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Polarization Observables in $\gamma p \to K^+ + \Lambda$ and $K^+ + \Sigma^0$ Using Circularly Polarized Photons on a Polarized Frozen Spin Target

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The search for undiscovered excited states of the nucleon continues to be a focus of experiments at the Thomas Jefferson National Accelerator Facility (JLab). A large effort was done using the CEBAF Large Acceptance Spectrometer (CLAS) detector to provide the database, which will allow nearly model-independent partial wave analyses (PWA) to be carried out in the search for such states. Polarization observables play a crucial role in the effort, as they are essential in disentangling the contributing resonant and non-resonant amplitudes. Recent coupled-channel analyses have found strong sensitivity of the K^++Λ channel to several higher mass nucleon resonances. In 2008 and 2010, double-polarization data were taken at JLab using circularly and linearly polarized tagged photons incident on a longitudinally and transversely polarized frozen spin butanol target (FROST), operated at the temperature of 30˜mK. The reaction products were detected in CLAS. This work is based on the analysis of FROST data and the extraction of the E, L_x, L_z, T, F, T_x, and T_z asymmetries of the $K^+\Lambda$ and $K^+\Sigma^0$ final states and their comparison to predictions of recent multipole analyses. There are very few published measurements of the T asymmetry and none for the E, L_x, L_z, F, T_x, and T_z asymmetries for the $K^+\Lambda$ final state. The $K^+\Sigma^0$ final state has no published measurements for these asymmetries. This work is the first of its kind and will significantly broaden the world database for these reactions.

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