Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

The Kibble-Zurek mechanism in phase transitions of non-equilibrium systems HIL F H CHEUNG, YOGESH S PATIL, ADITYA G DATE, MUKUND VENGALATTORE, Cornell University — We experimentally realize a driven-dissipative phase transition using a mechanical parametric amplifier to demonstrate key signatures of a second order phase transition, including a point where the susceptibilities and relaxation time scales diverge, and where the system exhibits a spontaneous breaking of symmetry. Though reminiscent of conventional equilibrium phase transitions, it is unclear if such driven-dissipative phase transitions are amenable to the conventional Landau-Ginsburg-Wilson paradigm, which relies on concepts of scale invariance and universality, and recent work has shown that such phase transitions can indeed lie beyond such conventional universality classes [1]. By quenching the system past the critical point, we investigate the dynamics of the emergent ordered phase and find that our measurements are in excellent agreement with the Kibble-Zurek mechanism. In addition to verifying the Kibble-Zurek hypothesis in driven-dissipative phase transitions for the first time, we also demonstrate that the measured critical exponents accurately reflect the interplay between intrinsic coherent dynamics and environmental correlations, showing a clear departure from mean field exponents in the case of non-Markovian system-bath interactions. We further discuss how reservoir engineering and the imposition of artificial environmental correlations can result in the stabilization of novel many-body quantum phases and aid in the creation of exotic non-equilibrium states of matter.
[1] L. M. Sieberer et al., Phys. Rev. Lett. 110, 195301

Yogesh S Patil
Cornell University

Date submitted: 28 Jan 2017 Electronic form version 1.4