Abstract

Elastic electron scattering from the deuteron and near-threshold electrodisintegration have long provided benchmarks against which models of the nucleon-nucleon interaction are evaluated. Recent measurements of T_{20} in elastic scattering have tightened the constraints but still leave room for ambiguity. We propose to make similar improvements in the constraints imposed by electrodisintegration with an exclusive study of the reaction $d(\vec{e},e'p)n$ at $Q^2 = 12$ fm^{-2} and $E_{np} = 2$, 4, 6, 8 MeV. Under these kinematics, non-nucleonic as well as nucleonic degrees of freedom and relativistic effects are expected to play major roles. The experiment will be conducted in Hall A at JLab using the polarized CW electron beam, an HRS spectrometer to detect the electron, and the BigBite spectrometer to detect the proton. The first part of the experiment will be to extract the structure functions f_{LT}, f_{TT}, and f'_{LT} at an electron beam energy of 3200 MeV and electron scattering angle of 12.5°. The second part of the experiment will be to separate the longitudinal and transverse structure functions, f_L and f_T, by performing complementary measurements with a beam energy of 550 MeV and electron scattering angle of 90°. The individual structure functions are expected to be particularly sensitive to different components of the interaction. For example, f_{LT} is expected to be sensitive to relativistic effects, f_T is expected to be dominated by MEC effects, and f'_{LT} vanishes unless final state interactions are present and is expected to be insensitive to non-nucleonic degrees of freedom. The longitudinal cross section for elastic scattering depends on the isoscalar charge current whereas f_L for electrodisintegration depends primarily on the isovector charge current. Comparison of the two, as measured at the same time will allow us to separate the two contributions. A comparison of these data with theoretical models will isolate individual interaction components and thus provide more stringent tests of calculations.