Master 2 “Photonics, Complex and Quantum Systems (PhoCQS)”: Research Training 2023-2024
Master 2 “Matter Molecules and their Environment (MME)”: Research Training 2023-2024

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

Laboratory: PhLAM

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Collaborator(s):

Topic: Superfluidity and Turbulence in a Quantum fluid of light

Master 2: Select the master and the most appropriate option

x Master 2 PhoCQS	□ Master 2 MME (GP-SCP)
x Option Complex and Quantum Systems (GP-IKS)	□ Option Condensed Matter
	□ Option Condensed Matter/Pharma
	□ Option Dilute Matter and Spectroscopy

Quantum Fluids of Light in Two Dimensions: Superfluidity and Turbulence

Quantum fluids of light, realized with exciton-polaritons in semiconductor microcavities, provide a unique platform to investigate collective quantum phenomena in two dimensions. These systems combine the advantages of quantum optics (direct optical access, ultrafast timescales) with features of quantum fluids (superfluidity, vortices, turbulence). Many **open questions** drive current research: *How do mesoscale vortex patterns emerge in a turbulent quantum fluid? Can we “fly” without friction in a superfluid of light? What are the universal features of turbulence in low dimensions?* These challenges place polariton fluids at the center of modern efforts to understand out-of-equilibrium quantum matter.

The student will participate in an **experimental project** exploring the physics of quantum fluids of light in two dimensions. Using state-of-the-art optical setups and semiconductor microcavity structures, the internship will aim to prepare and probe polariton fluids in regimes where superfluidity, vortex nucleation, and turbulence can be observed. The internship will involve active participation in experiments, including optical alignment, imaging setup, data acquisition, and analysis. Depending on the student’s background and interest, there will also be opportunities to confront the results with simplified theoretical models.

Skills developed:

- Experimental techniques in modern optics and quantum science.
- Data analysis and interpretation of complex collective phenomena.
- Deeper understanding of open problems in low-dimensional quantum fluids.

Key words: (no more than 1 line)
Superfluidity, Quantum fluids, Out-of-equilibrium phenomena, low dimensional systems