# Master in Photonics – "PHOTONICS BCN"
# Master ERASMUS Mundus "EuroPhotonics"

## MASTER THESIS PROPOSAL

**Dates: April 2023 – July or September 2023**

**Laboratory: CD6**
**Institution: UPC**
**City, Country: Terrassa, Catalunya**

**Title of the master thesis:**
**Design, development and validation of a novel Static Fourier Transform Spectrometer based on the Extra Large Telescope M1 Local Coherencer**

**Name of the master thesis supervisor and co-supervisor:**
(for external proposals a co-supervisor from the Master program and a collaboration agreement is needed)
Email address:
Phone number:
Mail address:

**Keywords: Interferometry, spectrometry, optical design, modelization, Fourier.**

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

Our research group is involved in a project to develop the Extra Large Telescope (ELT) M1 Local Coherencer (LoCo), where we designed a validated a novel interferometer [1]. The ELT M1 LoCo is a non-contact metrology system aimed to simultaneously measure the relative pistons on the six sides of a target M1 segment with respect to neighboring ones (reference segments) with an accuracy below 300nm in a range of ±250µm.
According to the Wiener–Khinchin theorem, this novel interferometer can also be used as a spectrometer (figure 1). However, it has never been done before.

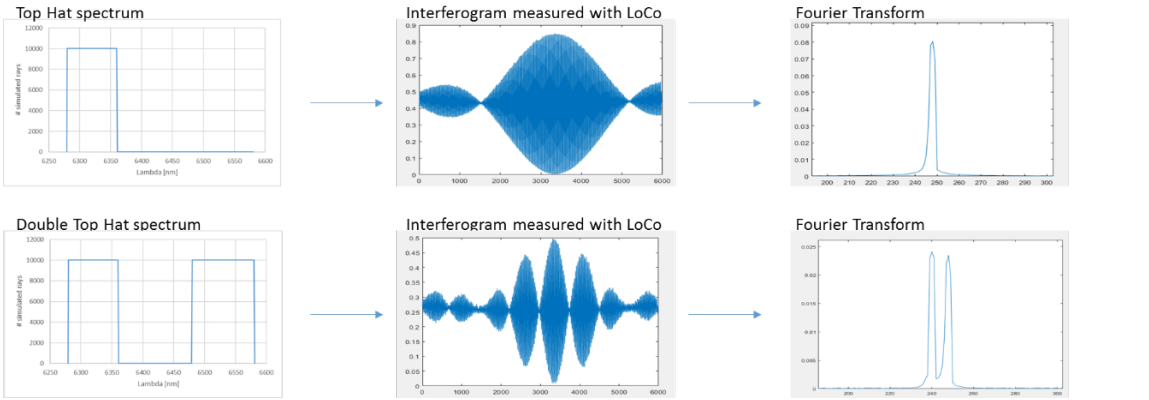


Figure 1. Simulation as an example of the interferogram obtained by two different spectral sources and how the spectral information can be found by computing the Fourier Transform of the interference signal.

In this Master Thesis you will become an expert about cutting-edge spectrometers.
You will design the optical layout to adapt the current Local Coherencer system in order to optimize the functionalities to measure the spectral curves of light sources.
You will mount and align the designed prototype in an optical laboratory environment.
You will develop a mathematical model based on the theory and the optical simulation to get the spectral curve from the interferogram pattern, as well as a software to automatically calculate it from raw detector data.
Finally, you will validate its performance by measuring light sources and compare the spectral curve acquired by the novel spectrometer developed during this master thesis with a spectral curve measured by a commercial spectrometer.

[1] Gaizka Murga, et al, "The Extremely Large Telescope (ELT) M1 Local Coherencer to phase mirror segments," Proc. SPIE 12182, Ground-based and Airborne Telescopes IX, 1218206 (26 August 2022); https://doi.org/10.1117/12.2628943

**Objectives:**

- **To review the spectrometry state-of-the-art, especially those based in interferometry.**
- **To design the optical layout of the prototype.**
- **To develop a mathematical model to retrieve the spectral curve from the interferogram pattern.**
- **To build and align the prototype on a laboratory environment.**
- **To validate the performance of the novel spectrograph.**

**Additional information (if needed):**

* Required skills:
    - Basic knowledge on Zemax and Matlab
* Miscellaneous:
    - Analytical skills.
    - Organization and proactivity.
    - Communication skills.
    - Motivated.