Master 2 "Photonics, Complex and Quantum Systems (PhoCQS)": Research Training 2025-2026
Master 2 "Matter Molecules and their Environment (MME)": Research Training 2025-2026

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

Laboratory: PhLAM – UMR 8523

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Collaborator(s): Hicham El Hamzaoui

Topic: Photonics (additive manufacturing)

Master 2: select the master and the most appropriate option

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|---|---|
| ❯ Master 2 PhoCQS (GP-IKS) | □ Master 2 MME (GP-SCP) |
| □ Option Complex and Quantum Systems | □ Option Condensed Matter |
| | □ Option Condensed Matter/Pharma |
| | □ Option Dilute Matter and Spectroscopy |
| | □ Option Atmospheric Sciences |
| | □ Option Modeling at the molecular & atomic scales |
| Return subject to : christophe.szwaj@univ-lille.fr | Return subject to : sebastien.merkel@univ-lille.fr |

# Two-photon polymerization of organic and hybrid photoresists for the application of artificial intelligence in 3D printing of photonic materials

Planar optical devices and fiber components (waveguides, Bragg mirrors, sensors, …) have revolutionized the field of photonics. Usually, such components are fabricated using complex facilities similar to those used in the domain of silicon devices. With the development of direct laser writing methods (such as 2 Photon polymerization), it is now possible to print transparent 3D devices with a submicron resolution allowing to design novel functions or components that cannot be fabricated by usual means.
Home-made organic and hybrid resins (combination of monomers and silica precursors) or commercial ones are used as source of raw material for the printers. Once the optical component is 3D printed (the resin is locally photopolymerized where the laser is focused), some additional treatments are needed to obtain the transparent material or function (washing for removing uncured resin, heating to remove the organic part, …). This project is a part of PhotonIA project, which aim to build artificial intelligence models capable of predicting, for each specifically targeted optical function, the adapted manufacturing protocol.
During this internship, you will contribute to this research field by printing and characterizing some simple objects. Optical characterization that are envisaged are for example: the refractive index, the Rayleigh scattering coefficient, … Measurements are however challenging since dimensions are in the order of 200 x 200 x 200 $\mu m^3$. Some available characterization benches will be adapted in this internship.

The internship will take place within the Photonics team of the PhLAM laboratory, located in the IRCICA Institute and is related to activities developed within the framework of Equipex+ project (ADD4P) and PhotonIA project (PEPR DIADEM).

Key words: Additive manufacturing, Two-Photon Polymerization, Optical components, Photonics.