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**The Kibble-Zurek mechanism in a driven dissipative transition**

YOGESH S PATIL, HIL FUNG HARRY CHEUNG, Cornell University, TAMIRO VILLAZON, Boston University, ADITYA G DATE, California Institute of Technology, ANUSHYA CHANDRAN, ANATOLI POLKOVNIKOV, Boston University, MUKUND VENGALATTORE, Cornell University — In open quantum systems, the competition between coherent and dissipative dynamics can give rise to new forms of driven dissipative transitions, dynamical states and critical behavior that lies beyond the standard paradigms of equilibrium phase transitions. We investigate the critical dynamics of a driven dissipative phase transition in the presence of a dynamically engineered non-Markovian environment. We demonstrate that our system exhibits universal scaling behavior following a quench into an ordered phase and confirm the validity of the Kibble-Zurek mechanism in dynamical phase transitions. Further, the growth of the order parameter following such quenches reveals a universal two-parameter scaling function dependent on both the quench rate and the temperature. This two-parameter scaling function thus allows us to access the critical behavior of the zero-temperature transition using finite temperature measurements. We also measure the critical exponents of the phase transition based on the Kibble-Zurek paradigm and show that these exponents are significantly modified due to the non-Markovian system-reservoir interactions. Our studies experimentally confirm the profound effect of environmental correlations on the dynamics of a driven, dissipative transition, and can potentially serve as a touchstone for further experiments on such dynamical transitions in the quantum many-body regime.

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