# PHOTONICS - EUROPHOTONICS MASTER COURSE

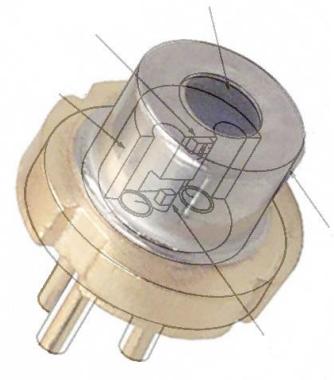
## PROPOSAL FOR A MASTER THESIS

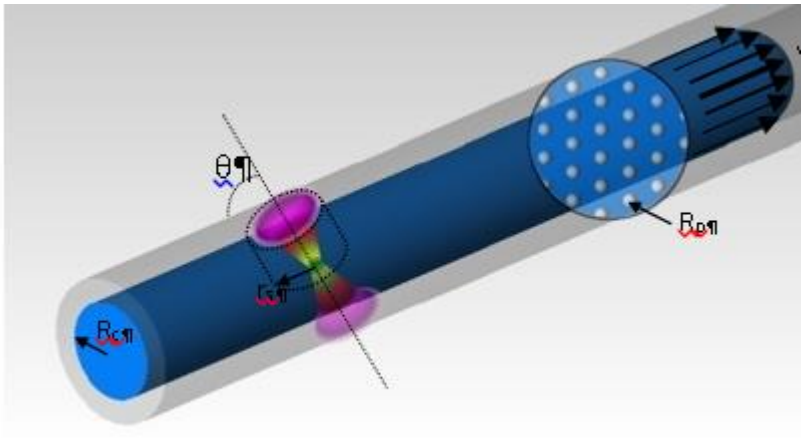
**Dates : April 1st, 2016 – September 31st, 2016**

**Laboratory : Centre for Sensors, Instrumentation and systems Development (UPC-CD6)**
**City, Country : Terrassa, Spain**

**Title of the master thesis :**

## Optical depth sectioning in self-mixing lasers for biomedical and industrial applications





**Name of the tutor of the master thesis : Santiago Royo/Miguel Ares**
Email address : santiago.royo@upc.edu
Phone number : 34 93 7398904
Mail address : Rambla Sant Nebridi 10 E08222 Terrassa

**Summary of the subject (maximum 1 page):**

Illumination in scattering media provides a general means to provide optical diagnosis in a noninvasive, painless and low cost approach, which has pushed forward the interest of the field both in biomedical and industrial applications. Several biophotonics techniques are based on the use of the therapeutic window of skin, where diffusion of light is dominant and the classical geometrical optics approach gets lost, with only radiometric methods being valid in practice. A comparable analysis is valid for industrial applications where the analysis of inclusions in scattering elements is involved.

These radiometric models, however, become limited as far as all the information obtained needs to be reconstructed carefully in order to "de-blur" the image to retrieve depth information. Depth information may tell us, for instance, the depth from which a particular change in properties is taking place, and scanning such depth sections may enable to determine local variations of the optical properties. However, different optical sectioning techniques have been described, and may be applied to solve this problem.

Besides, self-mixing lasers have shown its potential in such fields for detailed amplitude sensing and flow measurements with very compact and inexpensive setups. At CD6 we are currently working in optical sectioning techniques on self-mixing lasers with the purpose of building a prototype in order to prove optical sectioning capabilities oriented to medical device development. The student(s) working in this project will join the team involved in the development of the setup, in order to validate the preliminary proof of concept prototype already built, and to improve it to demonstrate optical sectioning capacities. Tests on optical phantoms (for testing of optical properties) and flow channels (for flow testing) will precede the testing of the final device on patients in medical settings, something which is expected to happen within the time frame of the proposed MSc Thesis.

**Keywords :** Microscopy, optical sectioning, metrology, medical devices, optomechanics, tissue optics, biomedical photonics.

**Additional information :**

* Amount of the monthly allowance (if it is the case):
To be discussed depending on the value of candidate.

* Required skills :
Interest in application-driven experimental work for solving real-world innovation needs.
Basic concepts in optical metrology and optical engineering
Programming (C++, MatLab) and scientific software packages (Sigmaplot,...)
Search of resources, both scientific and technical
Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

* Miscellaneous :
This thesis contents will be considered confidential due to its closeness to market.
International team with several years of experience in the technique proposed.
Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.
Possibility of joining the Centre for a PhD/Project Manager career in case of common interest.
Early incorporation welcome.