Abstract:

An open quantum system, whose time evolution is governed by a master equation, can be driven in steady state into a given pure quantum state by an appropriate design of the system-reservoir coupling.
This points out a route towards preparing many body states and non-equilibrium quantum phases by quantum reservoir engineering. Here we discuss in detail the example of a driven dissipative Bose Einstein Condensate (BEC), where atoms in an optical lattice are coupled to a bath of Bogoliubov excitations via the atomic current representing local dissipation. In the absence of interactions the lattice gas is driven into a pure state with long range order. Weak interactions lead to a weakly mixed state, which in 3D can be understood as a depletion of the condensate, and in 1D and 2D exhibits properties reminiscent of a Luttinger liquid or a Kosterlitz-Thouless critical phase at finite temperature, with the role of the ``finite temperature'' played by the interactions.