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Assessing Thermal Rydberg Atoms Utility for Wideband Electric Field Sensing[1] DAVID MEYER, US Army Research Laboratory, ZACHARY CASTILLO, University of Maryland, KEVIN COX, PAUL KUNZ, US Army Research Laboratory — In the quest for a sensor that can measure electric fields of arbitrary frequency, all potential platforms exhibit trade-offs between sensitivity, operational frequency range, and instantaneous bandwidth. Thermal vapors of Rydberg atoms, which are sensitive to fields ranging from DC to $\sim$ 1 THz, are a recent contender in this endeavor. We have previously shown quantum-limited performance in this system and characterized the instantaneous bandwidth; however, a quantitative measure of the sensitivity, particularly in relation to other mature sensor technologies, has not been performed. Here I will present such an assessment, derived from first principles, of the sensitivity to fields spanning 1 kHz to 1 THz and I will compare this to the performance of ideal dipole antenna-couple passive electronics and electro-optic crystals. I will highlight current limitations and potential areas of significant improvement for the Rydberg sensor.

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