Measuring the Production Cross Sections of the Ground State Cascade in Photoproduction

Jesse Hernández

September 29, 2022

For decades an assortment of quark models and more recently lattice QCD calculations have predicted many more Cascade baryon states than have been experimentally observed. Furthermore, the fundamental physics of flavor SU(3) symmetry indicates that there should be a Cascade partner for every N^*- and Δ^*- resonance combined. The spectrum of the doubly strange Ξ baryons is poorly known and only a few states have been experimentally observed. Moreover, the production mechanism for these states are not well understood. It is assumed that Ξ resonances are produced in the strong decay of intermediate highly excited singly strange hyperons.

The GlueX experiment in Hall D at Jefferson Lab has accumulated high-statistics samples of photoproduction data. Using these high-statistics data and the fact that the lowest-lying Cascade states are expected to have very narrow widths, GlueX will be able to shed more light on the systematics of the spectrum. In addition, the high statistics data in conjunction with the linearly polarized photon beam at GlueX makes it possible to measure the differential cross section and various polarization observables with high accuracy. These measurements will be the only of their kind for the Cascade in photoproduction at energies above 6 GeV. Consequently, the measurement of these observables will allow for the composition of a full partial wave analysis to fully understand the production mechanism.