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Measuring Microwaves via Absorption and Dispersion in Rydberg Atoms DANIEL STACK, MITRE Corp, PAUL KUNZ, US Army Research Laboratory, DAVID MEYER, University of Maryland - College Park, NEAL SOLMEYER, US Army Research Laboratory — Weak microwave frequency electromagnetic fields can be difficult to detect and fully characterize with traditional methods. However it is possible to transduce the measurement of these fields from the microwave domain to the optical domain via resonant transitions between Rydberg levels in atomic vapors using electromagnetically-induced transparency and the Autler-Townes effect. This technique allows for sensitive measurements of the microwave field amplitude, polarization, and spatial waveform (via the position of the probe and coupling laser beams) as compared to measurements performed with dipole antennas. We are able to obtain these quantities by monitoring the properties of a probe laser beam as it passes through a rubidium vapor cell. Previous experiments using Rydberg spectroscopy have typically relied on measuring the absorption of the probe laser as it passed through the atomic system. We report on progress to use the polarization rotation of the probe as it passes through the atoms in a static magnetic field, which corresponds to the real part of the susceptibility of the atomic medium, for measuring the characteristics of a microwave frequency signal. This effect is known as Nonlinear Magneto Optical Rotation (NMOR) and has been used for sensitive magnetometry.

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