Elucidating Strangeness with Electromagnetic Probes

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Theory models predict a total of 44 cascade baryons below 2.5 GeV. Currently, there are only six Ξ states that have been assigned at least a three-star rating in the PDG, and the production mechanism of these states still remains mostly elusive. From a theoretical standpoint, the study of cascades is appealing due to the symmetry arising from the presence of two medium-mass s-quarks. Additionally, cascade spectroscopy is a promising tool to differentiate genuine quark states from hadronic molecules, since we have the ability to measure the line shape in various decay branches with unprecedented precision. This work focuses on the analysis of CLAS12 data collected at Jefferson Lab to study the production mechanisms and decays of excited cascade baryon states that are not well established or missing, with the aim of determining their branching ratios and quantum numbers. To address the substantial and complex background arising from out-of-time particles, a novel analysis technique based on multi-dimensional sequential weighting is introduced, allowing for a clean separation of genuine cascade signals from background contributions. The possibility to use the same dataset to explore multi-strange exotics in meson and baryon sectors will also be discussed.