Soutenance de thèse de doctorat

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Lundi 21/10/2019, 14:00-18:00

Orme des Merisiers Amphi Claude Bloch, Bât. 774

Orazio Scarlatella

IPhT

Driven-dissipative quantum many-body systems

My PhD was devoted to the study of driven-dissipative quantum many-body systems. These systems represent natural platforms to explore fundamental questions about matter under non-equilibrium conditions, having at the same time a potential impact on emerging quantum technologies.

In this thesis, we discuss a spectral decomposition of single-particle Green functions of Markovian open systems, that we applied to a model of a quantum van der Pol oscillator.

We point out that a sign property of spectral functions of equilibrium systems doesn't hold in the case of open systems, resulting in a surprising "negative density of states", with direct physical consequences.

We study the phase transition between a normal and a superfluid phase in a prototype system of driven-dissipative bosons on a lattice. This transition is characterized by a finite-frequency criticality corresponding to the spontaneous break of time-translational invariance, which has no analog in equilibrium systems.

Later, we discuss the mean-field phase diagram of a Mott insulating phase stabilized by dissipation, which is potentially relevant for ongoing experiments.

Our results suggest that there is a trade off between the fidelity of the stationary phase to a Mott insulator and robustness of such a phase at finite hopping.

Finally, we present some developments towards using dynamical mean field theory (DMFT) for studying driven-dissipative lattice systems.

We introduce DMFT in the context of driven-dissipative models and developed a method to solve the auxiliary problem of a single impurity, coupled simultaneously to a Markovian and a non-Markovian environment.

As a test, we apply this novel method to a simple model of a fermionic, single-mode impurity.