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Quantum simulation of open-system dynamical maps with trapped ions P. SCHINDLER, Institut fuer Experimentalphysik, Universitaet Innsbruck, Austria, M. MUELLER, Departamento de Fisica Teorica I, Universidad Complutense, Madrid, Spain, D. NIGG, J.T. BARREIRO, E.A. MARTINEZ, M. HENNRICH, T. MONZ, Institut fuer Experimentalphysik, Universitaet Innsbruck, Austria, S. DIEHL, P. ZOLLER, Institut fuer Theoretische Physik, Universitaet Innsbruck, Austria, R. BLATT, Institut fuer Experimentalphysik, Universitaet Innsbruck, Austria — Dynamical maps describe general transformations of the state of a physical system, and their iteration can be interpreted as generating a discrete time evolution. Quantum mechanical examples show intriguing phenomena such as dynamical localization on the single-particle level. We extend the concept of dynamical maps to an open-system, many-particle context: We experimentally explore the stroboscopic dynamics of a complex many-body spin model by means of a universal quantum simulator using up to five ions. In particular, we generate long-range phase coherence of spin by an iteration of purely dissipative quantum maps. We also demonstrate the characteristics of competition between combined coherent and dissipative non-equilibrium evolution. This opens the door for studying many-particle non-equilibrium physics and associated dynamical phase transitions with no immediate counterpart in equilibrium condensed matter systems. As a first step in this direction, we developed an error detection and reduction toolbox that facilitates the faithful quantum simulation of larger systems.

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