I. V. Savona: *Quantum correlations in driven-dissipative arrays of weakly nonlinear optical cavities*

Recent progress in nanotechnology has made it possible to fabricate various kinds of optical nanocavities – embedding a nonlinear optical medium – in which a sizeable nonlinearity arises already at the level of single photon occupation. Arrays of these nanocavities bear a close analogy with strongly correlated systems in condensed matter and atomic physics, but with the added possibility of selective coherent optical control of each individual cavity mode. This unique combination of features makes the system ideal for the generation and control of quantum correlated states of many photons, and ultimately for the investigation of a large variety of many-body phenomena in a quantum simulator fashion. Due to the dissipative nature of the optical cavities however, in order for quantum correlations to build up from interactions, a stringent requirement is that the two-body interaction energy be much larger than the dissipation rate. Parameters of current state-of-the-art systems lie still significantly behind this minimal requirement.

Quantum correlations however are not necessarily produced by interactions alone. We demonstrate that quantum correlations can arise in an array of weakly nonlinear cavities from the interplay of small nonlinear energy shifts (due to weak interaction) and quantum interference between different excitation pathways. By solving the quantum equations for the density operator of the driven-dissipative system, we show how this mechanism allows for the generation of photons with sub-poissonian statistics, and of multipartite entangled states of few photons, required by the *one-way quantum computation paradigm*. The simulations show that these phenomena are expected for realistic values of the nonlinearity, dissipation and decoherence rates, which are easily available in several state-of-the-art quantum optical systems.

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