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Master in PHOTONICS BCN

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

Master Erasmus+ EUROPHOTONICS-POESII

(http://www.europhotonics.org/)

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH
UAB Universitat Autònoma de Barcelona
UNIVERSITAT DE BARCELONA
ICFO The Institute of Photonic Sciences

Meritxell Vilaseca
UPC coordinator
Crina Cojocaru
Director
Universitat Politècnica de Catalunya, Barcelona

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Optics & Photonics – what does these field covers?

A traditional area of science and technology evolving very fast, that 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 → Integrated photonics
- Optical communications

- High powers 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
- ……

HIGHLY MULTIDISCIPLINARY

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

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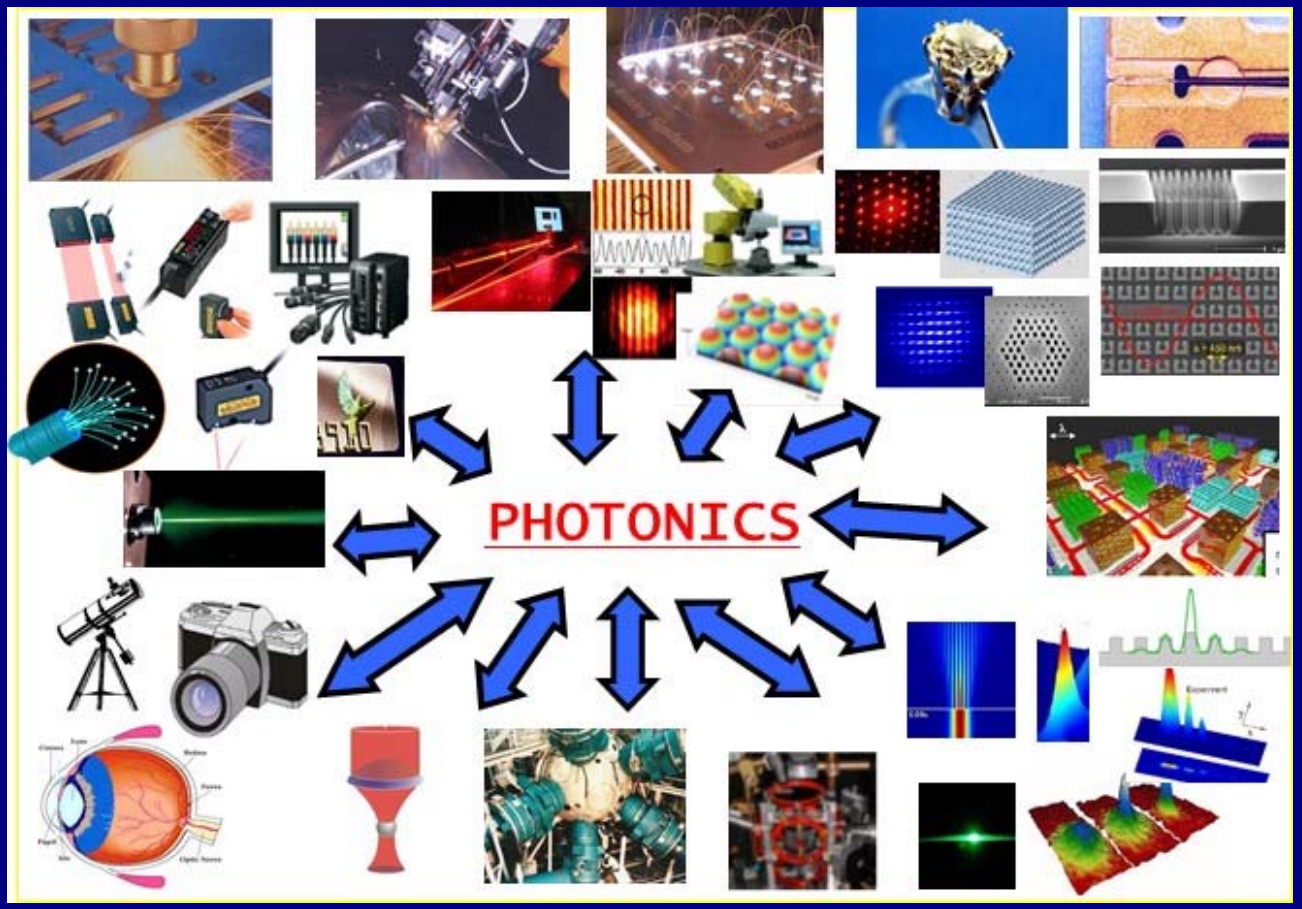
Photonics finds nowadays applications in a very broad scientific and technological fields:



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.

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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.**
- 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.
- 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**

