Probing Photoproduced $\eta^{(\prime)}\pi^0$ Systems in the Seach for Exotic Hadrons

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Physicists have been captivated by the spectrum of hadrons for decades, seeking to better comprehend the fundamental building blocks of matter. While various experiments have laid the foundation for this spectrum, motivation by Lattice Quantum Chromodynamics (Lattice QCD) provides insight into new states with forbidden J^{PC} values, incompatible with the constituent quark model. These states, known as *exotic hybrid mesons*, hold the potential to reshape our understanding of hadronic structure and the strong interaction between quarks and gluons by permitting gluonic excitations.

At the GlueX experiment, multiple studies have emphasized the search for mesons with exotic contributions with a priority being given to investigating the lightest Lattice QCD predicted exotic state with $J^{PC} = 1^{-+}$, known as the π_1 meson. Given the compelling evidence provided by prior experiments, alongside the natural emergence of forbidden quantum numbers in systems with odd orbital angular momentum, significant attention has been directed towards both $\eta\pi^0$ and $\eta'\pi^0$ systems.

Specifically, ongoing amplitude analysis studies of $\gamma p \to \eta^{(\prime)}\pi^0 p \to 4\gamma\pi^+\pi^- p$, leveraging the polarization of the photon beam at the GlueX experiment, will be discussed. These studies offer useful insights into the intricate dynamics of hadronic interactions, contributing to the ongoing exploration and future identification of exotic hybrid meson candidates.