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Circuit-QED-based superconducting quantum simulator for the Holstein-polaron model[1] FENG MEI, School of Natural Sciences, University of California, Merced, VLADIMIR STOJANOVIĆ, Department of Physics, Harvard University, IRFAN SIDDIQI, Quantum Nanoelectronics Laboratory, Department of Physics, University of California, Berkeley, LIN TIAN, School of Natural Sciences, University of California, Merced — We propose an analog quantum simulator for the Holstein molecular-crystal model based on a superconducting circuit-QED system in the dispersive regime. The many-body Hamiltonian of this model includes both bosonic and fermionic degrees of freedom. By varying the driving field on the superconducting resonators, one can readily access both the adiabatic and anti-adiabatic regimes of this model, and reach the strong e-ph coupling limit required for small-polaron formation. We show that small-polaron state of arbitrary quasi-momentum can be generated by applying a microwave pulse to the resonators. We also show that significant squeezing in the resonator modes can be achieved in the polaron-crossover regime through a measurement-based scheme.

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