

# Master in PHOTONICS

## ““Photonics BCN””

(<http://www.photonics.masters.upc.edu>)



## Master Erasmus Mundus EUROPHOTONICS

(<http://www.europhtonics.org/>)



UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH

**UAB**

Universitat Autònoma  
de Barcelona



UNIVERSITAT DE  
BARCELONA

**ICFO**

The Institute  
of Photonic  
Sciences

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Director of the Interuniversity Master in Photonics

& Master Erasmus Mundus - Europhotonics

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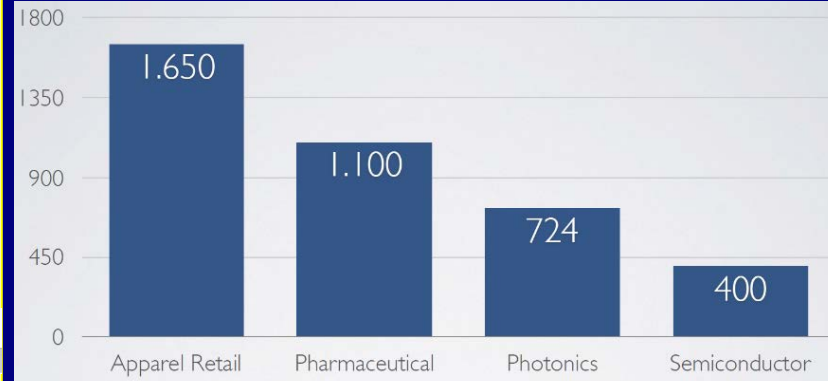
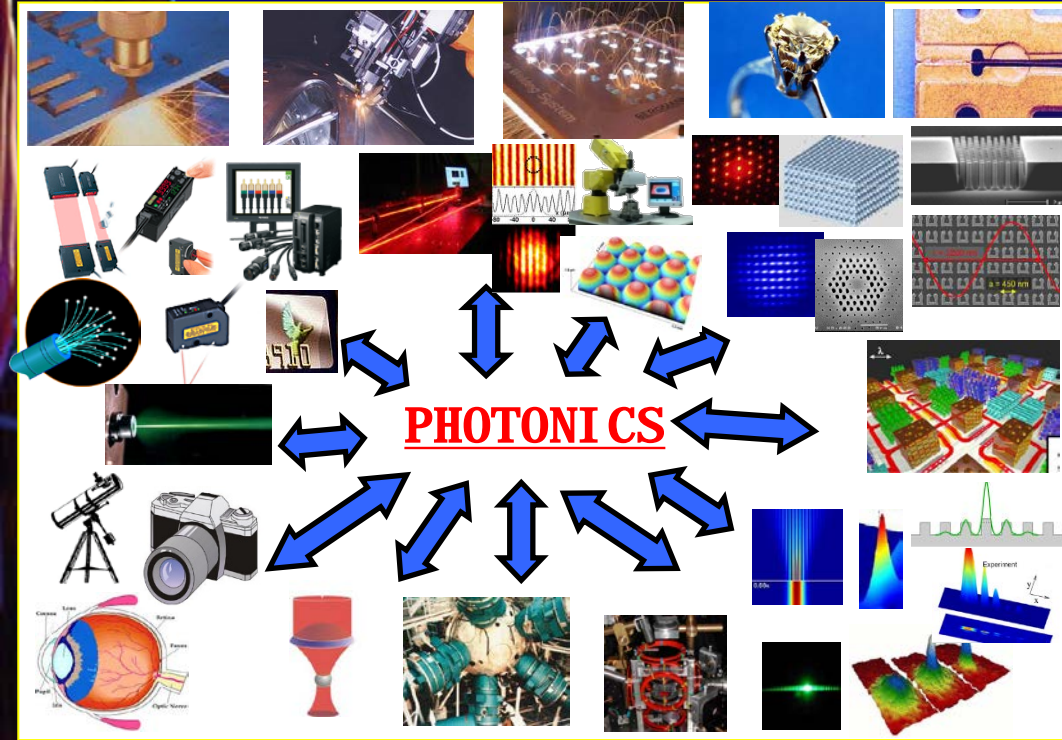
# Optics & Photonics

- 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
  - .....

