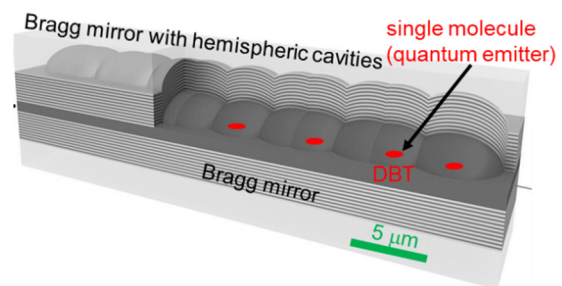


Experimental many-body physics with quantum emitters in a photonic lattice

The coupling of one or several quantum emitters to the optical modes of a photonic lattice opens up new opportunities to engineer exotic sources of quantum light and to develop novel types of quantum simulators with long range interactions. It would allow studying strongly correlated phases of light in a lattice.

The main goal of this internship 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 with a single quantum emitter. The open cavity is made of two mirrors brought in close proximity (about 1 micron 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. The coupling of the quantum emitters to the photonic lattice modes is expected to result in the emergence of non-classical states of light with spread entanglement [1].



The internship will consist in the alignment and characterization of the open cavity with quantum emitters and the study of the temporal dynamics and quantum properties of the light emitted by the emitters in the lattice. We will use a fully developed experimental set-up with a streak camera and photon counters.

This internship is part of the [QuantERA european project MOLAR](#) and will be continued into a financed PhD thesis. The internship is also paid.

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

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

Techniques/methods in use: Experimental optics, quantum microscope

Applicant skills: Lenses and other optics manipulation, training on quantum mechanics

Internship supervisor(s): Alberto AMO, alberto.amo-garcia@univ-lille.fr

Internship location: Laboratoire PhLAM, Cité Scientifique in Villeneuve d'Ascq (next to Lille)

Possibility for a Doctoral thesis: Yes (funding granted)