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

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

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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
Optics & Photonics

• **2007**: Nature journals about Photonics are created
  - “Nature Photonics” journal
  - “Light: Science & Applications”, open access.

• **2010**: EU selects Photonics as one of the five KET (“Key-Enabling Technologies”)

• **2013**: USA: National Photonics Initiative – “Optics and Photonics. Essential technologies for our nation” (2012)

• **2015**: China: “Laser World of Photonics” trade fair, held in China for the 1st time. International Year of Light, and of technol. based on light

• **2015**: International Year of Light, and of technologies based on light

• **2016 & 2017**: Gravitational waves detection
  Europe: Extream Light Infrastructure (ELI) project goes on.
  Second Gravitational waves detection (LIGO & VIRGO)

• **2020**: EU renew the KET list keeping Photonics as one of them.

XXI century: - 9 Nobel Prize in Physics
- 2 Nobel Prize in Chemistry

related to PHOTONICS
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.

MSc Photonics – “PHOTONICS BCN”
Quantum & Nonlinear Optics, Quantum information.

Image processing, diffractive optics, metrology.

Synchrotron light, X-ray optics.

Thin films, multilayers.

Quantum information

Optical trapping, optical tweezers

Applied optics: image processing, diffractive optics

Optoelectronic devices, CMOS

Quantum & Atom optics

Nanophotonics & metamaterials

High resolution microscopy

Nonlinear optics & devices, Ultrafast light

Biophotonics

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

Optical fiber commun. & networks

EUROPHOTONICS @ BCN
PROFESSORS: more that 60

Universitat Politècnica de Catalunya (23 professors)
- Department of Optics & Optometry
- Department of Physics
- Department of Signal Theory and Communications:
- Department of Electronics Engineering:

Universitat Autònoma de Barcelona (10 professors)
- Department of Physics, Optics Group
- Department of Physics, Quantum Information Group

Universitat de Barcelona (12 professors)
- Department of Applied Physics and Optics
- Department of Electronics
- Department of Matter Structure & Constituents

Institut de Ciencies Fotòniques (ICFO) (17 group leaders)
Masters in Photonics “PHOTONICS BCN” & Master Erasmus+ “EUROPHOTONICS”

since 2010

European Erasmus+ Program (2 years): multiple degree
Masters in Photonics – “Photonics BCN”

OBJECTIVES

- Provide knowledge and training in different areas of Photonics, considering both fundamental and applied aspects.
- Flexibility: the student can choose from many elective courses, to get either general training, or more specialized training in different possible areas.
- Develop competences and skills that will help the student to initiate a research or a professional carrier.
- Prepare you for: a PhD thesis or to work in a company. It fosters entrepreneurial skills to conduct own initiatives.

ADDRESSED TO

- Bachelor in Physics, Physical Engineering
- Bachelor in Telecommunication and Electric and Electronics Engineers
- Bachelor in Optics and Optometry
- Bachelors in Engineering in general: Nanoscience & Nanoengineering, Industrial, Material Sciences,…
- Other degrees
### Compulsory courses 20 ECTS

- **Fundamentals of Photonics** 10 ECTS
  - Introduction to photonics. Optics and Lasers 5 ECTS
  - Beam Propagation and Fourier Optics 5 ECTS

### Applied Photonics & Transversal Skills 10 ECTS

- Photonics Laboratory 5 ECTS
- Business and Patents in Photonics 5 ECTS

### Elective Courses 24 ECTS

- Quantum Optics (QUANTOP) 18 ECTS
- Biophotonics and Imaging (BIOIMA) 12 ECTS
- Materials and Nanophotonics (MATNANO) 12 ECTS
- Telecomm. & Photonics Circuits (TELPHO) 12 ECTS
- Optical Engineering (OPTENG) 12 ECTS

### Master Thesis 16 ECTS

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

<table>
<thead>
<tr>
<th>Course</th>
<th>ECTS</th>
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<tbody>
<tr>
<td>Quantum optics</td>
<td>3</td>
</tr>
<tr>
<td>From cooling &amp; trapping of neutral atoms to BE condensates</td>
<td>3</td>
</tr>
<tr>
<td>Quantum simulators with ultracold quantum gases</td>
<td>3</td>
</tr>
<tr>
<td>Light and atom interaction</td>
<td>3</td>
</tr>
<tr>
<td>Advanced quantum optics with applications</td>
<td>3</td>
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<tr>
<td>Machine learning on classical and quantum data</td>
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</table>

## Materials, Nanophotonics & Photonics Circuits 18 ECTS

<table>
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<tr>
<td>Photonic materials and metamaterials</td>
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<tr>
<td>Nonlinear optics</td>
<td>3</td>
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<tr>
<td>Nanophotonics</td>
<td>3</td>
</tr>
<tr>
<td>Ultrafast and ultraintense laser light</td>
<td>3</td>
</tr>
<tr>
<td>Optoelectronics and photovoltaic technology</td>
<td>3</td>
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<tr>
<td>Integrated photonics</td>
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## Optical Engineering 15 ECTS

<table>
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<tr>
<td>Laser systems and applications</td>
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<tr>
<td>Optical design</td>
<td>3</td>
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<tr>
<td>Managing light with devices</td>
<td>3</td>
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<tr>
<td>Measuring with light (optical metrology)</td>
<td>3</td>
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<tr>
<td>Fibers and telecommunications</td>
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</table>
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 undergrowth your Master Thesis in an external research center, university or company;

