

Hypernuclear spectroscopy via $(e, e' K^+)$ reaction

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After 15 years of efforts at JLab, the $(e, e' K^+)$ reaction spectroscopy of Λ hypernuclei was established. This method converts a proton to a Λ while well-established (K^-, π^-) and (π^+, K^+) reactions convert a neutron to a Λ . Therefore, hypernuclear spectroscopies with electron and with meson beams are complimentary and quite useful to discuss isomultiplet partners.

The hypernuclear production with electron beams has experimental advantages over spectroscopies with meson beams such as capability of absolute energy calibration and excellent energy resolution thanks to high quality of electron beams. However, it suffers from severe background problems due to Bremsstrahlung and Møller scattering. Many experimental efforts were paid to meet this challenge in JLab Hall-A and C. Introduction of a new short-orbit high-resolution kaon spectrometer (HKS), high-resolution electron spectrometer (HES) with an optimized configuration to avoid high rate electron backgrounds in Hall-C and introduction of high efficiency kaon identification systems in Hall-A are examples.

The spectroscopies on ${}^7_{\Lambda}\text{He}$ [1], ${}^{10}_{\Lambda}\text{Be}$ [2], ${}^{12}_{\Lambda}\text{B}$ [3], ${}^{16}_{\Lambda}\text{N}$ [4], ${}^{28}_{\Lambda}\text{Al}$ [5] were successfully carried out and these results triggered recent intensive efforts on study of the Charge Symmetry Breaking of the ΛN interaction. I will review what we have learned from the investigation of hypernuclear spectroscopy with electron beams at JLab based on recent and near future publications.

- [1] S.N. Nakamura *et al.*, Phys. Rev. Lett. **110**, 012502 (2013).
- [2] T. Gogami *et al.*, to be submitted.
- [3] L. Tang *et al.*, Phys. Rev. **C 90**, 034320 (2014).
- [4] F. Cusanno *et al.*, Phys. Rev. Lett. **103**, 202501 (2009).
- [5] C. Chen *et al.*, to be submitted.