Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Non-equilibrium pseudo-crystal bandgap structures NICOLAS BACHELARD, CHAD ROPP, YUAN WANG, XIANG ZHANG, UC Berkeley — Crystalline structures possess the ability to shape wave propagation, for example, through the formation of bandgaps. Such structures might be obtained either by top-down fabrication or by static self-assembly processes. However, these structures arise at thermodynamic equilibrium and are inherently rigid and, thus, difficult to reconfigure. Less rigid structures are obtained far from equilibrium through the continuous input of energy, which is collectively dissipated by the system and leads to spontaneous organization. Because of their many degrees of freedom, non-equilibrium structures are typically difficult to achieve artificially over large ranges. Here, we report the realization of a non-equilibrium bandgap structure composed of particles moving along a waveguide, driven by a coherent field. We observe the dynamic attraction of the particles towards a pseudo-crystalline order defined by many equivalent configurations. For an arbitrarily large set of particles, we analytically demonstrate the existence a unique phase distribution at steady state, which corresponds to the emergence of a transmission bandgap with an edge locked to λ. This work opens avenues for the realization of out-of-equilibrium bandgap structures, which can be dynamically self-assembled and reconfigured on-command at any scales.

Nicolas Bachelard
UC Berkeley

Date submitted: 10 Nov 2016 Electronic form version 1.4