Contribution ID: **172**   Type: **Talk**

Spin observables in charged pion photo-production from polarized neutrons in solid HD at Jefferson Lab

Tuesday, 26 September 2017 18:10 (20 minutes)

While QCD is regarded as a mature theory of interacting quarks, due to the complexity of the nucleon, a successful description of its spectrum of excited states remains a huge challenge. The photo-couplings to excited N states provide benchmark tests for models. These require a determination of photo-production amplitudes and are extracted through detailed partial-wave analyses (PWA), which must be fit to many different polarization observables to control ambiguities. Since the electromagnetic interaction is not isospin invariant, the N photo-couplings for neutron and proton targets are different. While there are considerable proton data, there are very little neutron target data and almost no spin-dependent data. As a result, the photo-couplings to states excited from neutrons are very poorly determined. To address this issue, the Jlab E06-101 (*g14*) experiment was performed during 2011-2012 using the CLAS detector in Hall B with circularly and linearly polarized photons incident on longitudinally polarized Deuterons in frozen-spin targets of solid Hydrogen-Deuteride (HD). First results will be discussed for the beam-target helicity asymmetry (E) in the $\gamma + n(p) \rightarrow \pi^- + p(p)$ reaction spanning the nucleon resonance region from invariant mass $W = 1500$ to 2300 MeV. These will be compared to PWA predictions with their associated photo-couplings [1]. Other observables are under study and preliminary results will be presented.

1. This work has been accecpted by Physical Review Letters; arXiv:1705.04713

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Session Classification: Spectroscopy of baryons

Track Classification: Spectroscopy of baryons