Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

Monday, June 12, 2019 - 14:30 h
CFEL Seminar room O1.060 (Bldg. 99)

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Correlated driven-dissipative systems

Driven-dissipative systems represent natural platforms to study non-equilibrium phases.
In the first part of the talk, I will present some physical results for which both non-equilibrium conditions and interactions are crucial. I will argue that a prototype model of correlated driven-dissipative lattice bosons, relevant for upcoming generation of circuit QED arrays experiments, exhibits a phase transition where a finite frequency mode becomes unstable, as an effect of quantum interactions and non-equilibrium conditions. In the broken-symmetry phase the corresponding macroscopic order parameter becomes non-stationary and oscillates in time without damping, thus breaking continuous time-translational symmetry.

To get some more insights on this transition, I studied the spectral properties of Markovian driven-dissipative quantum systems using a Lehmann representation. Focusing on the nonlinear quantum Van der Pol oscillator as a paradigmatic example, I showed that a sign constraint of spectral functions, which is mathematically exact for closed systems, gets relaxed for open systems; it is eventually replaced by an interplay between dissipation and interactions.

In the last part of the talk, I will finally discuss a new method to solve quantum impurity models, small interacting quantum systems coupled to a non-Markovian environment, in presence of additional Markovian dissipation. I will derive a Dyson equation for the time-evolution operator of the reduced density matrix and approximate its self-energy resuming only non-crossing diagrams. I will test this approach on a simple problem of a fermionic impurity.

Host: Michael Sentef

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