Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Rydberg Dipole Antennas DANIEL STACK, BRADON RODENBURG, STEPHEN PAPPAS, WANGSHEN SU, MARC ST. JOHN, MITRE Corp, PAUL KUNZ, US Army Research Laboratory, MATT SIMON, JOSHUA GORDON, CHRISTOPHER HOLLOWAY, National Institute of Standards and Technology — Measurements of microwave frequency electric fields by traditional methods (i.e. engineered antennas) have limited sensitivity and can be difficult to calibrate properly. A useful tool to address this problem are highly-excited (Rydberg) neutral atoms which have very large electric-dipole moments and many dipole-allowed transitions in the range of 1–500 GHz. Using Rydberg states, it is possible to sensitively probe the electric field in this frequency range using the combination of two quantum interference phenomena: electromagnetically induced transparency and the Autler-Townes effect. This atom-light interaction can be modeled by the classical description of a harmonically bound electron. The classical damped, driven, coupled-oscillators model yields significant insights into the deep connections between classical and quantum physics. We will present a detailed experimental analysis of the noise processes in making such measurements in the laboratory and discuss the prospects for building a practical atomic microwave receiver.

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Date submitted: 28 Jan 2017 Electronic form version 1.4