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High-resolution hypernuclear decay pion spectroscopy at MAMI and future

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Precise measurements of Λ hypernuclear binding energies are essential in understanding the interaction between Λ and nucleons. Thanks to the recent progress of accurate theoretical calculations and cutting-edge experiments for Λ hypernuclei around the light mass regions, the studies of the interaction of the hypernuclear medium have progressed well; for example, the effect of Λ-Σ coupling and the Λ-N Charge Symmetry Breaking. Though recent ${}^{3}_{\Lambda}$H mass and lifetime results from the heavy-ion collision experiments have significantly impacted reconsidering the hypernuclear picture, more accurate measurements are necessary to discuss further.
We have developed a new technique "decay pion spectroscopy" to measure the Λ binding energies of the hypernuclear ground states with an accuracy of better than 100 keV/c^2. In 2015, we successfully measured the Λ binding energy of ${}^{4}_{\Lambda}$H by measuring the momentum of two-body decay pion from ${}^{4}_{\Lambda}$H with a resolution of $<$100 keV/c in FWHM.
We applied the same spectroscopic technique to ${}^{3}_{\Lambda}$H by updating the target system and the energy calibration method. The physics data taking was already done in 2022, and the analysis is ongoing.
I will present the updated experiment and the latest analysis status. I will also introduce a plan for high-resolution spectroscopy of Λ hypernuclei.

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