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Radiative Decays of Hyperons,

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The goal of this experiment is to probe the quark wavefunctions of the hyperons by measuring the electromagnetic decays of low lying states of the Λ and Σ hyperons – the *uds* quark systems. Specifically, we will measure the branching ratios of the electromagnetic decays of the low lying excited hyperons, $\Lambda(1405)$, $\Lambda(1520)$, and the $\Sigma^0(1385)$, using the CEBAF Large Angle Spectrometer (LAS). We will produce the excited hyperons using a tagged photon beam, via the reaction

$$\gamma p \rightarrow K^+ Y^* \rightarrow K^+ \Lambda\gamma \rightarrow K^+ p\pi^-\gamma.$$

The kaon, proton and π^- will be detected in the CLAS with both large solid angle and good momentum resolution. The four momentum of the excited hyperon can be reconstructed from the beam photon energy and the kaon momentum; that of the Λ (from the $Y^* \rightarrow \Lambda\gamma$ decays) can be reconstructed from the proton and π^- momentum. The excellent CLAS mass resolution will allow us to suppress the backgrounds due to π^0 decays that would otherwise mask the photons from the $Y^* \rightarrow \Lambda\gamma$ decays.

The level diagram for the low lying hyperon system is shown in the figure. A typical set of theoretical branching ratios for the various photon transitions are given along with the existing experimental values which can be identified by the error bars. Some idea of the experimental situation is conveyed by the fact that the existing data from the reaction $K^- p \rightarrow \Lambda\gamma$ disagree by a factor of 5 for the Λ (1520) level and are very model dependent for the Λ (1405) level. The Σ (1385) level is isospin forbidden in this reaction. Values for the branching ratios vary even more between various models. The primary advantage of the proposed experiment is that it produces a tagged Y* beam which then decays electromagnetically free of any hadronic final state effects. For this reason, the proposal has been strongly supported by many theorists.

S=0
T=0

Level diagram for the low lying hyperon system. A typical set of theoretical branching ratios is given in the boxes. For those transitions that have been measured, the experimental value is given with quoted errors.