Photodisintegration of Light Nuclei

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Understanding hadron interactions and nuclear structure in terms of the fundamental degrees of freedom of QCD has been a long-standing problem in nuclear physics. At high enough energies, quarks interact weakly, allowing perturbative calculations to be performed. Alternatively, in the low-energy or confinement regime, a solution of QCD is very difficult to be obtained. At these energies, effective field theories that use hadronic degrees of freedom, are quite successful in describing hadron interactions and nuclear structure. It still remains unclear what are the underlying dynamics and the relevant degrees of freedom in the largely unexplored transition region between the meson-nucleon and the quark-gluon descriptions of nuclear physics.

The reactions of deuteron photodisintegration and ^3He breakup provide information that is sensitive to the underlying dynamics in the few-GeV photon-energy region. In this talk I will report the preliminary results of the beam-spin asymmetry of deuteron photodisintegration, $\vec{\gamma}d \to pn$, and the differential cross sections of two-body breakup of ^3He, $\gamma^3He \to pd$. These were measured with the CLAS detector at Jefferson Laboratory. A comparison of the deuteron photodisintegration data with model predictions suggests that there is a strong pn rescattering contribution, since the Hard Rescattering Mechanism accounts very well for the shape of the data at 90°. The dimensional scaling of the differential cross section observed in the two-body photodisintegration of ^3He suggests that quarks and gluons are the relevant degrees of freedom at energies lower than previously considered.

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