Members of SECPhO: contact with companies (https://www.secpho.org)
All the information about:

- Timetable
- Course program
- Course content
- Master Thesis

can be found at:
- https://photonics.masters.upc.edu/en/academic-year-2020-21
<table>
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<td><strong>4</strong></td>
<td><strong>5</strong></td>
<td><strong>39</strong></td>
</tr>
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</table>

**BSc degree:**
- 14 Physics
- 2 Engineering physics
- 1 Nanoscience and nanotechnology
- 3 Optics & Optometry
- 3 Mechanical Engineering
- 1 Industrial Eng.
- 2 Material Eng.
Careers in Photonics

Very broad, given the interdisciplinary character and increasing relevance of photonics:

- PhD in Photonics, Optics, Physics, Optical Engineering, Nanophotonics, Biophotonics, Telecommunications, Electronics, Imaging, Quantum Information, etc.
  - Joining education and high-level training in the field of photonics
  - R&D and innovation programs in companies, basic or applied research centers or Universities.

- Consultant / engineer on photonics-related issues;
- High-level qualification technical positions for laboratory / technological / medical services as microscopy, x-ray diffraction, thin films, etc.
- Joining (and promoting) spin-off or other technology-based small companies.
Careers in Photonics

When did you finish the MSc in Photonics/Europhotonics?

- 2015: 13
- 2016: 8
- 2017: 7
- 2018: 5

How long did it take you to find a position after graduation?

- Less than 3 months: 34
- Less than 6 months: 3
- Less than 1 year: 2
- More than 1 year: 1
Careers in Photonics

Which was your first position after graduation?
42 responses

- PhD student/researcher: 64.3%
- Photonics Company: 21.4%
- Other Companies: 11.9%
- Others: 7.1%

In which country?
42 responses

- Spain (27): 64.3%
- Germany (3): 11.9%
- UK (5): 7.1%
Careers in Photonics

If your first position was "PhD student/researcher", which was your main Research Field?
31 responses

- Biophotonics and Imaging: 32.3%
- Materials and Nanophotonics: 16.1%
- Optical Engineering: 25.8%
- Quantum Optics: 19.4%
- Telecommunications and Photonics Circuits

Is your current professional career related to photonics?
42 responses

- Yes: 90.5%
- No: 9.5%

If your first position was "Photonics Company", which was your Photonics Sector?
9 responses

- Lasers and optoelectronics: 55.6%
- Optics: 11.1%
- Manufacturing technology for optics: 11.1%
- Sensors, test and measurement equipment: 11.1%
- Imaging: 11.1%
- Lasers and laser systems for production: 11.1%
- Optical information and communication systems: 11.1%
- Biophotonics and medical engineering: 11.1%
Master in Photonics ranked with the maximum evaluation “EXELENCE” in the last evaluation.
Pre-enrolmenet information

**Deadlines Fall Semester 2020-2021 (to begin classes in February 2021)**

for the following 4 masters:

1. **MEE** - Master’s degree in Electronic Engineering
2. **MET** - Master’s degree in Telecommunications Engineering
3. **MATT** - Master’s degree in Advanced Telecommunication Technologies
4. **MENGFIS** – Master’s degree in Physics Engineering

- Pre-enrolment from October 29, 2020 to December 11, 2020
- Admitted students resolution to be published January 22, 2021
- Classes begin: February

MASTERS. Pre-enrolment.
Pre-enrolment information

Deadlines Fall Semester 2021-2022 (to begin classes in September 2021):

for the following 2 masters:

1. MPHOTON- Master's degree in Photonics
2. MCYBERS-Master's degree in Cybersecurity

✓ Pre-enrolment from January 7, 2021 to July 5, 2021
✓ Admitted students resolution to be published July 2021
✓ Classes begin: September 2021

for the following 4 masters:

1. MEE - Master's degree in Electronic Engineering
2. MET - Master's degree in Telecommunications Engineering
3. MATT - Master's degree in Advanced Telecommunication Technologies
4. MENGFIS - Master's degree in Physics Engineering

✓ Pre-enrolment from March 13, 2021 to July 5, 2021
✓ Admitted student's resolution to be published by the end of July 2021
### ETSETB-Àrea de Gestió Acadèmica

<table>
<thead>
<tr>
<th>UPC</th>
<th>any other PUBLIC UNIVERSITY in Spain</th>
<th>FOREIGN UNIVERSITIES</th>
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</tbody>
</table>

**Academic’s procedures LINKS of interest:**

- MASTERS. Pre-enrolment.
- MASTERS. Enrolment New students
- Academic management Calendar

**Document or link to the course description of the subjects in the transcript of records**

**Official certificate of the EQUIVALENCES to the rating system of Spanish universities**
Pre-enrolmenet information

ETSETB-Àrea de Gestió Acadèmica

Please contact us:
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secretaria.etsetb@upc.edu
93 405 4174 / 93 401 6772
93 401 5966 / 93 401 6750

Building B3 - Ricardo Valle
Campus Nord Jordi Girona, 1-3, 08034 Barcelona

Important:
Following the COVID-19 protocols prior appointment is required to FACE-TO-FACE attention:

- Please Check availability at this link:

PRIOR APPOINTMENT