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The Study of Excited Baryons at High Momentum Transfer with the CLAS Spectrometer

Paul Stoler, V. Burkert, M. Taiuti, Spokespersons

This experiment will measure exclusive single meson electro-production on nucleons in the resonance region (W = 1.2 to 2 GeV) at high Q^2 (> 3 GeV^2/c^2) using the CLAS spectrometer. The motivation is to study the evolution of resonance form factors and short range phenomena in a kinematic region which has never before been studied by exclusive reactions. A specific goal is to address the issue of the transition from the non-perturbative GCD (npQCD) regime, where theoretical descriptions have used non-relativistic, and relativised mean field models, toward those involving leading order perturbative QCD (pQCD), which is characterized by helicity conserving factorized form factors and pQCD scaling rules'. A description of the physics issues may be found in Ref. 2 and references within. In the current experiment we will study the magnitudes, decay angular distributions, and dependences for the most prominent resonances; i.e., the P33(1232), D13 (1530) and F15 (1688). This is a long range program which will incrementally make use of the maximum CEBAF electron beam energies, and the maximum acceptance and luminosity capabilities of the CLAS spectrometer. The initial measurements will utilize an electron energy of 4 GeV, and the initial complement of CLAS detectors. We will investigate phenomena in the range of 3 to 4 GeV2/c2. With a beam energy of 6 GeV^2/c^2 measurements will be extended to a Q^2 of about 7 GeV^2/c^2. In the initial cross sections will be DQ2 - .25 (GeVc)2 and DW = 50 MeV. To separate individual resonances and their contributing electromagnetic multipoles, we will measure angular distributions of exclusive reactions such as (e,e'p) and (e,e'h). With the CLAS spectrometer angular distributions for all excitation energies, over a significant range of, for po, p+ and h are obtained simultaneously. The neutral po and h channels will be measured by detecting the protons in the kinematically complete p(e,e'p)h, po reactions. The charged p+ will be directly detected.

References:

1. G.P. Lepage and S.J. Brodsky, Phys. Rev. D22 (1980) 2180.
2. P. Stoler, Physics Reports, **226**, 103 (1993).