Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

QND Measurements in a Resonant Cavity-QED System[1] ZILONG CHEN, JUSTIN G. BOHNET, JIAYAN (PHOENIX) DAI, JILA, University of Colorado at Boulder, JAMES K. THOMPSON, JILA, NIST, University of Colorado at Boulder — We demonstrate QND measurements on an ensemble of 10^6 ^{87}Rb atoms. Quantum state-dependent populations are determined at the projection noise level by measurements of the collective Vacuum Rabi Splitting for the resonantly coupled atom-cavity system. The splitting is measured by simultaneously scanning the frequency of two probes across the two transmission resonances and phase coherently detecting the full IQ response of the reflected electric fields. Measurement back-action imposes AC Stark shifts on the atoms, resulting in a reduction of the Ramsey fringe contrast due to inhomogeneity in the probe-atom coupling. We show that the spin-echo sequences that will be needed to achieve atomic spin-squeezing on the Rb clock transition also strongly suppress these AC stark shifts. The remaining probe-induced decoherence is close to the fundamental limit imposed by free space scattering of the probe photons.

[1]Funding: NIST and NSF Physics Frontier Center

Zilong Chen
JILA, University of Colorado at Boulder

Date submitted: 31 Mar 2010 Electronic form version 1.4