



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

MASTER THESIS PROPOSAL

Full time from April 2026 (it can start part time from February 2026)
Presentation date to be chosen: end of July or beginning of September 2026

Note: The main Master Thesis supervisor has to be a professor of the Master in Photonics program. One co-supervisor (internal or external) can be defined. Main Supervisor is responsible for the subject of the proposal and has to give continuous support to the student (research development, Report writing and presentation preparation). For external proposals a co-supervisor from the Master program and a collaboration agreement with UPC are needed. You can find all information about the Master Thesis process in [our webpage](#).

Laboratory: PLAT (Polarized Light Applications and Technologies)

Institution: Universitat de Barcelona

City, Country: Barcelona, Spain

Title of the master thesis: Wide-field polarimetric analysis of brain tissue

Name and affiliation of the master thesis supervisor: Oriol Arteaga, Universitat de Barcelona

Name and affiliation of the co-supervisor (if any):

(for external proposals a co-supervisor chose among the Master Program professors and a collaboration agreement with UPC is needed)

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Keywords: polarimetry, brain, polarized light, biological tissue

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

The structural organization of brain tissue plays a fundamental role in its physiological and functional behaviour. Optical techniques based on polarized light have demonstrated a strong potential for characterizing microstructural properties of biological tissues due to their sensitivity to anisotropy, birefringence and scattering phenomena. Wide-field polarimetric imaging, in particular, offers the possibility of obtaining spatially resolved information over large areas, enabling high-resolution mapping of microstructural variations without requiring point-by-point scanning.

The PLAT (Polarized Light Applications and Technologies) laboratory at the Universitat de Barcelona has extensive expertise in polarimetric instrumentation and Mueller matrix analysis for



material and biological tissue characterization. This master thesis will explore the application of wide-field polarimetric methods to the study of brain tissue, focusing on how polarization-derived parameters correlate with microstructural features. The study will involve ex-vivo animal brain samples and computational reconstruction tools for interpreting polarimetric signatures.

The project combines experimental work, optical setup operation, data processing, and interpretation based on physical models. The goal is to advance the understanding of how wide-field polarimetry can be used as a non-invasive, label-free imaging modality for neuroscientific and biomedical applications.

2. Objectives (maximum 1 page):

- **Implement and optimize a wide-field polarimetric imaging setup** suitable for the study of biological tissues, ensuring stability, calibration accuracy and reproducibility.
- **Acquire polarimetric data from brain tissue samples** and other relevant phantoms, using Mueller matrix or polarization state-based measurements.
- **Extract polarimetric parameters** (e.g., birefringence, depolarization, diattenuation) and analyze their spatial distribution across the samples.
- **Correlate the optical parameters with microstructural features** of brain tissue, evaluating their potential as imaging biomarkers.
- **Prepare the final thesis report and presentation**, summarising experimental results, methodology, analysis and future research directions.

Additional information (if needed):

* Required skills:

- Familiarity with polarized light, polarimetry and imaging systems
- Programming skills (Lview, MATLAB, Python or similar)
- Interest in biomedical applications of optical technologies

* Miscellaneous:

The project will be developed within the PLAT group at the Universitat de Barcelona, offering access to advanced optical instrumentation and interdisciplinary collaboration opportunities.