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**Observation of phase transitions in quantum Rabi model with single trapped ion** MINGLEI CAI, ZIDU LIU, YUKAI WU, QUANXIN MEI, YUE JIANG, WENDING ZHAO, XIANG ZHANG, LI HE, ZICHAO ZHOU, LUMING DUAN, Tsinghua University — Quantum Rabi model is arguably the simplest light-matter interaction model involving only a two-level atom and a single-mode bosonic field. Rich quantum properties of this model have been explored both experimentally and theoretically. It has been shown recently that such simple system can even exhibit phase transitions which normally only occur in many-body interacting systems approaching thermodynamic limit. Here, we employ a single trapped ion to simulate the quantum Rabi Hamiltonian and find evidence of quantum phase transition through observing the corresponding order parameters. Furthermore, adding controllable dissipation to the coherent drive of the Rabi Hamiltonian, we construct an open quantum Rabi model and observe the dissipative phase transition through the qualitative change of average phonon number in the steady states.

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