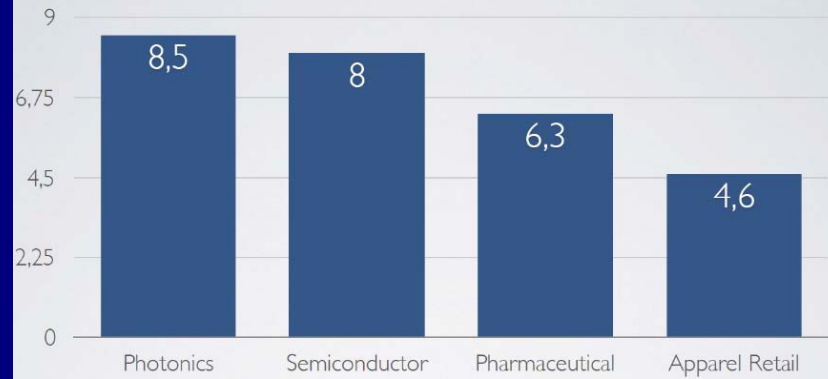
## Highly multidisciplinary

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

# Photonics in Science and Technology



PREDICTED MARKET SIZE IN 2020  
in Billion Euro



PREDICTED CAGR\* (%) (2017-2020/22)

in Billion Euro  
\*Compound Annual Growth Rate

# 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 1<sup>st</sup> 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.**

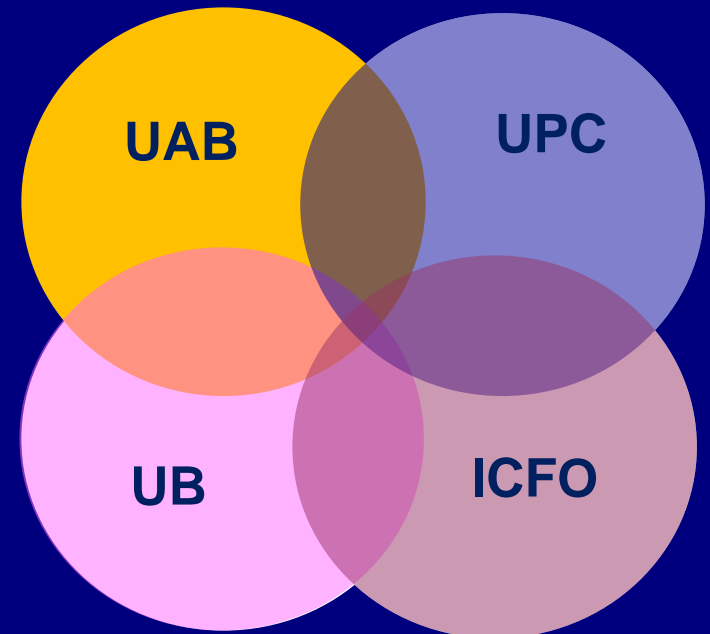
**XXI century:** - 9 Nobel Prize in Physics  
- 2 Nobel Prize in Chemistry } **related to PHOTONICS**

# Optics & Photonics



# MSc Photonics – “PHOTONICS BCN”

- 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 13<sup>th</sup> edition
- Official **60 ECTS (1 year)** Spanish Degree.
- All courses are taught in English.



