Contrats doctoraux 2026

Titre du projet de thèse : Quantum simulation with quantum emitters couplet to a photonic lattice

Directeur de thèse : Alberto Amo

Co-directeurs de thèse : Clément Hainaut

Résumé du projet de thèse (en 20 lignes maximum) :

Coupling quantum emitters to the optical modes of a photonic lattice creates new opportunities for engineering exotic quantum light sources and developing novel quantum simulators with long-range interactions. It would allow studying non-classical states with spread entanglement and the implementation of strongly correlated phases of light [1].

The main goal of this thesis is to experimentally study the optical properties of quantum emitters coupled to a lattice of photonic resonators. We have recently implemented an open cavity system with embedded individual molecules of DBT. Each molecule is a two-level system whose excitation couples to light. The open cavity is made of two mirrors brought in close proximity (about 2 microns apart) with the use of dedicated piezo actuators. One of the mirrors has been etched using focus ion beam technology to engineer lattices of hemispheric cavities, which define a photonic lattice.

By modifying the geometry of the photonic resonators, the density of states can be engineered to display Dirac points, van Hove singularities, flat bands, etc. These collective photonic modes can be used to couple the quantum emitters in different ways via the exchange of lattice photons. The objective of this thesis is to demonstrate the coupling of distant quantum emitters mediated by cavity photons and to reveal phenomena such as superradiance and subradiance, which have never been observed in the context of lattice quantum electrodynamics.
This PhD thesis is part of the QuantERA european project MOLAR in collaboration with Florence, Madrid, Prague and Würzburg.
Group website: https://photonlattices.eu/

[1] A. González-Tudela and J. I. Cirac, Phys. Rev. Lett. 119, 143602 (2017)

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Contact (adresse e-mail) : alberto.amo@univ-lille.fr

Remarques/commentaires supplémentaires :