DNP13-2013-000233

Abstract for an Invited Paper
for the DNP13 Meeting of
the American Physical Society

The study of excited nucleons and their structure

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The nucleon excitation spectrum reflects properties of the quark-gluon system and their interaction. Quark models and Lattice QCD make predictions of masses and quantum numbers of the excited states and their internal structure according to radial, spin, and orbital transitions of the 3-quark and gluon system. Pion induced transitions revealed many nucleon states consistent with these predictions, but many predicted states have not been observed, especially at higher masses. The quest for a better understanding of the underlying symmetries and the internal structure of baryons has led to a worldwide effort to measure the nucleon excitation spectrum using electromagnetic induced processes. Jefferson Lab is playing a key role in this effort. Differential cross sections and polarization observables have been measured with unprecedented precision. Some of the data have been used in coupled-channel resonance analyses that led to new evidence for a number of excited states that were previously unobserved or lacked strong evidence. In this talk, I will discuss two directions of experimental research, the search for new nucleon states using meson photoproduction and the study of transitions form factors to understand their internal structure and the nature of excited states.