

# Corner-space renormalization method for driven-dissipative strongly correlated systems

S. Finazzi, A. Le Boité, F. Storme, A. Baksic, C. Ciuti

<sup>1</sup> *Matériaux et Phénomènes Quantiques, Université Paris Diderot et CNRS, France*

Lattices of coupled photonic resonators with quantum nonlinearities are emerging artificial materials for the realization of strongly correlated photonic (polaritonic) phases[1]. These systems encompass networks of superconducting circuit QED resonators, lattices of semiconductor photonic microcavities, and opto-mechanical arrays. The theory of such systems is generally challenging since the size of the Hilbert space grows exponentially with the number of sites. In presence of driving and dissipation, one has to solve the master equation for the system density-matrix.

After a concise introduction of the topic, this talk will present a theoretical method[2] to investigate driven-dissipative lattices of nonlinear photon cavities.

The steady-state density-matrix of the lattice is obtained by solving the master equation in a small corner of the Hilbert space. The states spanning the corner space are determined through an iterative procedure, using eigenvectors of the density-matrix of smaller lattice systems, merging in real space two lattices at each iteration and selecting  $M$  pairs of states by maximizing their joint probability. Accuracy of the results is then improved by increasing  $M$ , the number of states of the corner space, until convergence is reached. The efficiency of such an approach is demonstrated by applying it to the driven-dissipative 2D Bose-Hubbard model.

[1] I. Carusotto, C. Ciuti, *Quantum fluids of light*, Rev. Mod. Phys. 85, 299 (2013).

[2] S. Finazzi, A. Le Boité, F. Storme, A. Baksic, C. Ciuti, *Corner space renormalization method for driven-dissipative 2D correlated systems*, arXiv:1502.05651