PhD in Photonics/Optics

Modelling and Design of 3D nano-structured surfaces for industrial photonics applications

Context and description:
IMT Atlantique is an elite graduate ("Grande Ecole") engineering school located near Brest in Brittany on France's Atlantic coast. We are currently looking to fill a funded PhD position to work on the "Nanoshape" French ANR research project, follow-on from our successful "Phenomenon" and FABulous EU projects (https://fabulous3d.eu/). Nanoshape aims to develop an industrial meta-surface fabrication technology that exploits breakthroughs in parallel-write multiphoton lithography to manufacture high resolution 3D meta-surfaces at industrial production rates. Meta-surfaces use nanostructures (smaller than the illuminating wavelength) to manipulate light with unprecedented flexibility, opening the route to novel optical functions and smaller, lighter, higher performance optical devices and coatings.

The PhD will centre on the electro-magnetic modelling, design and optimisation of novel photonic meta-surfaces to take full advantage of the new industrial scale 2D and 3D nano-fabrication possibilities offered by the Nanoshape photoplotter now operational in our laboratory within the ARAGO platform. Modelling/design will be performed using both commercial software packages (LightTrans, PlanOpSim, Lumerical etc.) and code/modules developed by the candidate. Numerous types of photonic meta-structures will be studied including propagation phase (effective refractive index), Pancharatnam-Berry phase and resonant regimes to find/develop structures best adapted to the constraints of the Nanoshape production process and the targeted industrial applications. The work will be performed in close collaboration with other PhD students and research staff working on the Nanoshape project and Optics Department academic and industrial partners including Oberthur, Essilor-Luxxotica, Optics Institute and Freeform research centre at Rochester University, Fraunhöfer IISB, Heidelburg Instruments GmbH.

Tasks/objectives
The selected candidate's roles will include:

- digitally model, design and iteratively optimise novel photonic meta-structures and -surfaces
- fabricate nanostructure test devices using the prototype Nanoshape photoplotter in our Arago platform cleanrooms and perform structural and optical characterisation of their performance.
- contribute to the running of the Nanoshape project: participate in progress meetings, liaison with partners, report writing, transfer of know-how to industrial partners
- disseminate the scientific results (patents, conferences, publications etc.).

The candidate should have a strong theoretical and practical background in photonics or related fields, experience of the digital modelling of physical processes and will be expected to contribute his/her own innovative ideas to develop new concepts and photonics devices.

Candidate profile

- Masters or engineering student and with a solid grounding in photonics/electro-magnetics
- Background and experience of digital modelling (Matlab, Python, C etc.) of physical processes
- Practical experience of characterisation techniques: optical/electronic microscopy, spectroscopy
- Cleanroom and photolithography experience not essential but 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 : Autumn 2025
Duration : 36 months
Applications open: 1st February 2025
Please send applications to Prof. Kevin Heggarty kevin.heggarty@imt-atlantique.fr