FACOLTÀ DI SCIENZE MATEMATICHE, FISICHE E NATURALI
DIPARTIMENTO DI MATEMATICA E FISICA "NICCOLÒ TARTAGLIA"
INTERNATIONAL DOCTORAL PROGRAM IN SCIENCE

Nonequilibrium phases of an incoherently-driven photonic lattice

Introducono:

Prof. Fausto Borgonovi
Università Cattolica del Sacro Cuore

Interviene:

Dott. ALBERTO BIELLA
Université Paris Diderot, Sorbonne Paris Cité, Laboratoire Materiaux et Phenomenes Quantiques, France

Abstract

Interacting many-particle systems driven away from the thermodynamic equilibrium exhibit a number of interesting features both in the classical and quantum regime. Our understanding of such systems is limited by the fact that nonequilibrium can emerge in a broad variety of forms, making difficult to develop an unitary picture. Arrays of coupled QED-cavities offer a unique playground for the investigation of open many-body systems in nonequilibrium conditions and they are particularly appealing from the condensed matter physics perspective since they allow the quantum simulation of archetypal (interacting) lattice models [1]. In the work I will present [2], we have explored the physics of a lattice of coupled resonators with giant optical nonlinearities where optical gain is provided by incoherently pumped two-level systems. Within a Gutzwiller mean-field approach, we predict the existence of a nonequilibrium symmetry-breaking transition from an incompressible localized phase of photons to a delocalized phase, which is akin to a coherent laser of strongly correlated photons. Our work shows that incoherently excited photonic lattice systems provides an enticing platform for the study of strongly correlated quantum phases and collective behaviors in driven-dissipative systems.

[1] M. Hartmann, Quantum simulation with interacting photons, J. Opt. 18, 104005 (2016). K. Le Hur, L. Henriet, A. Petrescu, K. Plekhanov, G. Roux, and M. Schir´o, Many-body quantum electrodynamics networks: Non-equilibrium condensed matter physics with light, C. R. Physique 17, 808 (2016). C. Noh and D. Angelakis, Quantum simulations and many-body physics with light, Rep. Prog. Phys. 80 016401 (2017).

[2] A. Biella, F. Storme, J. Lebreuilly, D. Rossini, R. Fazio, I. Carusotto, and C. Ciuti, Phase diagram of incoherently-driven strongly correlated photonic lattices, arXiv:1704.08978 (2017).

Seminario

Venerdì 26 maggio 2017
Sala Riunioni, ore 12.00
Via dei Musei 41 - Brescia

I-LAMP
Interdisciplinary Laboratories for Advanced Materials Physics

UNIVERSITÀ CATTOLICA del Sacro Cuore