CEBAF EXPERIMENT 99-008

Large-Angle Two-Body Photodisintegration of the Deuteron at High Energy

R. Gilman, R. J. Holt, Z.-E. Meziani, Spokespeople

At present, high-energy deuteron photodisintegration data exist only at c.m. reaction angles of 90° or less. Recent theoretical developments indicate that a comparison of the cross section at small and large angles would reveal new information about the dominant reaction process for the D(γ, p)n reaction.

Radyushkin proposes that the reaction is dominated by a short-distance quark-interchange mechanism, with the incoming photon absorbed on the exchanged quarks. This leads to the prediction that the cross section is nearly symmetric about $90^\circ_{\rm cm}$, with strong forward- and backward-angle peaking. Nagornyi and Dieperink, in an asymptotic meson-exchange model, calculate that the cross section is very asymmetric, due to the difference between u- and t-channel mechanisms. They predict a small rise in the large-angle cross section due to helicity non-conservation. At sufficiently high energy, helicity conservation leads to differential cross sections decreasing with scattering angle. More recent calculations by Frankfurt, Miller, Strikman, and Sargsian reproduce forward-angle cross sections, but have not yet been extended to large angles.

We are approved to extend the existing differential cross section measurements for the exclusive D(γ, p)n reaction to c.m. reaction angles as large as 145° in the energy region of 1.2 to 2.4 GeV. The proposed experiment must be performed in Hall A because of the need for spectrometer arms which can operate at large angles and which have a large target length acceptance as well as excellent target reconstruction properties. This experiment is running parasitically to E89-019, which measures $90^\circ_{\rm cm}$ polarizations for D(γ, p)n, during fall 1999.