CEBAF EXPERIMENT 89-031

Study of Multi-nucleon Knockout with the CLAS

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In the simplest model, electro-nuclear reactions can be assumed to proceed through virtual photon absorption on a single nucleon with the emission of a nucleon or nucleon resonance from the nucleus. The investigation of multi-nucleon knockout reactions is an important topic because it probes many-body processes such as nucleon-nucleon correlations, many body forces, and nucleon resonance absorption that can complicate this simple model. Data from *(e,e'p)*, *(γ,NN)*, and pion absorption experiments have shown surprising results for multinucleon emission in the quasielastic and Δ(1232) resonance regions. However, electron scattering experiments measuring two-nucleon knockout and higher multiplicity final states are just beginning due to the unavailability of high duty factor/high energy electron accelerators and large acceptance spectrometers. The CLAS detector at CEBAF will be ideally suited to this type of work, with a solid angle covering a large fraction of 4π sr.

This experiment will greatly extend the momentum transfer (Q^2) and energy transfer range of existing multi-nucleon data. High Q^2 is important because at higher Q^2 finer details in the multi-nucleon reaction will be resolved. Compared to real photon or pion experiments, electron scattering has the additional advantage that there is both a longitudinal and transverse interaction, where the longitudinal cross section is particularly sensitive to nucleon-nucleon correlations. We intend to measure interference terms between the longitudinal and transverse scattering, and will investigate the possibility of doing a direct separation of the longitudinal and transverse cross sections. High energy transfer is important in order to study multi-nucleon emission across the entire nucleon resonance region and into the deep inelastic region. Beyond the Δ peak, essentially nothing is known about the phenomena of multi-nucleon emission. By taking data on a series of nuclei from light (A=3,4) to heavy systems (A=56) we will investigate how the multinucleon reaction develops with increasing nuclear mass number. This is an approved experiment and has, in conjunction with several other experiments, been awarded 33 days of run time with 20% of the time at 0.8 GeV, 30% at 2.0 GeV, and 50% at 4.0 GeV.