

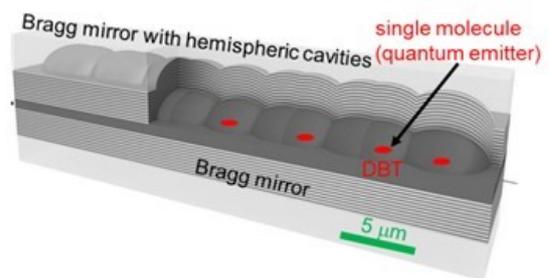


PhD in experimental many-body physics with quantum emitters in a photonic lattice (Lille – France)

The coupling of one or more quantum emitters to the optical modes of a photonic lattice opens up new opportunities to engineer exotic quantum light sources and to develop novel types of quantum simulators with long-range interactions. This approach would enable the study of strongly correlated phases of light in a lattice.

The primary goal of this PhD project is to develop one of the first experimental systems for lattice quantum electrodynamics using molecular quantum emitters. We are currently fabricating an open cavity system with embedded nanocrystals, each containing a single quantum emitter. The open cavity consists of two mirrors positioned in close proximity (approximately 1 micron apart) using dedicated piezo actuators. One of the mirrors has been etched using focused ion beam technology to create lattices of hemispherical cavities, which define a photonic lattice.

The lattice enables the engineering of photonic modes to which the emitters couple. These photonic modes give rise to unconventional classical and quantum interference effects. One of the goals of the PhD project is to observe the perfect localization of light resulting from this interference, a phenomenon known as lattice subradiance [1]. A second objective is to implement long-range interactions between quantum emitters mediated by the photonic lattice modes. Achieving this significant result would demonstrate the potential of this system to simulate spin Hamiltonians using photons and to manipulate non-classical states of light with distributed entanglement, which will also be a focus of this work.



The project is mainly experimental and relies in established collaborations with theory groups with expertise in the area of lattice quantum electrodynamics. The PhD thesis may involve visits to our partners in Madrid, Florence and Würzburg.

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

To apply: <https://emploi.cnrs.fr/Offres/CDD/UMR8523-ALBAMO-011/Default.aspx?lang=EN>

Starting date and duration: 1st October 2025, 3 years.

Prerequisites: master in physics or engineering. Good notions of quantum mechanics.

Salary: 1716€/month net (6 weeks vacations, medical insurance and social security benefits provided in addition to the net salary)

Group website: <https://photonlattices.eu/>

Supervisor: Alberto Amo (alberto.amo-garcia@univ-lille.fr)

Location: Laboratoire PhLAM, Cité Scientifique in Villeneuve d'Ascq (next to Lille, France).