



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: Optoelectronics Group

Institution: ICFO – The Institute of Photonic Sciences

City, Country: Castelldefels, Spain

Title of the master thesis: Development and characterization of fiber devices to quantum networks

Name and affiliation of the master thesis supervisor: Prof. Dr. Valerio Pruneri, ICFO

Name and affiliation of the co-supervisor (if any): Dra. Evelyn A. Ortega, Dr. Jorge Fuenzalida, ICFO

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

Email address: evelyn.ortega@icfo.eu, Jorge.fuenzalida@icfo.eu

Phone number:

Mail address:

Keywords: optical fibers, photonic lanterns, quantum networks

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

Research on optical fibers has grown rapidly over the last few decades, leading to the development of devices with various applications, including sensors, laser systems, and optical telecommunications. Among these emerging technologies is the photonic lantern, which enables an adiabatic transition between a multimode input and multiple single-mode outputs (or vice versa). This unique capability allows light from a multimode environment to be efficiently distributed into single-mode channels, maintaining coherence and minimizing losses.

The development of fiber communication schemes with new types of fibers enables an increase in fiber capacity and open access for multiuser quantum networks. Photonic lantern devices can be



beneficial for node combinations of multiple fibers in quantum communication networks. The primary objective of this Master's project is to design, fabricate, and characterize a photonic lantern employing optical fiber tapering and fusion techniques. Later, the device has to be used in a multiuser quantum network to distribute entangled photon pairs.

The successful completion of this project will contribute to the local development of advanced fiber devices and provide a foundation for future research in spatial-division multiplexing, fiber lasers, and integrated photonic sensors.

2. Objectives (maximum 1 page):

The project will be divided in two main sections. The first one consists in the fabrication and characterization of the photonic lantern device. The objectives of this section are:

- Understanding the theoretical basis of mode coupling and adiabatic transitions in photonic lantern
- Fabricating the photonic lantern using a fiber fusion splicer and tapering setup.
- Experimentally characterizing insertion loss and mode conversion efficiency.

Upon successful completion of the previous objectives, the student will characterize the device with the entanglement photon source. The objectives of this section are:

- Align and characterize polarization-entangled photons distribution over multiple user by space division multiplexing employed a photonic lantern.
- Analysing the quality of the distributed entanglement in a multiuser quantum network.

Additional information (if needed):

* Required skills:

- Motivation to work and passion for quantum physics.
- Medium programming experience in more than one language, Python, Matlab and/or Labview.
- Basic knowledge in classical optics and optical fibers

* Miscellaneous: