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

Master Erasmus+ EUROPHOTONICS-POESII
(http://www.europhotonics.org/)

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Optics & Photonics – what does this field cover?
A traditional area of science and technology evolving very fast, that has become one of the most relevant branches of Science & Technology of the XXIth Century.

• Classical optics
• Imaging and vision
• Optical sensors and light sources
• Optoelectronics, optomechanics \(\rightarrow\) Integrated photonics
• Optical communications

HIGHLY MULTIDISCIPLINARY
• Optics
• Engineering
• Material science
• Chemistry
• Micro and Nanotechnology
• Telecommunications
• Biology
• Medicine
• Art and heritage

• High power lasers
• Materials processing
• New materials and devices: nanophotonics, plasmonics, photonic crystals, metamaterials,…
• Energy, environment: lighting, solar panels,…
• Quantum optics and technology, quantum information,
• Biophotonics & medicine
• Optogenetics
• ………..
 Photonics finds nowadays applications in a very broad scientific and technological fields:

 Photonics is the revolution of the 21st century and together with electronics, chemistry and material science makes possible most of the technological applications sustaining our day by day life.
Optics & Photonics

- **2010**: EU selects Photonics as one of the five KET (“Key-Enabling Technologies”)
- **2020**: EU renew the KET list keeping Photonics as one of them.
- **2015**: China: “Laser World of Photonics” trade fair, held in China for the 1st time.
- **2015**: International Year of Light, and of technologies based on light
- ........................

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

related to PHOTONICS
Functions that can be accomplished with photons
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 16th edition

Official *60 ECTS (1 year)* Spanish Degree.

More than 50 professors & researchers

All courses are taught in English.

Tax/year: €2,766 (€4,149 for non-EU residents).
PROFESSORS: more than 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 and Biomedical Engineering
  Department of Quantum Physics and Astrophysics

Institut de Ciencies Fotòniques (ICFO) (17 group leaders)
**Optical engineering:** sensors, vision, metrology, opt. design, adaptive optics, color science
- Image processing, liquid crystal, machine vision
- Nonlinear optics and dynamics
- Nanomaterials, Remote sensing
- Optical Fiber Communications & networks
- Integrated photonics

**Applied optics:** image proc., diffractive optics
- Thin films
- Optical tweezers
- Optoelectronics devices, CMOS
- Quantum information

**Quantum & Nonlinear Optics, Quantum information**
- Image processing, diffractive optics, metrology.
- Synchrotron light, X-ray optics
- Thin films, multilayers.

**Nanophotonics**
- Advanced optical imaging
- Quantum & atom optics
- Nonlinear optics & devices, ultrafast light
- Biophotonics, optical tweezers
- Photonic materials
Masters in Photonics “PHOTONICS BCN” & Master Erasmus+ “EUROPHOTONICS”

Master in Photonics “Photonics BCN”

Erasmus Mobility Scheme

Erasmus Mundus EuroPhotonics
(2 years): multiple degree
### Multidisciplinarity

#### ADDRESSED TO:

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Master in Photonics</th>
<th>Europhotonics</th>
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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.
### 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)** (21 ECTS)
- **Biophotonics and Imaging (BIOIMA)** (15 ECTS)
- **Materials and Nanophotonics (MATNANO)** (21 ECTS)
- **Optical Engineering (OPTENG)** (15 ECTS)
- **Telecomm. & Photonics Circuits (TELPHO)** (9 ECTS)
- **Master Thesis** (16 ECTS)

**Total: 60 ECTS**
### Quantum Optics 21 ECTS

<table>
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<tr>
<th>Course</th>
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<tr>
<td>Quantum optics</td>
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<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>
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<tr>
<td>Quantum light-matter interfaces: modern systems and applications</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>
<td>3</td>
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<tr>
<td>Qubit applications</td>
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### Materials and Nanophotonics 21 ECTS

