Master 2 "Systèmes Complexes, Optique, Lasers (SCOL)": Research Training 2022-2023
Master 2 "Matter Molecules and their Environment(MME)": Research Training 2022-2023

Appel à sujet de stage recherche / Call for research training subject

Laboratory: PhLAM

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Collaborator(s):

Topic: Nonlinear optics, topology, polaritons

Master 2: select the master and the most appropriate option

X Master 2 SCOL	□ Master 2 MME (GP-SCP)
X Option Complex Systems (GP-IKS)	X Option Condensed Matter
	□ Option Condensed Matter/Pharma
	X Option Dilute Matter and Spectroscopy
	□ Option Atmospheric Sciences
	□ Option Modeling at the molecular & atomic scales

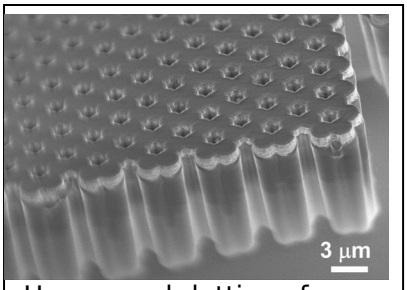
Quantum simulation with photonic lattices

Lattices of photonic resonators are a remarkable system to study experimentally the physics of particles in complex Hamiltonians. In a photonic lattice, the dynamics of light is determined by the interplay of tunnelling between adjacent sites, gain, losses and the optical nonlinearities. For instance, in a honeycomb lattice, light propagation mimics the extraordinary transport of electrons in graphene, with the addition of nonlinearities, which give rise to novel classes of solitons.

In this experimental internship, **we will explore the emergence of a novel type of nonlinear structures known as algebraic solitons**. They are expected to appear at the Dirac dispersion of a honeycomb lattice of nonlinear photonic resonators (see image) and present an algebraic decay very different to that of standard Kerr solitons.

There are funding opportunities to extend this master internship into a PhD thesis by extending the study of nonlinear effects to topological edge states in polariton lattices.

This experimental project is part of the European ERC grant EmergenTopo recently awarded to Alberto Amo, and it will be developed in collaboration with the Center for Nanosciences and Nanotechnologies in Palaiseau (where the lattices are fabricated) and with theory groups from France, Japan and Italy. More information: http://honeypol.eu/.



Honeycomb lattice of microcavity polaritons.

-*Direct observation of photonic Landau levels and helical edge states in strained honeycomb lattices*, O. Jamadi et al., Light. Sci. Appl. 9, 144 (2020)
- *Nonlinear Polariton Fluids in a Flatband Reveal Discrete Gap Solitons*, V. Goblot et al., Phys. Rev. Lett. 123, 113901 (2019).

Key words: nonlinear optics, Dirac solitons, topology