

Study of ^3He nuclei by polarization observables in quasi-elastic electron scattering

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The ^3He nucleus lies at the core of nuclear physics and represents the perfect playground to test nuclear dynamics [1]. The understanding of its ground-state electro-magnetic and spin structure has far-reaching implications not only for nuclear physics itself, but also for a variety of ^3He -based experiments seeking to extract neutron information from ^3He as an effective neutron target.

The most fruitful experimental approach to the study of ^3He is by electron-induced knockout of protons, neutrons, and deuterons, in particular when the process is investigated by measuring its response as a function of the magnitude of missing momentum, yielding detailed information on nucleon momentum distributions, isospin structure of the currents, final-state interactions, and meson-exchange currents. Polarization degrees of freedom have the further potential to tremendously enhance the sensitivity to manifestations of dominant and sub-leading ground-state wave-function and three-nucleon forces.

In a recent set of measurements at Jefferson Laboratory, we have studied the missing-momentum dependence of beam-target asymmetries in exclusive

$$^3\vec{\text{He}}(\vec{e}, e'p)pn, \quad ^3\vec{\text{He}}(\vec{e}, e'p)d, \quad \text{and} \quad ^3\vec{\text{He}}(\vec{e}, e'd)p$$

channels [2] at a previously unattainable level of precision and unreached range in missing momenta. We have also measured single-spin asymmetries in the processes

$$^3\text{He}^\uparrow(e, e') \quad \text{and} \quad ^3\text{He}^\uparrow(\vec{e}, e'n),$$

where the nuclei were transversely polarized [3,4]. Preliminary results will be presented.

[1] W. Glöckle et al., Eur. Phys. J. A **21** (2004) 335.

[2] S. Gilad, D. W. Higinbotham, W. Korsch, S. Širca, B. E. Norum (spokespersons), JLab Experiment E05-102: *Measurement of the A_x and A_z asymmetries in the quasi-elastic $^3\vec{\text{He}}(\vec{e}, e'd)$ reaction.*

[3] T. Averett, X. Jiang, J.-P. Chen (spokespersons), JLab Experiment E05-015: *Measurement of the target single-spin asymmetry in quasi-elastic $^3\text{He}^\uparrow(e, e')$.*

[4] T. Averett, D. W. Higinbotham, V. A. Sulkosky (spokespersons), JLab Experiment E08-005: *Measurements of the target single-spin asymmetry A_y in the quasi-elastic $^3\text{He}^\uparrow(\vec{e}, e'n)$ reaction.*

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