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Reentrant Behavior in A Multi-connected Superconducting Jaynes-Cummings Lattice[1] LIN TIAN, KANGJUN SEO, School of Natural Sciences, University of California, Merced, CA 95343, USA — Superconducting quantum devices have excellent connectivity, tunable coupling and long decoherence time as demonstrated by recent experiments. These devices provide a powerful platform for constructing analog quantum simulators to study novel many-body effects. Here we present a multi-connected Jaynes-Cummings lattice model, where the qubits and the resonators are connected alternatively. In a one-dimensional configuration, this model bears an intrinsic symmetry between the left and the right qubit-resonator couplings under a mirror reflection. Different from the coupled cavity array (CCA) model, the qubit-resonator couplings in this model induce both onsite Hubbard nonlinearity and hopping of the excitations along the lattice. By analyzing this model in the limiting cases of very different couplings, we show that this model demonstrates a Mott insulator–superfluid–Mott insulator transition at commensurate fillings with symmetric critical points. The reentry to the Mott insulator phase originates from the symmetry between the couplings.

[1] K. Seo and L. Tian, eprint arXiv:1408.2304.

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