



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**

**Laboratory: Dynamic Optical System Lab
Institution: Universitat de Barcelona
City, Country: Barcelona, Spain**

Title of the master thesis: Laser fabrication of diffractive optical elements

Name and affiliation of the master thesis supervisor: Martí Duocastella Solà, Universitat de Barcelona

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Keywords: laser materials processing, additive manufacturing, diffractive optics

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

Diffractive optical elements (DOEs) enable light splitting, focusing, and beam shaping with an extremely small thickness – on the order of only a few wavelengths of light – making them highly attractive for integration into miniaturized devices such as portable cameras and photodetectors. However, conventional fabrication methods rely on photolithographic processes that are inherently multistep and typically restricted to flat, rigid substrates. As a result, there is a growing need for fabrication approaches that allow the on-demand production of tailored DOEs on curved and flexible substrates, offering improved integration and tunable optical functionality.

In this master’s thesis, we propose to investigate the direct-write laser fabrication of DOEs on stretchable materials. Specifically, we will explore both additive and subtractive laser manufacturing techniques to fabricate DOEs whose optical properties can be dynamically tuned through mechanical deformation of the substrate, applied either before or after fabrication.



2. Objectives (maximum 1 page):

The main objective of the thesis is to study the direct-laser fabrication of DOEs on stretchable substrates. To this end, we have organized the work plan into four different tasks, which will occur sequentially through a 4-month period, as detailed next.

- 1- Perform a systematic study of the main laser parameters – including laser pulse energy, donor-receiver separation, donor thickness – for fabricating simple geometries on a stretchable substrate using both additive and subtractive laser processes. Based on these results, the optimal laser fabrication strategy will be selected.
- 2- Analyze the effects of mechanically stretching the substrate on the fabricated patterns, both before and after fabrication.
- 3- Design a DOE and simulate the expected performance taking into account the constraints imposed by the fabrication process.
- 4- Fabricate the DOE from task 3 and characterize its morphological and optical properties.
- 5- Write the thesis.

Additional information (if needed):

* Required skills: the candidate is expected to show an interest in multidisciplinary subjects, and basic programming in Python and MATLAB.