Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Tuning the Order of the Nonequilibrium Quantum Phase Transition in a Hybrid Atom-Optomechanical System[1] AXEL PELSTER, University of Kaiserslautern, Germany, NIKLAS MANN, MICHAEL THORWART, University of Hamburg, Germany — A quantum many-body hybrid system is considered formed by a nanomembrane, which interacts optomechanically with light in a pumped cavity, and an ultracold atom gas in the optical lattice of the out-coupled light. An effective atom-membrane coupling can be realized in two different ways: first, the membrane is coupled to the motion of the atoms in the lattice[1] and, second, the motion of the membrane is coupled to transitions between two internal atomic states[2]. By tuning the applied laser intensity, the optomechanical coupling of the membrane motion to the atomic motional or internal states can be tuned and a nonequilibrium quantum phase transition occurs above a critical intensity. Focussing on the latter case, the nonequilibrium quantum phase transition is characterized by a sizeable occupation of the energetically higher internal states and a displaced membrane. In contrast to the motional coupling scheme, its order can be changed by tuning the transition frequency.

[1] N. Mann, M. Reza Bakhtiari, A. Pelster, M. Thorwart, Phys. Rev. Lett. **120**, 063605 (2018)

[2] N. Mann, A. Pelster, M. Thorwart, submitted (arXiv:1810.12846)

[1]DFG via SFB/TR185

Axel Pelster
University of Kaiserslautern

Date submitted: 23 Jan 2019 Electronic form version 1.4