Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Bloch Oscillations of Cold Atoms in a Cavity: Effects of Quantum Noise B. PRASANNA VENKATESH, D.H.J. O'DELL, McMaster Univesrity — We extend our theory of Bloch oscillations of cold atoms inside an optical cavity [Venkatesh *et al.*, Phys. Rev. A **80**,063834 (2009)] to include the effects of quantum noise. The noise acts as a form of quantum measurement backaction by perturbing the coupleddynamics of the atoms and the light. We take it into account by solving the Heiseberg-Langevin equations for linearized fluctuations about the atomic and optical meanfields and examine how this influences the signal-to-noise ratio of a measurement of external forces using this system. In particular, we investigate the effects of changing the number of atoms, the intracavity lattice depth, and the atom-light coupling strength, and show how resonances between the Bloch oscillation dynamics and the quasiparticle spectrum have a strong influence on the signal-to-noise ratio. One of the hurdles we overcome along the way is the proper treatment of fluctuations about *time-dependent* meanfields in the cold atom cavity-QED context.

B. Prasanna Venkatesh
McMaster Univesrity

Date submitted: 22 Jan 2013 Electronic form version 1.4