**Universitat Politècnica de Catalunya (UPC)**



**Universitat Autònoma de Barcelona (UB)**



**Universitat de Barcelona (UB)**



**ICFO – The Institute of Photonic Sciences**



# EUROPHOTONICS @ BCN



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

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

- **Quantum & Atom optics**
- **Nanophotonics & metamaterials**
- **High resolution microscopy**
- **Nonlinear optics & devices, Ultrafast light**
- **Biophotonics**





**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)**

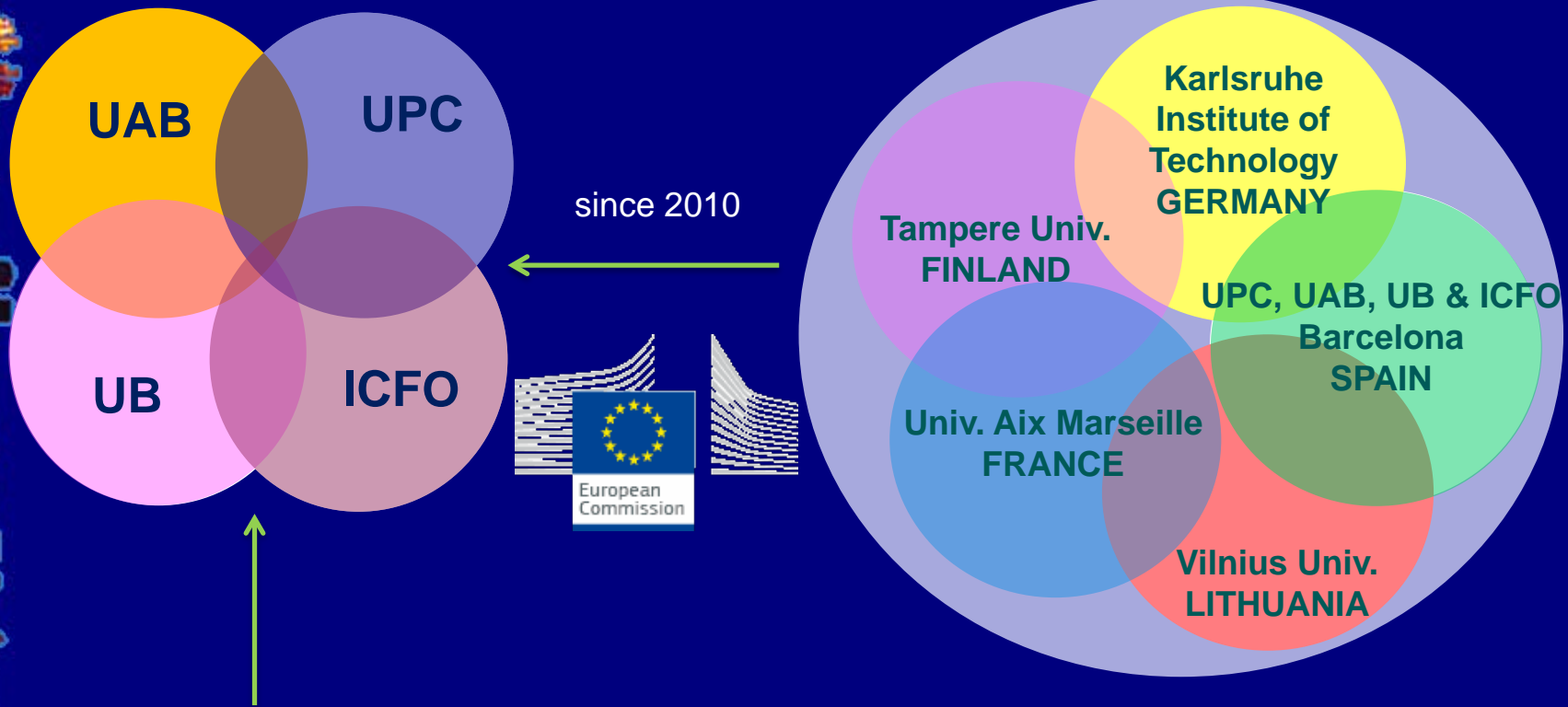
Department of Applied Physics and Optics

