Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

THz Detection and Imaging using Rydberg Atoms CHRISTOPHER WADE, NIKOLA SIBALIC, JORGE KONDO, NATALIA DE MELO, CHARLES ADAMS, KEVIN WEATHERILL, Univ of Durham — Atoms make excellent electromagnetic field sensors because each atom of the same isotope is identical and has well-studied, permanent properties allowing calibration to SI units. Thus far, atoms have not generally been exploited for terahertz detection because transitions from the atomic ground state are constrained to a limited selection of microwave and optical frequencies. In contrast, highly excited 'Rydberg' states allow us access to many strong, electric dipole transitions from the RF to THz regimes. Recent advances in the coherent optical detection of Rydberg atoms have been exploited by a number of groups for precision microwave electrometry Here we report the demonstration of a room-temperature, cesium Rydberg gas as a THz to optical interface. We present two configurations: First, THz-induced fluorescence offers non-destructive and direct imaging of the THz field, providing real-time, single shot images. Second, we convert narrowband terahertz photons to infrared photons with 6% quantum efficiency allowing us to use nano-Watts of THz power to control micro-Watts of laser power on microsecond timescales. Exploiting hysteresis and a room-temperature phase transition in the response of the medium, we demonstrate a latching optical memory for sub pico-Joule THz pulses.

Kevin Weatherill
Univ of Durham

Date submitted: 26 Jan 2016 Electronic form version 1.4