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Simulating an Interacting Quantum Gas with Superconducting Circuits CHRISTOPHER EICHLER, JONAS MLYNEK, JONAS BUTSCHER, PHILIPP KURPIERS, ETH Zurich, TOBIAS OSBORNE, Gottfried Wilhelm Leibniz Universität Hannover, ANDREAS WALLRAFF, ETH Zurich — The high level of control achievable over quantized degrees of freedom have turned superconducting circuits into one of the prime physical architectures for quantum computing and simulation. While conventional approaches towards quantum information processing mostly rely on unitary time evolution, more recently open-system dynamics are considered for quantum simulations. In this talk, I will present experiments in which we use an open cavity QED system with tunable interactions to simulate the ground state of an interacting Bose gas confined in one dimension [1,2]. These experiments rely on the ability to efficiently measure higher order photon correlations of the cavity output field. For this purpose we have developed a quantum limited amplifier achieving phase-preserving amplification at large bandwidth and high dynamic range [3]. Our results explore a different path towards the simulation of complex quantum many-body physics based on the controlled generation and detection of nonclassical radiation in an open quantum system.
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