Department of Electronics

Department of Matter Structure & Constituents

**Institut de Ciències Fotòniques (ICFO) (17 group leaders)**

# Masters in Photonics “PHOTONICS BCN” & Master Erasmus+ “EUROPHOTONICS”



Erasmus Mobility Scheme

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
- Beam Propagation and Fourier Optics

5 ECTS

5 ECTS

### Applied Photonics & Transversal Skills

**10 ECTS**

- Photonics Laboratory
- Business and Patents in Photonics

5 ECTS

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

Quantum optics	3
From cooling & trapping of neutral atoms to BE condensates	3
Quantum simulators with ultracold quantum gases	3
Light and atom interaction	3
Advanced quantum optics with applications	3
Machine learning on classical and quantum data	3

## Materials, Nanophotonics & Photonics Circuits

18 ECTS

Photonic materials and metamaterials	3
Nonlinear optics	3
Nanophotonics	3
Ultrafast and ultraintense laser light	3
Optoelectronics and photovoltaic technology	3
Integrated photonics	3

## Optical Engineering

15 ECTS

Laser systems and applications	3
Optical design	3
Managing light with devices	3
Measuring with light (optical metrology)	3
Fibers and telecommunications	3

## 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 o company;
- **Members of SECPHO:** contact with companies (<https://www.secpo.org>)



All the information about:

- **Timetable**
- **Course program**
- **Course content**
- **Master Thesis**

can be found at:

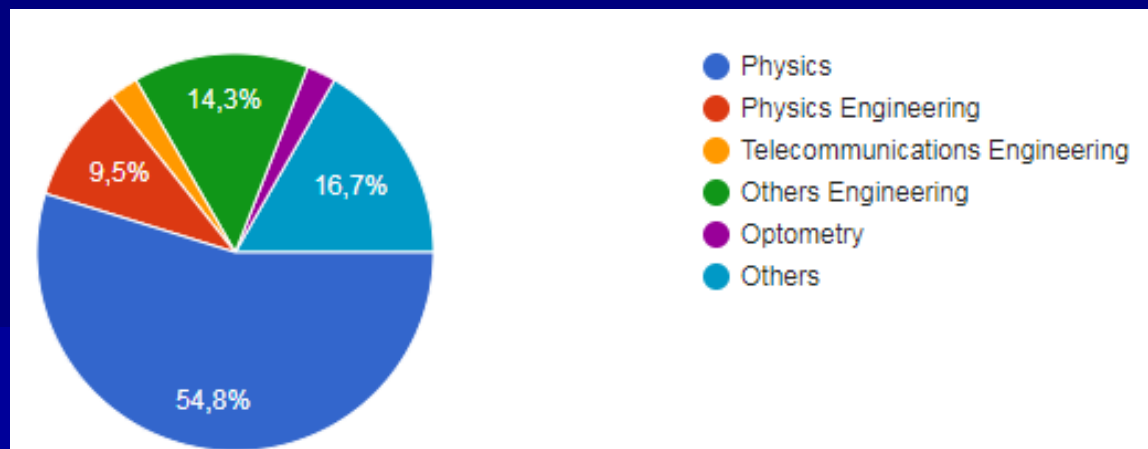
- [https://photonics.masters.upc.edu/en/copy\\_of\\_erasmus-mundus-master-and-phd](https://photonics.masters.upc.edu/en/copy_of_erasmus-mundus-master-and-phd)
- <https://photonics.masters.upc.edu/en/academic-year-2020-21>



Academic year	Master in Photonics	Europhotonics	Erasmus Mobility	Total
2011-12	26	18	2	<b>46</b>
2012-13	26	5	6	<b>37</b>
2013-14	27	5	4	<b>36</b>
2014-15	23	7	4	<b>34</b>
2015-16	29	4	3	<b>36</b>
2016-17	28	5	14	<b>46</b>
2017-18	26	6	14	46
2018-19	26	2	9	37
2019-20	27	1	5	33
<b>2020-21</b>	30	4	5	<b>39</b>

### BSc degree:

- 14 Physics
- 2 Engineering physics
- 1 Nanoscience and nanotechnology
- 3 Optics & Optometry
- 3 Mecanical Engineering
- 1 Industrial Eng.
- 2 Material Eng.



