Symposium - Topological Synthetic Phases with Photons

Rapport sur les contributions

https://indico.math.cnrs.fr/e/4704

ID de Contribution: **1** Type: **Non spécifié**

From electrons to photons, and back to electrons

vendredi 17 mai 2019 10:15 (1 heure)

There are many intriguing physical phenomena which are associated with topological features — global properties that are not discernible locally. The best-known examples are quantum Hall effects in electronic systems, where insensitivity to local properties manifests itself as conductance through edge states which are insensitive to defects and disorder. In the talk, we first discuss how similar physics can be observed for photons; specifically, how various quantum Hall Hamiltonians can be simulated in an optical system. We report on the imaging and measurement of topological photonic edge states and the generation of correlated-photon pairs, in silicon photonics platform. We then discuss how strong interaction between photons can be created by the integration of topological photonic structures with solid-state quantum emitters. Specifically, we demonstrate the chiral emission of a quantum emitter into topological edge modes and establish their robustness against sharp bends. In the end, we describe how photons, in a different role, could be exploited to probe and manipulate topological electronic states. In particular, we theoretically investigate the realization of a two-component fractional quantum Hall phases in monolayer graphene by optically driving the system, in a non-equilibrium regime. Moreover, we discuss how quantum optics toolbox can be applied to such correlated states of electrons.

Orateur: M. HAFEZI, Mohammad (University of Maryland)

ID de Contribution: **2** Type: **Non spécifié**

Exploring Synthetic Quantum Materials in Superconducting Circuits

vendredi 17 mai 2019 11:30 (1 heure)

Superconducting circuits have emerged as a competitive platform for quantum computation, satisfying the challenges of controllability, long coherence and strong interactions. Here we apply this toolbox to the exploration of strongly correlated quantum materials made of microwave photons. We build a Chern insulator lattice for microwave photons, and observe topologically protected edge states using time- and site- resolved measurements. I will show our progress towards strong coherent interactions by coupling the lattice sites to superconducting qubits. In another experiment, we develop a new approach for preparing photonic many-body phases, where engineered dissipation is used as a resource to protect the fragile quantum states against intrinsic losses. We apply it to a strongly interacting Bose-Hubbard lattice and realize a dissipatively stabilized Mott insulator of photons. Our circuit experiments open many possibilities for exploration of strongly interacting topological phases, and quantum dynamics in driven-dissipative settings.

Orateur: M. MA, Alex Ruichao (University of Chicago)

ID de Contribution: **3** Type: **Non spécifié**

Topological slow light and Weyl exceptional rings

vendredi 17 mai 2019 14:00 (1 heure)

First, I propose that topological edge states can be used to induce robust slow-light waveguides. Next, I will experimentally demonstrate the realization of Weyl exceptional rings in photonic lattices.

Orateur: M. RECHTSMAN, Mickael (Penn State University)