



Education and Culture DG

ERASMUS MUNDUS



## PHOTONICS - EUROPHOTONICS MASTER COURSE

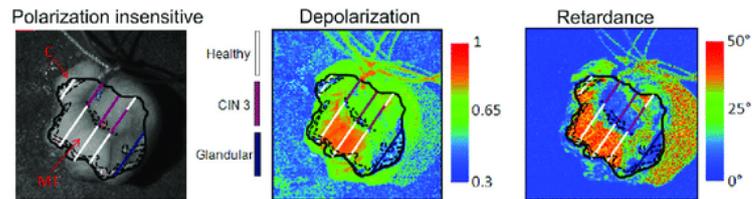
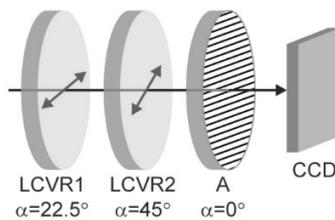
### PROPOSAL FOR A MASTER THESIS

Dates: February 1<sup>st</sup>, 2022 – September 31<sup>st</sup>, 2022

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

Title of the master thesis:

*Mueller polarimetry based on Liquid Crystals Variable Retarders*



Name of the tutor of the master thesis: Santiago Royo/Sara Peña

Email address: [santiago.royo@upc.edu](mailto:santiago.royo@upc.edu)

Phone number: 34 93 7398904

Mail address: Rambla Sant Nebridi 10 E08222 Terrassa

### Summary of the subject:

#### *Which is the problem?*

Matrix polarimetry has arisen in the past two decades as a powerful tool in material inspection. The ability of measuring the Mueller matrix of a sample provides the optical intrinsic characteristics such as depolarization, anisotropy, absorbance, using a basic set-up by applying the polarization concepts.

Detecting exoplanets around stars, improving the precision in medical imaging, increasing contrast when detecting far objects and when diffuse media is present are some of the multiple applications polarization provides to the different fields of astronomy, medicine, remote sensing, and surveillance. Taking into account this property of light allows moving a step forward in research.

This TFM proposal is linked to a cutting-edge line of research about polarization and its applications carried in the CD6. Several projects such as the design of a polarimetric camera and its use in improving detection through fog together with the theoretical and experimental validation of a polarized light propagation model are currently being under development.

The aim of this TFM is to design and construct a Mueller polarimeter based in liquid crystal variable retarders (LCVRs) for exploring the use of the polarization-related optical properties in solving real-world problems.

***Why are we interested?***

Developing new devices that detect polarization signals and allow retrieve the inherent optical information for a light beam will provide us the ability of broaden the perspectives of new products and open new doors to study potential applications such as vision enhancement in turbid media or improve imaging optimizing the polarization signal detection.

***What will you do?***

You will be in charge of developing and constructing a Mueller polarimeter from the basis. Together with the researchers in the polarization field, you will have to design the set-up using the LCVRs, look for the necessary components and get ready to taste the work of an experimental researcher.

Once the set-up is finished, you will have to make it work and think about applications to prove its performance. These tasks will provide you experience in working in real-laboratory conditions and apply the research in real-world applications. In addition, this project will make you more confident in dealing with projects from zero up to the final stage.

***Is this TFM for you?***

This is an experimental Thesis. If you are willing to work with state-of-the-art tech-challenges and seeing your progress applied in a real-world application whilst working with a good and enriching environment, this TFM is for you.

**Keywords:** Mueller polarimetry, polarization imaging, LCVR calibration, Image processing

**Additional information:**

**\* Recommended skills:**

Interest in application-driven experimental work for solving real-world problems.

Basic concepts in image processing

Programming (MatLab appreciated)

Search of resources, both scientific and technical.

Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

**\* Miscellaneous :**

Team with several years of experience in the topic proposed.

Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.