Master in PHOTONICS
”Photonics BCN”
(http://www.photonics.masters.upc.edu)

Master Erasmus Mundus EUROPHOTONICS
(http://www.europhotonics.org/)

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15 years ago, researchers covering different fields of Photonics in Barcelona area (UPC, UAB, and UB) and in the Institute of Photonic Science (ICFO), decided to put together their complementary expertise to offer a joint Master in Photonics.

**Initiative and close collaboration between the four partner institutions:** a larger number of photonic areas are covered

- The program started in 2007 – we are running the 13th edition

- Official 60 ECTS (1 year) Spanish Degree.

- All courses are taught in English.
Optics & Photonics

- A traditional area of science and technology evolving very fast.

- One of the most relevant branches of Science & Technology for the XXI-th Century
  - Classical optics: geometrical, electromagnetic, …
  - Imaging and vision
  - Photoemitters and detectors
  - Sensors, remote sensing
  - Optoelectronics, optomechanics
  - Integrated photonics
  - Optical communications
  - High powers lasers: ultrashort and ultraintense
  - Materials processing: cutting, welding, marking, 3D printing, …
  - New materials and devices: nanophotonics, plasmonics, photonic crystals, metamaterials, …
  - Energy, environment: lighting, solar panels, green photonics, blue photonics, controlled nuclear fusion, …
  - Nonlinear optics
  - Quantum optics and technology, quantum information, atom optics,
  - Biophotonics & medicine
  - Optogenetics
  - …

- Highly multidisciplinary
  - Optics
  - Engineering
  - Material science
  - Material processing
  - Micro and Nanotechnology
  - Telecommunications
  - Biology
  - Medicine
  - Art and heritage

- Recent Nobel awards related with Photonics (Physics and Chemistry):
  - 2014: Blue LEDs
  - 2009: Optical fibers and CCD sensors
  - 2005: Quantum theory of optical coherence
  - 2001: Bose-Einstein condensates
  - 2000: Heterostructures for optoelectronics
  - 1997: Atom trapping and cooling
  - 2014: Optical Nanoscopy
  - 2008: GFP discovery
Expertise spread over the four institutions

- **Quantum & Nonlinear Optics, Quantum information**
  - Optical trapping, optical tweezers
  - Applied optics: image processing, diffractive optics
  - Optoelectronic devices, CMOS

- **Optical engineering**: sensors, remote sensing, metrology, optical design, adaptive optics, vision & machine vision, confocal microscopy
  - Image processing
  - Liquid crystal
  - Nonlinear optics, nonlinear dynamics
  - Nanomaterials & metamaterials
  - Opt. fiber commun.& networks

- **Quantum & Atom optics**
  - Nanophotonics & metamaterials
  - Opt. fiber commun. & networks

- **High resolution microscopy**
  - Nonlinear optics & devices, Ultrafast light
  - Biophotonics

- **Quantum & Nonlinear Optics, Quantum information**
  - Image processing, diffractive optics, metrology.
## Compulsory courses

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## Elective Courses

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**Total:** 60 ECTS
### Quantum Optics and Technology 18 ECTS

- Quantum optics
- From cooling & trapping of neutral atoms to BE condensates
- Quantum simulators with ultracold quantum gases
- Light and atom interaction
- Advanced quantum optics with applications
- Machine learning on classical and quantum data

### Materials, Nanophotonics & Photonics Circuits 18 ECTS

- Photonic materials and metamaterials
- Nonlinear optics
- Nanophotonics
- Ultrafast and ultraintense laser light
- Optoelectronics and photovoltaic technology
- Integrated photonics

### Optical Engineering 15 ECTS

- Laser systems and applications
- Optical design
- Managing light with devices
- Measuring with light (optical metrology)
- Fibers and telecommunications
**Biophotonics and Imaging**  
12 ECTS

- Experimental optical techniques in biology 3
- Active and spectral imaging 3
- Visual optics and biophotonics 3
- Image processing in biophotonics 3

**Additive key competencies**  
5 ECTS

**Business and Patents in Photonics**  
5

- provide fundamental entrepreneurial skills required to successfully start and develop a technology based business,
- learn how to develop a project in a large company environment.
- incite business awareness and to explore the hard and fascinating way leading from cutting-edge research to the marketplace.
Many opportunities to start your scientific research (fundamental or applied), in different areas of Photonics in a research lab or in a company.

More than 50 project proposals every year (see list of proposals for 2020_2021 at: https://photonics.masters.upc.edu/en/list-of-proposals-2020-21).

Possibility to carry out your Master Thesis in an external research center, university or company;

Members of SECPhO: contact with companies (https://www.secpho.org)
Masters in Photonics “PHOTONICS BCN” & Master Erasmus+ “EUROPHOTONONICS”

Erasmus Mobility Scheme

European Erasmus+ Program
(2 years): multiple degree