Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Reservoir Engineering Enhanced Quantum State Preparation and Cooling HIL FUNG HARRY CHEUNG, YOGESH PATIL, MUKUND VENGALATTORE, Cornell University — Feedback cooling and control using weak continuous measurement have traditionally been applied to quantum systems that are in contact with a Markovian reservoir (see for example, [1]). The realization of open quantum systems with artificially imposed non-Markovian dynamics offers a promising new route to robust techniques of quantum state preparation. In an optomechanical system of a silicon nitride membrane resonator with artificially engineered non-Markovian system-reservoir interactions, we experimentally demonstrate that feedback cooling can achieve over 300-fold lower final temperatures than obtained in the Markovian limit. Building on these substantial enhancements, we use optimal control theory to design system-reservoir interactions to implement enhanced and robust state preparation, and in particular, explore non-Markovian interactions for the generation of non-Gaussian quantum states in optomechanical systems [see also 2]. We further evaluate potential enhancements for force-sensing and metrological applications in the context of cavity optomechanical systems using such reservoir-engineered interactions. [1] A. C. Doherty and K. Jacobs, Phys. Rev. A 60, 2700 (1999) [2] S. Diehl et. al., Nature Physics 4, 878 - 883 (2008)

Yogesh Patil
Cornell University

Date submitted: 01 Feb 2019 Electronic form version 1.4