Probing the Faraday Effect of Polarized $^3\text{He}$

GRETCHE\, PHELPS, JOSH ABNEY, WOLFGANG KORSCH, University of Kentucky — The Faraday Effect refers to the phenomenon in which the polarization of light transmitted through a magnetized medium is rotated. The relation $\phi = V l B$ describes the magnitude of the rotation, where $V$ is the material dependent Verdet constant and $l$ is the length of the medium in an applied magnetic field $B$. Polarized $^3\text{He}$, generated in a glass cell constructed of GE-180, gives rise to a Faraday rotation via nuclear spin optical rotation (NSOR), a measure of which establishes a new technique in $^3\text{He}$ polarization monitoring. Our set-up incorporates a triple-modulation technique with present sensitivities at the $\mu$rad level. This is accomplished through the combination of a photo-elastic modulator, an optical chopper, and a sinusoidally driven magnetic field. Several calibration samples were used to test the triple-modulation method. Good agreement between our results and the commonly accepted values for the Verdet constant was achieved. Technical challenges and progress towards the determination of $V_{^3\text{He}}$ will be presented.