Recent Studies of Hypernuclei Formation with Electron Beams at MAMI

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At the Mainz Microtron MAMI strangeness production off the proton and light nuclear targets with a continuous-wave unpolarized or spin-polarized electron beam has been subject of intensive investigation.

In 2007 the usage of magnetic spectrometers to measure the momenta of pions following weak two-body decays of electroproduced hyperfragments was proposed for Jefferson Lab [1]. The method is aimed at the determination of ground-state masses of a variety of Λ-hypernuclei off the valley of stability with hitherto unrivaled precision. Confronting precise mass measurements and unique structure information on light Λ-hypernuclei with *ab initio* and cluster calculations for light nuclei will help to accurately determine the *YN* interactions and *e.g.* the role of three-body forces.

From 2011 onwards a series of measurements at the Mainz Microtron MAMI was performed to initiate this new spectroscopic approach. In order to keep background from bremsstrahlung low the experimental program focuses on low Z targets like ^{12}C, ^{9}B and natural ^{6,7}Li. In these measurements the kaon detection is performed in the multi-spectrometer facility with the Kaos spectrometer, that is operated in different experimental geometries. A unique setup was realized to use the broad momentum-band spectrometer at zero degrees angle with respect to the beam direction to tag strangeness producing processes with maximum acceptance [2]. A sample of (order 10^3) weak pionic decays from a beryllium target was collected by the coincidence technique almost free of random background events. It is assumed that this sample mostly contains free Λ hyperon decays and a small fraction of possible weak two-body and three-body decays. The data analysis is now concentrated on extracting signatures and/or hyperfragment formation limits.

The spectrometer also offers the possibility to detect the scattered electron at zero degrees in coincidence to a positively charged hadron. In the latter case the production rate in missing mass experiments on the direct formation of hypernuclei is maximized.

For electroproduction the electromagnetic vertex in the reactions can be calculated exactly and elementary strangeness formation measurements provide information on hadron structure and dynamics. Differential cross section measurements of the $p(e, e'K^+)\Lambda, \Sigma^0$ reaction and the determination of the beam helicity asymmetry at low four-momentum transfers in the nucleon's third resonance region have been performed. The data shows a high sensitivity to parameters of effective Lagrangian models and modern Regge-Plus-Resonance models that describe the elementary kaon production mechanism [3].

In this talk, the present status of the experimental programs on strangeness electroproduction at MAMI and future plans will be presented.

[1] L. Tang et al., *Exp. Proposal E-08-012*, Jefferson Lab (2007).

[2] A. Esser et al., Nucl. Phys. A (2013), http://dx.doi.org/10.1016/j.nuclphysa.2013.02.008

[3] P. Achenbach et al., Eur. Phys. J. A 48, 14 (2012)

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