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High-precision measurement of the hypertriton mass

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Recent high-precision measurements in light hypernuclei using magnetic spectrometers have changed our knowledge of the ΛN interaction. Accessible observables are Λ binding energies, excitation spectra (if particle-bound excited states exist), spins, lifetime and decay branching ratios. Substantial differences between emulsion studies and recent magnetic spectrometer measurements, e.g. differences in binding energy from -700 keV to +200 keV for individual hypernuclei, are suggestive that emulsion data could have larger uncertainties than published and that systematic uncertainties change with different hypernuclei. Especially unfortunate is the fact, that for the most elemental hypernucleus, the hypertriton, so far no reliable magnetic spectrometer data for its binding energy is available. Therefore, no crosscheck of the emulsion studies exist.

Like the deuterium for conventional baryon interactions, the hypertriton provides several important benchmarks for any strong interaction theory dealing with strange baryons. As the hypertriton is so little bound its lifetime and its Λ binding energy are expected to be intimately related. Its very small binding energy as observed by the emulsion technique implies that the bound Λ has an extended wave function and should have properties similar to the free Λ. In contrast, its lifetime observed in heavy-ion collisions is 30-40% shorter than the free Λ lifetime leading to a strongly debated puzzle. The situation calls for new precision measurements for the hypertriton.

I will discuss ongoing activities and future projects for the determination of ground state masses of light hypernuclei –in particular of the hypertriton. In order to reduce the systematic uncertainty of current pion-decay spectroscopy data at MAMI a novel high precision beam energy measurement based on interfering undulator radiation is presented.

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