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Atomic Sensors using Nonlinear Magneto-Optical Rotation in the Strongly Saturated Regime PAUL KUNZ, Army Research Labs, DAVID MEYER, Army Research Labs / University of Maryland, QUDSIA QURAISHI, FREDRIK FATEMI, Army Research Labs — We report on two separate atomic sensor experiments that rely on narrow spectral features associated with nonlinear magneto-optical rotation (NMOR). The first experiment uses a cold cloud of rubidium to investigate a "twist" feature nested within the standard dispersive-shaped NMOR curve. Though similar features have been observed previously in warm vapor, in this case the mechanism responsible is different. Here it is due to the combination of Zeeman and AC Stark shifts leading to complex evolutions of the atomic angular momentum, namely alignment-to-orientation conversion (AOC). This twist can be used as a rapid measure of transverse magnetic fields since its width scales linearly with the magnitude of the magnetic field directed along the optical polarization. We demonstrate applications of this feature both as a measure of background DC magnetic fields and also magnetic field gradients imaged with a CCD camera. Separately, in the second experiment we have begun investigations of NMOR in Rydberg levels for the purpose of measuring microwave electric field amplitudes. This has the potential to significantly enhance the signal-to-noise ratio over previous absorption-based techniques.

Paul Kunz
Army Research Labs

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