

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

MASTER THESIS PROPOSAL

Dates: April 2020 - September 2021

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

Title of the master thesis: A new data analysis method for a Mueller matrix polarimeter based on photoelastic modulators.

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Keywords: polarimetry, imaging, polarization, microscopy

Summary of the subject (maximum 1 page):

Photoelastic modulators (PEMs) are the key optical elements in many polarization measurement techniques. The distinctive advantage of instruments based on PEMs with respect to other sources of polarization modulation is the high-sensitivity measurement of polarization properties. As a consequence of its design, a PEM has unique optical features, such as high modulation purity and efficiency, broad spectral range, high-power handling capability, large acceptance angle, large useful aperture, and high retardation stability. 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 studied medium. Many optical such as ellipsometry, circular dichroism, Faraday rotation, or the magneto-optic Kerr effect are based on the partial or complete determination of the Mueller matrix.

This work proposes the implementation of a new data analysis method in a Mueller matrix polarimeter based on four different photoelastic modulators [O. Arteaga, J. Freudenthal, B. Wang, and B. Kahr, “Mueller matrix polarimetry with four photoelastic modulators: theory and calibration,” *Appl. Opt.* 51, 6805-6817 (2012)]. The new method has been theoretically described in A. S. Alenin, F. Bashar, M. E. Gehm, and J. S. Tyo, “Multi-carrier channeled polarimetry for photoelastic modulator systems,” *Opt. Lett.* 43, 5789-5792 (2018), but never



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implemented in a real system. The goal of this work is to adapt this method of measuring to our spectroscopic Mueller matrix polarimeter and to program new routines that enable this data analysis. A comparison between the “new” and “old” methods will be made.

Additional information:

* Required skills: Interest in polarization optics and data analysis is recommended. Some Labview programming fluency is necessary.