

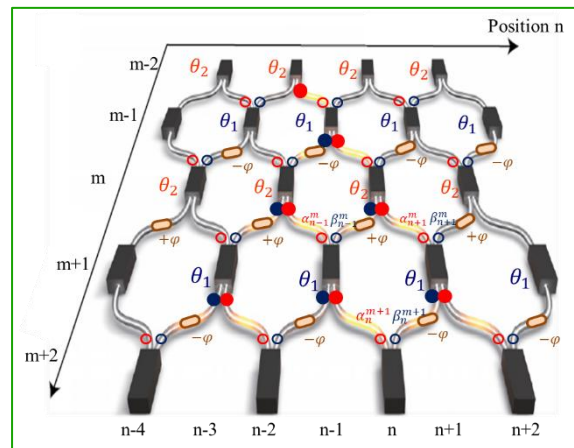
## Title: Synchronization and Nonlinear Dynamics in an Optical Lattice

**Keywords:** nonlinear optics, photonic lattices, quantum optics, topology

### Scientific description:

The study of nonlinear light propagation is a highly active field of research, renowned for its complexity and the rich physical phenomena it reveals. Coupling these nonlinear dynamics with a lattice structure, where light can tunnel between sites, enables the exploration of collective effects such as gap solitons and synchronized arrays of photonic resonators.

This internship project aims to investigate both numerically and experimentally the emergence of nonlinear phenomena in a unique lattice of coupled fibre rings. In this system, light evolves in discrete steps. This evolution leads to nonlinear dynamics that are fundamentally distinct from those in standard photonic lattices, giving rise to effects like long-range synchronization across the lattice and novel topological phases [1].



The main objective is to characterize these effects through numerical modelling and to observe them in laboratory experiments. This internship is part of a collaboration with the École Normale Supérieure de Lyon and the Institute for Fundamental Physics in Madrid. It is designed to lead directly into a PhD thesis in our group.

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

[1] R. Asapanna et al., [Phys. Rev. Lett. 134, 256603 \(2025\)](#).

**Techniques/methods in use:** Experimental optics, fibres

**Applicant skills:** Optics, quantum mechanics

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