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Measurements of Cross Sections and Polarizations of Lambda-Nucleon and Lambda-Deuteron Elastic Scattering with the CLAS Detector

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The elementary YN interaction remains of significant and continuing interest in nuclear physics. On the one hand, it is important to understand hadron dynamics in which the strange quark is involved and to construct a comprehensive picture of the baryon-baryon interaction. On the other hand, reliable YN potentials are needed for in-medium calculations, such as of hypernuclear structure and the equation of state of neutron stars. Decades of theoretical and experimental studies of the NN interaction have led to the development of established and tested theoretical frameworks for constructing reliable baryon-baryon potentials, both from phenomenological analyses and chiral effective field theory. These techniques have successfully been extended to the strangeness sector. Yet, the very poor database of YN scattering cross-sections does not allow to determine uniquely the YN phase shifts and all low-energy parameters of the YN potentials. Thus, a comprehensive understanding of the YN interaction is still lacking, and the topic continues to be a fascinating problem in strong physics. While hypernuclear spectroscopy provides valuable information, the extraction of the elementary YN interaction from analysis of hypernuclear binding energies is sensitive to uncertainties related to medium modifications and many-body effects. Parameters, such as scattering lengths, are poorly constrained. In this talk, we will present an experimental program aiming to provide a large set of experimental observables of elastic scattering of lambda off the nucleon and deuteron using high-statistics, high-polarization photoproduction data taken with the CEBAF Large Acceptance Spectrometer (CLAS) at Jefferson Lab. The program utilizes secondary scattering within the same target cell and final-state interactions to access the reactions of interest. We will discuss recent Lambda-proton total elastic scattering cross sections, which have demonstrated the feasibility of the secondary scattering technique and have added new higher-precision data points to the world database. We will also showcase several ongoing studies of LambdaN and LambdaNN measurements and discuss the physics opportunities they present.

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