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Baryon Spectroscopy at GlueX

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High-energy electrons and photons are a remarkably clean probe of hadronic matter, essentially providing a microscope for examining atomic nuclei and the strong nuclear force. One of the most striking phenomena of Quantum Chromodynamics (QCD) is the formation of the nucleon out of massless gluons and almost massless quarks. This system of confined quarks and gluons serves as the basic constituent of ordinary baryonic matter and exhibits the characteristic spectra of excited states, which are sensitive to the details of quark confinement. Complementary to nucleon structure studies in deep inelastic scattering experiments, nucleon excitations provide the unique opportunity to explore the many aspects of non-perturbative QCD. While the last few years have seen significant progress toward the mapping of the nucleon and Δ spectrum, experimental information on the spectrum, structure, and decays of strangeness -2 baryons remains sparse compared to non-strange and strangeness -1 baryons. Moreover, the photoproduction mechanism for these so-called Cascade resonances is not well understood and expected to proceed via highly excited intermediate singly strange hyperons in reactions such as $\gamma p \to K\,Y^*\,(\Lambda^*, \Sigma^*) \to KK\,\Xi^{(*)}$.

The GlueX experiment in Hall D at Jefferson Lab has accumulated high-statistics samples of photoproduction data in recent years. Since the lowest-lying Cascade states are expected to have narrow widths (as compared to the broad and overlapping N^* states), GlueX will be able to shed more light on the systematics of the spectrum of excited states and their properties. Copious data for excited strangeness -1 baryons have also been collected with GlueX, e.g. for the $\Lambda(1405)$ and $\Lambda(1520)$, along with the data for Cascade baryons in this experimental hyperon program. In this talk, I will discuss preliminary GlueX results on photoproduced Cascade baryons, including differential cross section measurements for the $\Xi(1320)^-$ octet ground state, recent results for excited strangeness -1 baryons, including the measurement of spin-density matrix elements for the $\Lambda(1520)$, and give a brief outlook on the GlueX potential for a spectroscopy program on excited Λ^* baryons.

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