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## **Master in Photonics – “PHOTONICS BCN” Master ERASMUS+ “EuroPhotonics”**

### **MASTER THESIS PROPOSAL**

**Dates: April 2021 - September 2022**

**Laboratory: Polarimetry Lab, Feman Group**  
**Institution: Universitat de Barcelona**  
**City, Country: Barcelona, Spain**

**Title of the master thesis: Upgrade of a Mueller matrix microscope with new fast and compact piezoelectric rotators**

**Name of the master thesis supervisor and co-supervisor: Oriol Arteaga**

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**Keywords: polarimetry, imaging, polarization, microscopy**

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

Mueller matrix polarimetric imaging measures Mueller matrices over a field of view and thus allows for visualizing the polarization characteristics of the objects. The Mueller matrix represents the transfer function of an optical system in its interactions with polarized light, and it contains all of the necessary information about the linear optical properties of the medium. Mueller matrix microscopy (MMM) is a powerful approach to probe microstructural and optical information of biological samples (e.g., tissue and bacteria) and samples of interest in material science (e.g. nanostructured samples, nanotubes, liquid crystals) which otherwise cannot be obtained directly from intensity or spectral images. Achieving high lateral resolution in MMM, similar to other microscopy approaches, while having a fast and accurate measurement of the complete Mueller matrix remains a challenge.

This work will upgrade a polarimetric microscope available in lab [O. Arteaga, M. Baldrís, J. Antó, A. Canillas, E. Pascual, and E. Bertran, “Mueller matrix microscope with a dual continuous rotating compensator setup and digital demodulation,” Appl. Opt. 53, 2236-2245 (2014)] with a new piezoelectric rotators that will adjust the position of the compensators. The data acquisition will be switched from continuous rotation to discrete rotation, allowing for a faster and more optimal data acquisition process. The goal of this work is to install the new

rotators, to program new routines that enable this data analysis and to perform MMM measurements that illustrate the new capabilities of the system.

**Additional information:**

\* Required skills: Interest in polarization optics and experimental lab work is recommended. Some Labview and Python programming knowledge is recommended

\* Future prospects: For interested students, we offer the possibility to continue the research initiated during the Master Thesis work into a PhD thesis at our lab in University of Barcelona, exploring further this field of research (or something related). Funding opportunities will be explored for these students.