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A Luttinger liquid of photons and spin-charge separation in hollow-core waveguides DIMITRIS G. ANGELAKIS, Centre for Quantum Technologies, National University of Singapore; Science Department, Technical University of Crete, Chania, Crete, Greece, MING-XIA HUO, ELICA KYOSEVA, Centre for Quantum Technologies, National University of Singapore, LEONG CHUAN KWEK, Centre for Quantum Technologies, National University of Singapore; IAS and NIE, Nanyang Technological University, Singapore — In this work we show that light-matter excitations (polaritons) generated inside a hollow one-dimensional fiber filled with two types of atoms, can exhibit Luttinger liquid behavior. We explain how to prepare and drive this quantum-optical system to a strongly interacting regime, described by a bosonic two-component Lieb Lininger model. Utilizing the connection between strongly interacting bosonic and fermionic systems, we show how spin-charge separation could be observed by probing the correlations in the polaritons. This is performed by first mapping the polaritons to propagating photon pulses and then measuring the effective photonic spin and charge densities and velocities by analyzing the correlations in the emitted photon spectrum. The necessary regime of interactions is achievable with current quantum optical technology.

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