Université de Lille

PhLAM

CNRS

PhD GRANTS 2023

PhD project title: **Topological photonics in coupled fibre rings**

PhD Supervisor: **Alberto Amo**

PhD project summary (max. 20 lines):

Topology is the study of the properties of a physical system that remain unchanged under a smooth distortion of the system. These properties are intimately related to the symmetries of the system, and result in the appearance of particle propagation channels extremely robust to disorder. These ideas have been employed in the context of photonics to implement on-chip topological photonic circuits in which light propagates with unprecedented efficiency.

This project aims at experimentally studying topological properties of synthetic lattices employing a coupled fiber ring system. We have successfully implemented this system and set up a unique method to measure the band structure of the lattice [1,2]. This system will make it possible to access a regime that has so far been remained quite explored, in which topological properties appear thanks to the temporal modulation of the lattice. We plan to unveil new topological phases for light in one- and two-dimensional multiplexed networks, to measure their topological invariants, and to study the robustness of these topological phases in the presence of optical non-linear effects.

The thesis aims to extend the research activities related to the ERC Consolidator EmergenTopo project, whose main subject is the study of topological properties of photonic networks.

More information about the group: http://honeypol.eu/

[1] C. Lechevalier, C. Evain, P. Suret, F. Copie, A. Amo, and S. Randoux, *Single-Shot Measurement of the Photonic Band Structure in a Fiber-Based Floquet-Bloch Lattice*, Commun Phys **4**, 243 (2021).

[2] A. F. Adiyatullin, L. K. Upreti, C. Lechevalier, C. Evain, F. Copie, P. Suret, S. Randoux, P. Delplace, and A. Amo, *Multi-Topological Floquet Metals in a Photonic Lattice*, ArXiv:2203.01056 (2022).