Non Equilibrium Dynamics of Interacting Bosons: Steady States and Dynamical Transitions

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We study the non-equilibrium dynamics of an interacting Bose gas with dipole conservation laws in the large N limit. Under a quench dynamics, we find that the system can reach a steady state where dipole conservation is broken, but the U(1) symmetry is preserved. This phase does not occur in the equilibrium phase diagram of the system.

Under a Floquet dynamics, we show that the quasi-steady state at high driving frequencies has a non-monotonic momentum distribution showing clear signatures of athermal behaviour. At low driving frequencies, the system shows dynamical phase transitions where the order parameter vanishes as a function of time in a non-analytic way.