Abstract Submitted
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Dissipative cavity optomechanics of levitated nanoparticles and nanodumbbells STEVEN HABRAKEN, Institute for Theoretical Physics, University of Erlangen-Nuremberg, Germany, WOLFGANG LECHNER, PETER ZOLLER, Institute for Quantum Optics and Quantum Information, Innsbruck, Austria — The interaction between dielectric particles and a laser-driven optical cavity gives rise to both conservative and dissipative dynamics, which can be used to levitate, trap, and cool nanoparticles. We analytically and numerically study a two-mode setup in which the optical potentials along the cavity axis cancel, so that the resulting dynamics is almost purely dissipative. For appropriate detunings of the laser drives, this dissipative optomechanical dynamics can be used to sort particles according to their size, to rectify their velocities, and to enhance transverse cooling. We also consider dumbbells of dielectric nanoparticles and show that properly tuned optical parameters allow for the study of the nonequilibrium dynamics of composite nanoparticles with nonisotropic optical friction. We find optically induced ordering and nematic transitions with nonequilibrium analogs to liquid crystal phases for ensembles of dimers.

[1]. S. J. M. Habraken, W. Lechner and P. Zoller, Phys. Rev. A 87, 053808 (2013). [2]. W. Lechner, S. J. M. Habraken, N. Kiesel, M. Aspelmeyer and P. Zoller, Phys. Rev. Lett. 110, 143604 (2013).

Steven Habraken
Institute for Theoretical Physics, University of Erlangen-Nuremberg, Germany

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