Deuteron Two Body Photodisintegration in the Quark-Hadron Picture

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One of the central issues in nuclear physics is the identification of quark effects in nuclei. Towards this aim, the study of high-energy two-body deuteron break up is of particular interest because the deuteron is the simplest nucleus and the photon's interaction with nucleons is well known. For a photon energy below 1 GeV, models based on the traditional nucleonic degrees of freedom are able to reproduce the experimental data [1]. On the other hand, at high photon energy, QCD calculations predict that the cross section scales with a unique simple power law of the square of the total energy [2]. Recent data taken at Jefferson Lab Hall C [3] for a few proton angles and a photon energy above 2 GeV show evidence of this scaling law, but with an angular-dependent energy threshold. However, proton polarization measurements taken at Jefferson Lab Hall A [4] seem to be inconsistent with perturbative QCD predictions up to 2.4 GeV. Thus, the study of the reaction in the intermediate-energy region can clarify the transition from the nucleonic degrees of freedom to the QCD picture of hadrons. The CEBAF Large Angle Spectrometer (CLAS) of Jefferson Lab Hall B allowed us for the first time to measure the differential cross section in this energy region, covering all proton angles up to 140° in the laboratory frame [5]. Preliminary results from the analysis of 30% of the total accumulated data will be shown. These results are in good agreement with the sparse previous data above 1 GeV. Recently, an expression for the cross section of the deuteron photodisintegration reaction at small momentum transfer has been derived in the framework of the Quark-Gluon String Model [6], which incorporates the Regge phenomenology in a non perturbative QCD picture. These calculation are in good agreement with both published data at higher energies and the new CLAS preliminary results.

References

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