Macroscopic Quantum Superposition in Cavity Optomechanics

JIE-QIAO LIAO, LIN TIAN, School of Natural Sciences, University of California, Merced, California 95343 — Quantum superposition in mechanical systems is not only a key evidence of macroscopic quantum coherence, but can also be utilized in modern quantum technology. Here we propose an efficient approach for creating macroscopically distinct mechanical superposition states in a two-mode optomechanical system. Photon hopping between the two cavity-modes is modulated sinusoidally. The modulated photon tunneling enables an ultrastrong radiation-pressure force acting on the mechanical resonator, and hence significantly increases the mechanical displacement induced by a single photon. We present systematic studies on the generation of the Yurke-Stoler-like states in the presence of system dissipations. The state generation method is general and it can be implemented with either optomechanical or electromechanical systems.

1The authors are supported by the National Science Foundation under Award No. NSF-DMR-0956064 and the DARPA ORCHID program through AFOSR.

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Date submitted: 05 Nov 2015

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