of 9 sets. Scintillation light is read out from both ends of a fiber by SiPM (MPPC), and thus the total number of channels is up to 1800. The AFT enables us to directly measure the energy loss of $K^\pm$ particles in the target event by event because the yield of output scintillation light is proportional to the energy loss. As a result, the target missing-mass resolution of 2 MeV/c^2 (FWHM) are expected to be achieved.

In this talk, I will report the status of the AFT and discuss the prospects of the J-PARC E70 experiment.

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