



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

### **MASTER THESIS PROPOSAL**

**Starting full time from April 2024**

**Presentation at the end of July or beginning of September 2024**

**Laboratory: Polarized Light Applications and Technologies**

**Institution: Universitat de Barcelona**

**City, Country: Barcelona, Spain**

**Title of the master thesis: Spatial dispersion in crystal: an experimental study**

**Name of the master thesis supervisor and co-supervisor: Supervisor Oriol Arteaga (co-supervisor: Subiao Bian)**

(for external proposals a co-supervisor from the Master program and a collaboration agreement is needed)

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**Keywords: spatial dispersion, polarization, polarimetry, dielectric function**

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

Spatial dispersion (SD) refers to the dependence of a material's dielectric properties on the wavevector at a fixed frequency. In essence, this means that the electromagnetic response of a medium depends not only on the wavelength but also on the direction in which the wave propagates in the medium, even in materials that, by crystal symmetry, are expected to have an isotropic optical response. SD has typically been considered in metamaterials when the wavelength of incoming electromagnetic waves becomes comparable to the size of the material's structural elements, resulting in significant SD effects. In standard materials, SD effects are much weaker because their constituent particles are much smaller than the wavelength of light. However, recent polarimetric measurements have demonstrated measurable SD effects in single crystals that have received very little consideration until now.

**Objectives:**

This primarily experimental work will involve conducting polarization-resolved measurements on single crystal wafers. The objective is to discern SD parameters that impact the material's dielectric properties while differentiating them from other factors, such as stress. We have suitable polarimeters available for these measurements and have also established a new theoretical framework for simulations, enabling a thorough investigation into the material's electromagnetic response.



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**Additional information (if needed):**

\* Required skills: Interest in aspects related to polarization of light. Good programming and experimental skills in optics are desirable.

\* Miscellaneous: After completing the Master Thesis, there is the possibility of developing a PhD thesis in the field of polarized light / polarimetry. Funding opportunities are possible depending on the interest and commitment of the candidate.