Measurement of the polarized electron beam asymmetry in exclusive reactions on nuclei with CLAS

The Multihadron Collaboration

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We propose a measurement of the polarized electron beam asymmetry (the fifth response function, R_{LT}') in exclusive reactions on the nuclei of ^{3}He, ^{4}He and ^{12}C. The CLAS detector is an ideal instrument for survey measurements of these asymmetries because of its extensive out of plane capabilities and full angular coverage. The asymmetry A_{LT}' (and the associated response function R_{LT}') is associated with the imaginary part of the longitudinal-transverse interference. Because its symmetry structure is time reversal odd, it vanishes for any direct process and thus provides an unambiguous signature for multi-step processes. As such, it provides information that is uniquely different from that available with the response functions accessible without polarization observables.

A question that is central to the multi-hadron reactions program is to determine the extent to which the virtual photon absorption mechanism that leads to multinuclear emission, sometimes at extreme kinematics, arises from a pre-existing configuration or via final-state rescattering. Measurement of this asymmetry can provide a powerful method for identifying and characterizing the multi-step final-state processes, thereby disentangling the relevant degrees of freedom in exclusive electron scattering on complex nuclei. This measurement is compatible with the already approved time for the cross section survey of the multi-hadron (E2) run group, but will require polarized beam, preferably at high polarization. We also require sufficient beam time to perform measurements of beam polarization with the Møller polarimeter.