



PhD position / Numerical simulation, Atoms physics, fibre-photonics, cold atoms and lasers

Organisation: University of LIMOGES

Research Field: Atom optics and photonics

Application deadline: before July 07, 2022

Offer starting date : 01/10/2022

Responsible to: Prof. Fetah Benabid

Location: Xlim Institute

123, avenue Albert Thomas, Limoges 87060, France

Type of contract : Temporary

Job status : Full-time

EU research framework : H2020 / FETOPEN

Job description:

The PhD project is part of the FETOPEN project CRYST³ funded by the European Research Council. This research program requires (i) micro-confining and laser cooling rubidium atom inside the core of a hollow core fiber, (ii) exploring cooperative effects and (iii) generation and characterization of superradiance. Also, the project comprises theoretical and simulations work, that will be undertaken by this PhD. The PhD program entails two objectives. The first one consists in studying the effects induced by the surface roughness of the core contour of hollow fibers on guided light scattering and on the evolution of the modal content during propagation. This modal dynamics will be essential in the study of the spectroscopic dynamics of micro-confined atoms in the fiber core. For this, 2D+1 simulation tools will be developed, for the first time for hollow core optical fibres, in order to take into account the impact of surface roughness on the dynamics of optical propagation. The simulation will include Bloch's equations solving to study the opto-mechanical dynamics of atoms in the fiber. The result would lead to a unique numerical platform to simulate

both the spatial modes of the atoms filled fiber, their propagative dynamics as well as the spectroscopic dynamic of the in-fiber atoms. The second objective will focus on the design of new fiber structures able to preferentially guide modes with specific spatial structures and able to modify their opto-mechanical impact on atoms, and therefore to carry out "intra-fiber" atom optics experiments such as trapping and cooling of atoms or the atom-surface interaction investigation. These will be the necessary milestones for the development of a cold atom PMC.

The PhD program will be undertaken in collaboration with the University of Modena in Italy. The PhD program may lead to a double-degree from Université de Limoges and University of Modena.

Working environment:

The PhD work will be undertaken at the Gas-Phase Photonic and Microwave Materials group (GPPMM) at Xlim CNRS research Institute, University of Limoges, France. The GPPMM is world-renowned research group for its mix of experimental and theoretical investigations into new hollow-core photonic crystal fibres (HC-PCF) and their applications in nonlinear and quantum optics applications. The group works in an inventive and highly interactive environment, with internal interactions being complemented by active international collaborations. Limoges is a pleasant and attractive city in the west-central France, close to Bordeaux and just 2½ hours by train from Paris.

Duties and Responsibilities:

1. To work with others in the Gas-Phase Photonic and Microwave Materials group to develop novel fiber modal propagation simulation tool including impact of surface roughness on the dynamics of optical propagation. With the goal to understand more deeply opto-mechanical and spectroscopic dynamics of micro-confined atoms in the fiber core.
2. To be in close relation with colleagues working on optical experiments involving cold atom, HCPCF and signal processing.
3. To prepare written reports for the project, to attend project meetings, and to interact with other parties involved in the project.
4. To prepare scientific papers for publication, both in international journals and at conferences. To attend conferences in order to present the results of research and to interact with the broader scientific community.
5. To work on related scientific projects as required
6. To report on a regular basis to the project investigator.

The prospective PhD student should have a background in one or more of the following: numerical simulation, modal solving, fibre photonics, nonlinear and quantum optics, atom optics.

Duration of appointment: 3 years. Salary: ~ 1500€/month.

For more information on the position and application please contact Prof Fetah Benabid (f.benabid@xlim.fr, in Cc benoit.debord@xlim.fr), send CV and motivation letter.

Skills/Qualifications:

- REQUIRED LANGUAGES : ENGLISH: Excellent, FRENCH : Desired

- QUALIFICATIONS : Master or equivalent level in physics, optics or photonics-related discipline

- EXPERIENCES/KNOWLEDGE :
 - Computing simulations
 - Experimental optics
 - Optical fibres
 - Laser metrology
 - Atom optics

- SKILLS :
 - Time management
 - Team work
 - Scientific writing

- ATTRIBUTES:
 - Team worker
 - Motivated
 - Hard worker
 - Initiative
 - Ability to communicate