

Abstract Submitted  
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**Progress towards a polarization spectroscopy experiment for quantum control of collective spin** PASCAL G. MICKELSON, ENRIQUE MONTANO, DANIEL HEMMER, POUL S. JESSEN, University of Arizona — We report preliminary results from an experiment that will implement quantum control of the collective spin of an atomic ensemble. In our setup, a weak probe laser interacts with a cold, trapped atomic sample of cesium atoms with high optical depth, leading to Faraday rotation of the probe light proportional to the atomic magnetization. If the atom-light coupling is strong enough, polarimetry of the probe light will provide a measurement of the magnetization with resolution better than the spin projection noise, at which point measurement back-action will become significant enough to be used for quantum control of the spin. Thus far, we have loaded cesium atoms into a  $\sim 50 \mu\text{K}$  deep optical dipole trap, and we observe Faraday rotation of the probe light as it passes through this cloud of atoms. Work is ongoing to increase the optical depth of the atom sample and to optimize the atom-light coupling by mode-matching the probe beam to the atom sample.

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