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Current status of hypertriton lifetime measurement with J-PARC E73 experiment

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As the lightest hypernucleus, hypertriton serves as an important benchmark for hypernuclear physics: its ground state spin, iso-spin and uniquely small binding energy (˜130 keV) has been used to derive the fundamental property of YN interaction since its discovery. For a long time, it has been generally accepted that the hypertriton has a similar lifetime as free Lambda hyperon
because of the large separation between Lambda and deuteron inside the hypertriton as a consequence of its small binding energy. However, since 10 years ago, several heavy-ion based experiments (HypHI in 2013, ALICE in 2016 and STAR in 2018) reported a surprisingly short lifetime. Though some of the listed experiments updated them results latterly, it is clear that an independent experimental approach is needed to improve the situation.

Our J-PARC E73 experiment is dedicated to perform the hypertriton lifetime measurement with an independent approach. We employ the so called strangeness exchange reaction $^{3}\mathrm{He}(K^{-},\pi^{0})^{3}_{\Lambda}\mathrm{H}$ at J-PARC K1.8BR beam line in Japan. A distinguished advantage of our method is to selectively populate the spin non-flip hypertriton ground state, which is not guaranteed for the heavy-ion based experiments. In order to measure out-going π^{0} meson, we invented a new photon-tagging method, which enables us to effectively select the strangeness exchange reaction even without the missing mass information. The populated hypertriton can be identified with the π^{-} meson decayed from $^{3}_{\Lambda}\mathrm{H}$ hypernucleus. The hypertriton lifetime can then be obtained by measuring the π^{-} meson decay time directly, which is different from the decay length method used by the heavy-ion based experiments. In this presentation, we will describe the E73 experimental setup and the current status.

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