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<th>Course</th>
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<tr>
<td>Photonic materials and metamaterials</td>
<td>3</td>
</tr>
<tr>
<td>Nonlinear optics</td>
<td>3</td>
</tr>
<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>
<td>3</td>
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<tr>
<td>Semiconductor photonics: applications and technology</td>
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### Optical Engineering 15 ECTS

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<th>Course</th>
<th>Credits</th>
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<td>Laser systems and applications</td>
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<tr>
<td>Optical design</td>
<td>3</td>
</tr>
<tr>
<td>Managing light with devices</td>
<td>3</td>
</tr>
<tr>
<td>Measuring with light (optical metrology)</td>
<td>3</td>
</tr>
<tr>
<td>Fibers and telecommunications</td>
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</table>

### Biophotonics and Imaging 15 ECTS

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<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Experimental optical techniques in biology</td>
<td>3</td>
</tr>
<tr>
<td>Active and spectral imaging</td>
<td>3</td>
</tr>
<tr>
<td>Visual optics and biophotonics</td>
<td>3</td>
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<tr>
<td>Image processing in biophotonics</td>
<td>3</td>
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<tr>
<td>3D light control for biological applications</td>
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### Telecomm. & Photonics Circuits (TELPHO) 9 ECTS

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Fibers and telecommunications</td>
<td>3</td>
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<tr>
<td>Integrated photonics</td>
<td>3</td>
</tr>
<tr>
<td>Optoelectronics and photovoltaic technology</td>
<td>3</td>
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</table>
Additional key competencies  

Business and Patents in Photonics  

- 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 2021_2022 at: https://photonics.masters.upc.edu/en/list-of-proposals-2021-22.

Possibility to undergrowth your Master Thesis in an external research center, university o company;

Erasmus mobility for the Master Thesis.

Members of SECPhO: contact with companies (https://www.secpho.org)
SPECIAL FEATURES

- **TRANSVERSAL or COMPLEMENTARY skills:** seminars + “Business and Patents in Photonics” allows contacts with professionals with high responsibility in companies, and fosters entrepreneurial and communication skills.

- **Activity weeks:** visits to labs. or companies, presentations, simulations, experiments,...
SPECIAL FEATURES
Calendar

- from **September 12**\textsuperscript{th} to **October 10**\textsuperscript{th} only core courses;

- from **October 10**\textsuperscript{th} to **April 21**\textsuperscript{st} core and elective courses organized in **3 teaching blocks**: 6 weeks + 1 week exams + 1 week activities
  - **Block 1**: October 10\textsuperscript{th} to December 5\textsuperscript{th}
  - **Block 2**: December 12\textsuperscript{th} to February 17\textsuperscript{th}
  - **Block 3**: February 20\textsuperscript{th} to April 21\textsuperscript{st}

- from **April 24**\textsuperscript{th} full time Master Thesis

- Two presentation date options: July or beginning of September
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, optical design, etc.

- **Joining (and promoting) spin-off** or other technology-based small companies.
All information about:

- **Content of each course:**

- **Timetable for the academic year 2022_2023:**

- **Master Thesis proposals for the academic year 2022_23**

- **CV of the professors:**
  https://photonics.masters.upc.edu/en/academic-staff-list

- **PhD and job advertisements:**
  https://photonics.masters.upc.edu/en/job-offers
Master in Photonics ranked with the maximum evaluation “EXCELENCE” in the last two evaluations.

L'Agència per a la Qualitat del Sistema Universitari de Catalunya certifica que el títol oficial

Màster Universitari en Fotònica
Escola Tècnica Superior d'Enginyeria de Telecomunicació de Barcelona · Universitat Politècnica de Catalunya

ha superat el procés d'avaluació establert a la Guia per a l'Acreditació de les titulacions oficials de grau i màster, aprovada per la Comissió d'Avaluació Institucional i de Programes d'AQU Catalunya, amb el resultat següent:

ACREDITAT AMB EXCEL·LÈNCIA

Aquest certificat té una validesa de sis anys per als títols de grau i doctorat, i de quatre anys per als màsters universitaris.
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Thank you for the attention!

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