Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Single-photon time-dependent spectrum in quantum optomechanics IMRAN M. MIRZA, STEVEN J. VAN ENK, Oregon Center for Optics, Department of Physics, University of Oregon, USA. — Single-photon optomechanics in the strong coupling regime is promising to play a key role in the realization of superpositions of macroscopic objects (for testing the foundations of quantum theory) and enhancing the nonlinear optomechanical interactions (for possible applications in quantum information processing). The stationary/time-independent spectrum of a single-photon interacting with a tiny movable mirror (in the context of cavity quantum optomechanics) can exhibit the signatures of optomechanical interaction as the appearance of multiple side bands in the spectrum. Strong optomechanical coupling and the good cavity limit are the two main conditions that need to be satisfied in order to observe all resonances in the spectrum [J.-Q. Liao et. al, Phys. Rev. A, 85,025803 (2012)]. We investigate the time-dependent (TD) version of the spectrum in the weak mechanical damping limit [Single-photon time-dependent spectrum in quantum optomechanics, I. M. Mirza, S. van Enk, to appear in Phys. Rev. A (2014)], which reveals some novel effects that are not possible to observe otherwise. For instance, the TD spectrum indicates that a sufficient amount of time has to pass before one can observe the fully resolved spectrum, even if the strong coupling and good cavity conditions are respected. Moreover, the TD spectrum also exhibits the order (in time) in which different side bands appear, thus further explaining the different photon-phonon interactions responsible for the production of distinct resonances.

Imran Mirza
Oregon Center for Optics, Department of Physics, University of Oregon, USA.

Date submitted: 09 Oct 2014 Electronic form version 1.4