APR14-2014-020163

Abstract for an Invited Paper
for the APR14 Meeting of
the American Physical Society

What Nucleons Resonances Teach Us About the Nucleon Structure

VOLKER D. BURKERT, Jefferson Lab, Newport News, Virginia

The excitation spectrum of atomic hydrogen contains the full information needed to describe its structure from its basic ingredients, protons and electrons, and the electromagnetic interaction between them. Similarly, the nucleon excitation spectrum contains information about the effective degrees of freedom and the forces between them. The difference between the two systems is that in the former case the electromagnetic interaction leads to a well-defined energy spectrum, while the latter has strongly interacting ingredients, hadrons, quarks and gluons, at its core leading to broad and overlapping energy levels that in most cases cannot be studied in isolation. Microscopic approaches such as modern constituent quark models and Lattice QCD, make predictions regarding masses and quantum numbers of the excited states and their internal structure according to radial, spin, and orbital transitions of the quark-gluon system. Pion induced transitions have revealed many states largely consistent with these predictions, but many of the predicted states have not been observed. The quest for a better understanding of the internal structure of nucleons has led to a worldwide effort to measure nucleon excitations using photon- and electron-induced processes and to determine their internal structure. At Jefferson Lab with the CLAS detector differential cross sections and polarization observables have been measured with unprecedented precision and some of these data have been analyzed with modern coupled channel approaches that led to evidence of a number of previously unobserved excited states. In this talk, I discuss the two main directions of current experimental research, the search for new states in meson photoproduction and the study of resonance transition form factors in electroproduction, which encode the internal structure and the nature of the excited states.