Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

A hybrid quantum interface between a mechanical resonator and an ultracold spin ensemble JIALUN LUO, YOGESH S PATIL, HIL F H CHEUNG, MUKUND VENGALATTORE, Cornell University — Cavity optomechanical systems of a diverse range of mass and size scales have been realized both for fundamental studies of quantum measurement as well as technological applications of force and mass sensing. However, in contrast to cavity QED systems, the comparatively large rates of dissipation and weak optomechanical interactions have stymied the robust quantum state preparation and control of macroscopic mechanical resonators purely via optomechanical interactions. To circumvent these limitations, we demonstrate a hybrid quantum system in which a macroscopic resonator is optically coupled to an ultracold spin ensemble and show that the optomechanical interaction can be dramatically enhanced and dynamically tuned by the effective spin-phonon coupling, thereby creating a robust platform for quantum state preparation, transduction, and beyond-SQL measurements.

Yogesh Patil
Cornell University

Date submitted: 28 Jan 2017 Electronic form version 1.4