# Careers in Photonics

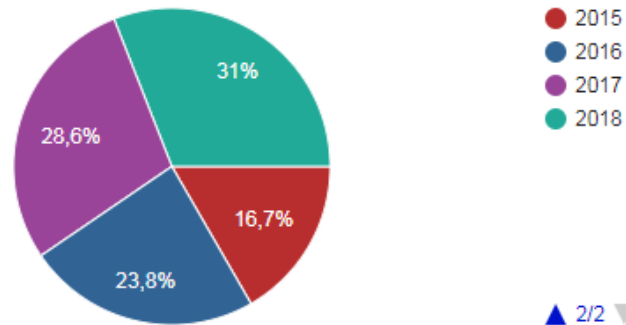
Very broad, given the interdisciplinary character and increasing relevance of photonics:

- 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

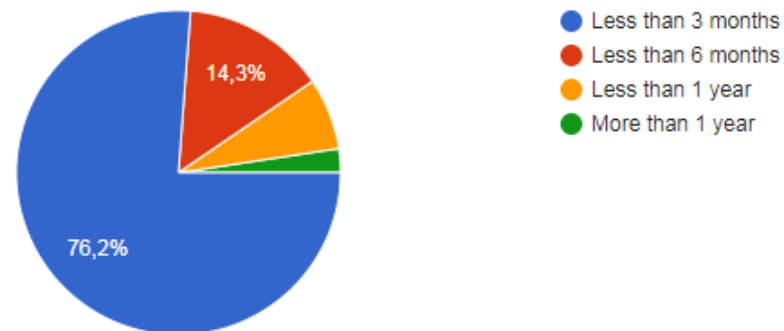
When did you finish the MSc in Photonics/Europhotonics?

42 respostes



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

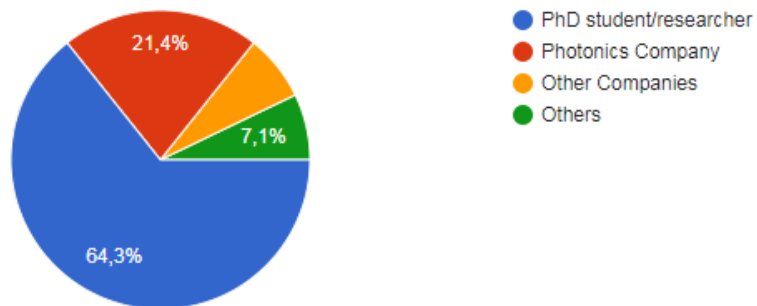
42 respostes



# Careers in Photonics

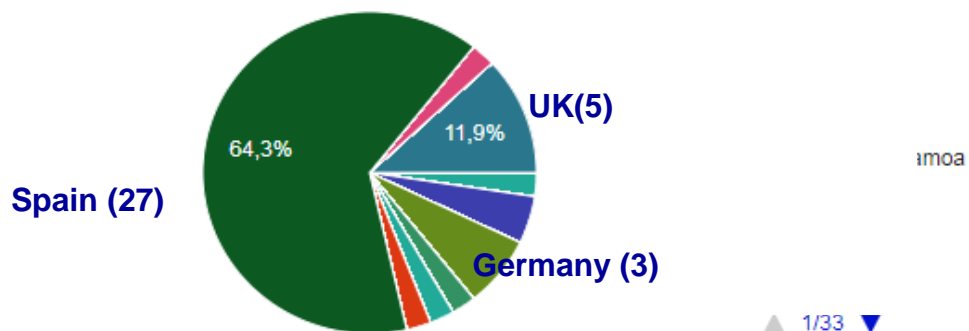
Which was your first position after graduation?

42 respostes



In which country?

