

Measurement of small components of the ^3He wave function using $^3\text{He}(e,e'p)$ in Hall A

The nucleus ^3He , due to its paired-off protons and lone polarizable neutron, has been used as a surrogate neutron target for measurements of the neutron charge form factor and deep inelastic spin structure. The isospin-dependent and tensor terms in the NN-interaction lead to corrections to the simple structure with different spin: the S'-state and D-state. A determination of these contributions has intrinsic interest due to their manifestation of components in the NN interaction, as well as practical interest, to calibrate corrections to the neutron measurements.

We will undertake a measurement of the three non-vanishing (in colinear kinematics) beam-target (and target) asymmetries for the reaction $^3\text{He}(e,e'p)$ in the quasielastic region. Parallel kinematics restrict only one response function to contribute to the longitudinal and sideways asymmetries. The relative kinetic energy in the final state is selected to be high and constant, for consistency in the FSI corrections. Calculations indicate that both the longitudinal (A_z') and sideways (A_x') asymmetries reveal strong dependence at high momentum transfer to the presence of the D-state. Sensitivity to the S'-state shows up in the 3-body-breakup channel.

FSI and MEC can complicate the extraction of the strength of these wave-function admixtures from the data. We therefore include in our measurement the normal target asymmetry. This observable vanishes in the plane-wave approximation and serves to calibrate FSI and MEC.

The two HRS spectrometers will be used with the polarized ^3He target. Four separate settings of beam, spectrometers, and target angle are used. At each setting, three asymmetries will be measured. In our estimates of uncertainties we assumed 10 uA beam current, 75% electron polarization, and 40% target polarization, leading to a request of 24 days. The UNH group has made longstanding institutional commitments in Hall A.