Probing Nucleon Structure in the Resonance Region

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I will discuss a variety of topics in electron scattering measurements at Jefferson Lab in the region of nucleon resonance excitations. The measurements are part of an extensive program to come to a better understanding of hadronic physics in the regime of strong QCD.

(1) Preliminary results from inclusive double polarization measurements using the CLAS detector will be presented. Polarization asymmetries have been measured over a wide range in the hadronic center of mass, and in momentum transfer Q^2. The first moment of the spin structure function $g_1(x, Q^2)$ has been extracted in a range $Q^2 = 0.15 - 1.2\text{GeV}^2$. The data show dramatic changes in the transition from the small distance scale probed in deep inelastic scattering to the large distance scale near the photon point. The first moment $\Gamma_1^p(Q^2)$ changes sign at small Q^2 showing the different physics probed at large distances.

Measurements on polarized ^3He have been performed in Hall A at Jefferson Lab. The generalized Gerasimov-Drell-Hearn integral on the neutron has been determined in a range of $Q^2 = 0.1 - 1.0\text{GeV}^2$.

(2) From the analysis of $p\pi^o$ in the $\Delta(1232)$ region a consistent picture is now emerging for the $N\Delta(1232)$ transition multipole ratios E_{1+}/M_{1+} and S_{1+}/M_{1+}, showing the importance of pion degrees of freedom at large and intermediate distances.

(3) Analysis of the $p\eta$ channel measured in the same experiment allows extraction of the transverse helicity amplitude for the $S_{11}(1535)$ resonance. Together with previous measurements in Hall C a consistent picture for the Q^2 dependence of the transition formfactor of this resonance is obtained.

(4) Preliminary data in the $p\omega$ and $p\pi^+\pi-$ channels have been obtained. These channels

are important in the search for so-called “missing” quark model states.