

Coincidence Reaction Studies with the CLAS

W. Bertozzi, W. Boeglin, L. Weinstein, Spokespersons

The largest problem facing nuclear physics today is how to move beyond the simple independent-particle mean-field model of the nucleus. This model has worked well, but it only describes about 60% of the nuclear structure. In order to understand nuclear structure beyond this simple model of the nucleus, we must understand the higher order nuclear currents (e.g., two-body, three-body, ...). Our understanding of the reaction mechanisms (and hence of the currents) involved in inelastic electron scattering (quasielastic, dip, quasifree-delta, and quasifree-N*) from nuclei is poor. The CLAS provides a unique facility to investigate this question by allowing us to detect almost all of the particles emitted following virtual photon absorption. This will enable us to identify one-nucleon, two-nucleon, etc. knockout and isolate the contributions of the various nuclear currents to inelastic electron scattering.

The anomalies observed in inclusive electron scattering, (e,e') , include the enhanced transverse / longitudinal ratio in the quasielastic region, enhanced yields in the so-called dip region and problems of yield and shape in the delta region. The enhanced longitudinal/transverse ratio is an especially good example of the failure of our simple models because the reduced response functions, f_L and f_T , are equal for $A=3$ but f_T is much greater than f_L for $A > 4$. This A -dependence is clear evidence of a non-single-nucleon response.

The anomalies observed in coincidence electron scattering, $(e,e'p)$, include the different shapes of the missing energy spectra for the longitudinal and transverse response functions, the missing strength in the spectroscopic factors, and the very large strength at large missing energies even at quasielastic kinematics.

Only by thoroughly understanding the nature of the quasielastic response can we begin to address more complicated nuclear issues such as nucleon modification in nuclei or color transparency.

'Coincidence Reaction Studies with the CLAS' will examine the dominant channels that comprise the inclusive (e,e') response. This experiment will measure $(e,e'X)$ on ^3He , ^4He , ^{12}C , and ^{56}Fe at a variety of electron energies from 0.8 to 4.0 GeV.

The tremendous data set that will be gathered by this program will allow us to thoroughly categorize the various currents and reaction mechanisms contributing to the (e,e') response. Improved understanding of multinucleon emission will help theorists move beyond the first-order mean-field models of the nucleus.