Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Velocity-sorting and stochastic resonances in a dissipative optical lattice ALEXANDER STARON, KEFENG JIANG, AJITHAMITHRA DHARMASIRI, ANTHONY RAPP, SAMIR BALI, Miami University — We present detailed measurements of pump-probe spectra which reveal evidence for a spontaneous emission-enabled Brownian ratchet capable of spatially sorting a selected velocity class of atoms in a dissipative optical lattice. We show that choosing different incident angles of the probe beam allows us to select different velocity-classes of atoms for directed transport. For the first time via direct pump-probe spectroscopy, we explore the possibility of observing a classical stochastic resonance in an optical lattice, where environmental fluctuations in the form of random spontaneous emission recoils are resonantly coupled to the atomic intrawell oscillation frequency to yield enhanced ratcheting. We discuss prospects for observing a quantum stochastic resonance in cold atoms by inducing synchronization between a weak, driving frequency and the stochastic quantum tunneling rate between adjacent lattice wells. Funded by Army Research Office (ARO).

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Date submitted: 30 Jan 2020 Electronic form version 1.4