PhD in Photonics/Optics

Design and fabrication of 3D nano-structured surfaces for reduced environmental impact optics/photonics devices

Context and description
The IMT Atlantique is an elite graduate (“Grande Ecole”) engineering school located near Brest in Brittany on France’s Atlantic coast. We currently have a fully-funded PhD position available to work on the recently obtained “FABulous” EU Horizon research project: follow-on from our successful “Phenomenon” (H2020) project. FABulous aims to develop an industrial surface ‘coating’ technology that exploits breakthroughs in multiphoton lithography to manufacture high resolution 3D metasurfaces at industrial production rates. Metasurfaces are capable of manipulating light with unprecedented flexibility and open the possibility to manufacture smaller, lighter, and more environmentally friendly products, through the replacement of bulky components and/or the chemical coatings currently used to enhance the efficiency and performance of optical products. The PhD will contribute to the system design and modelling/optimisation of the photo-chemical processes for the prototype “3D nanoprinter” currently being developed in our laboratory. The extremely high plot-rate demonstrator system is based on the combination of femtosecond laser induced multi-photon polymerisation and spatial light modulator (SLM) based massively parallel direct-write techniques into novel photopolymer materials with very high non-linear multi-photon absorption sensitivity. The aim is to fabricate fully 3D, 100nm resolution nano-structures over several cm² in minute timescales for numerous industrial partner applications (FABulous project partners from France, Germany, Spain, Greece include Stellantis (PSA), Fraunhöfer, Multiphoton Optics GmbH and Thales).

Tasks/objectives
To fulfil the tasks assigned to the IMT Atlantique in this project, the selected candidate’s roles will include:
• digitally model and iteratively optimise the photo-chemical parallel-write process in novel photopolymer materials to maximise plot rate, resolution and 3D structure shape fidelity and strength
• contribute to the design/assembly/optimisation of the prototype photoplotter.
• fabricate nanostructure test devices for the industrial partners using the prototype 3D nanoprinter
• contribute to the running of the EU project: participate in progress meetings, liaison with partners, report writing, transfer of know-how to industrial partners …
• disseminate the scientific results (patents, conferences, publications …).

The candidate should have a strong theoretical and practical background in photonics or related fields and will be expected to contribute his/her own innovative ideas to develop new concepts and devices for ultra-fast nano-fabrications. The work will be performed in a team with optics department researchers (Profs, Engineers, PhD students …) and with external partners, both academic and industrial.

Candidate profile
• Masters or engineering student and with a solid grounding in and practical experience of photonics
• Experience of digital modelling (Matlab, Python, C …) of photonic/physical processes
• Practical experience of characterisation techniques: optical/electronic microscopy, spectroscopy …
• Cleanroom and photolithography experience would be an advantage
• Taste and aptitude for laboratory experimentation (fabrication) and practical applications.
• Ability to work and write scientific reports and articles in English. French is not required initially.

Practical details
Start date: September 2023
Duration: 36 months
Applications close: 15th June 2023
Please send candidatures to Prof. Kevin Heggarty
kevin.heggarty@imt-atlantique.fr