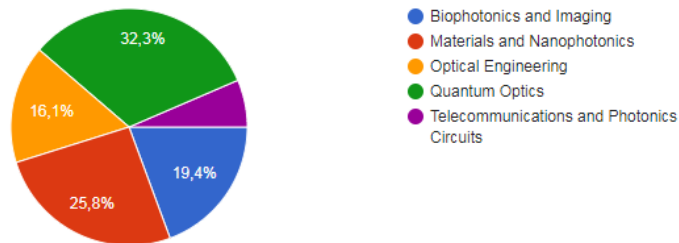
42 respostes



# Careers in Photonics

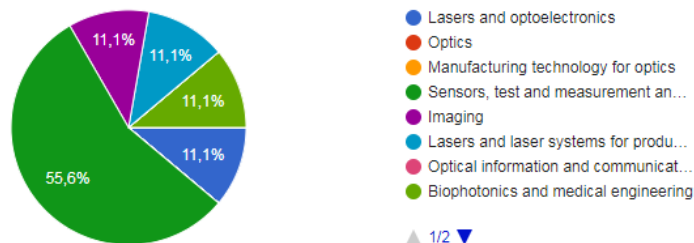
If your first position was "PhD student/researcher", which was your main Research Field?

31 respostes



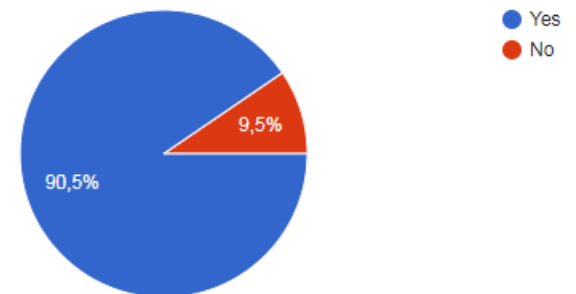
If your first position was "Photonics Company", which was your Photonics Sector?

9 respostes



Is your current professional career related to photonics?

42 respostes



**Master in Photonics** ranked with the maximum evaluation **“EXELENCE”** in the last evaluation.



Certificat número: 4313974-32865-17

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.



# Pre-enrolment information



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH

Escola Tècnica Superior d'Enginyeria  
de Telecomunicació de Barcelona



## **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.](#)



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**B**

**ICFO**  
Institut  
de Ciències  
Fotòniques

# Pre-enrolment information



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH

Escola Tècnica Superior d'Enginyeria  
de Telecomunicació de Barcelona



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

**for the following 2 masters:**

[MASTERS. Pre-enrolment.](#)

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**



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# Pre-enrolment information

## ETSETB-Àrea de Gestió Acadèmica

<u>UPC</u>	<u>any other PUBLIC UNIVERSITY in Spain</u>	<u>FOREIGN UNIVERSITIES</u>
ID (only foreign students)	ID (only foreign students)	Passport
B.2.2 English	B.2.2 English	B.2.2 English
Curriculum vitae	Curriculum vitae	Curriculum vitae
	Transcript of records	Transcript of records
	Bachelors Diploma	Bachelors Diploma
<b>Academic's procedures LINKS of interest:</b> <a href="#"><u>MASTERS. Pre-enrolment.</u></a> <a href="#"><u>MASTERS. Enrolment New students</u></a> <a href="#"><u>Academic management Calendar</u></a>		<b>Subjects description:</b> Document or link to the course description of the subjects in the transcript of records  <b>Official certificate of the EQUIVALENCES to the rating system of Spanish universities</b>

# Pre-enrolment information

## ETSETB-Àrea de Gestió Acadèmica

ANY  
QUESTIONS  
?

Please contact us:  
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[secretaria.etsetb@upc.edu](mailto:secretaria.etsetb@upc.edu)  
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93 401 5966 / 93 401 6750

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

➤ Please Check  
availability  
at this link :

[PRIOR APPOINTMENT](#)