Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Shot noise of a quantum displacement detector AASHISH CLERK, McGill University, STEVE GIRVIN, Yale University — Several recent experiments [1] [2] have demonstrated that a mesoscopic conductor (such as a single-electron transistor) can act as a near quantum-limited detector of the position of a nanomechanical oscillator; such experiments directly probe the output noise of the detector. Here, we study theoretically the frequency-dependent current noise of a quantum tunnel junction coupled to a nano-mechanical oscillator, focusing on the quantum versus classical aspects of the noise. We treat both the cases of dc and ac voltage bias. The dynamics of the oscillator can lead to large signatures in the shot noise, even if the oscillator-tunnel junction coupling is too weak to yield an appreciable signature in the average current. Moreover, the modification of the shot noise by the oscillator cannot be fully explained by a simple picture of a fluctuating conductance.

[1]Knobel *et al.*, Nature **424**, 291 (2003).
[2]M. D. LaHaye *et al.*, Science **304**, 74, (2004).

Aashish Clerk
McGill University

Date submitted: 22 Nov 2004 Electronic form version 1.4