High Resolution Spectroscopy of the $^{12}_{\Lambda}$B Hypernucleus Produced by the (e,e'K$^+$) Reaction

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The first high resolution hypernuclear spectroscopy experiment (E89-009 or HNSS) has been successfully performed using the CW electron beams at Jlab. The (e,e'K$^+$) reaction converts a proton in the target nucleus into a Λ hyperon, in contrast to strangeness exchange or associated production reactions which convert a neutron to a Λ. In addition, the (e,e'K$^+$) reaction carries significant spin-flip amplitudes, making it suitable to populate spin-flip states complementary to those produced by other reactions. More importantly, with the high quality and powerful CW electron beam, it is possible to achieve sub-MeV (FWHM) missing mass resolution. These features make electromagnetic production highly interesting.

The presented experiment used an average beam current of 0.6 μA on ~20 mg/cm^2 ^{12}C and ^{7}Li targets. The beam energy was about 1.8 GeV and the tagged scattered electron was about 0.3 GeV, with a scattering angle near zero degrees. Thus, the virtual photon had energy about 1.5 GeV, corresponding to a maximized cross section for the kaon photo-production. The kaon momentum was centered around 1.2 GeV/c with a scattering angle from 0 to 4 degrees. The momentum transfer to the Λ is thus about 300 MeV/c. The spectrum from C target demonstrates two distinct peaks in the bound region of $^{12}_{\Lambda}$B hypernuclear system. These peaks correspond to analogous states of the mirror-symmetric $^{12}_{\Lambda}$C system. The $^{12}_{\Lambda}$B system is anticipated to display a different pattern due to the presence of large spin-flip amplitude in the electromagnetic reaction.