Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Homodyne Microwave Electric Field Measurements Using Cesium Rydberg Atoms in Vapor Cells HAOQUAN FAN, SANTOSH KUMAR, JAMES SHAFFER, Homer L. Dodge Department of Physics and Astronomy, University of Oklahoma — Probe laser noise is one of the main factors limiting the sensitivity of microwave electric field measurements that use Rydberg atoms in vapor cells. We apply a homodyne detection technique using a Mach-Zehnder interferometer to achieve a new sensitivity limit for the measurement of microwave electric fields, $\sim 3-5\mu V cm^{-1}\sqrt{Hz}^{-1}$. The new sensitivity is almost one order of magnitude better than the previous results presented in Ref. [Nat. Phys. 8, 819 (2012)]. We also report on the homogeneous dephasing effects caused by transit time broadening, collision broadening, and the lifetime of Rydberg atoms which we can now directly observe. We show that these dephasing effects are the fundamental limiting factors that determine the shot noise limit.

Haoquan Fan
Homer L. Dodge Department of Physics and Astronomy,
University of Oklahoma

Date submitted: 28 Jan 2015 Electronic form version 1.4