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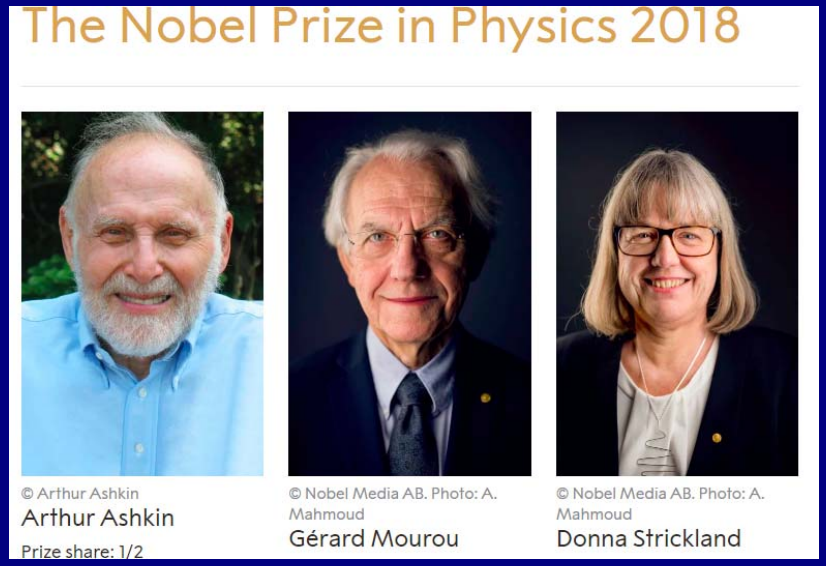
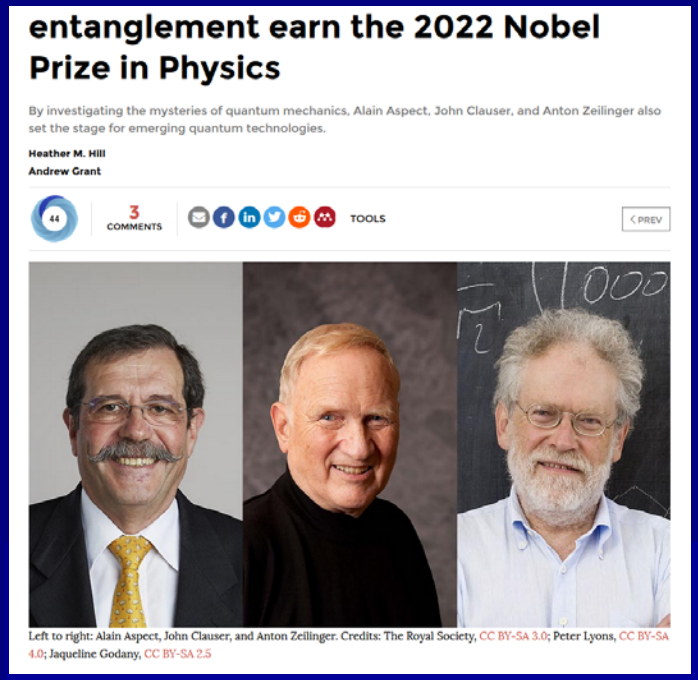
NOBEL PRIZE in PHYSICS 2022



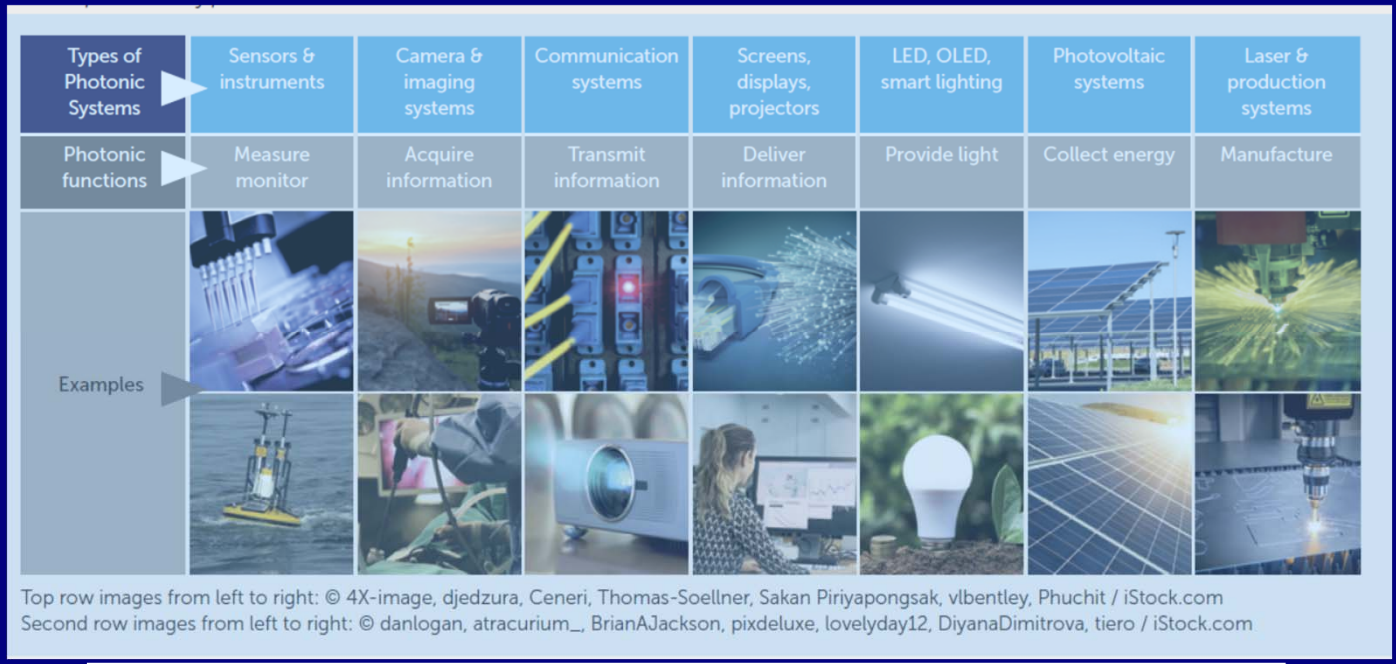
"for inventions in the field of laser physics (optical tweezers and ultra-short pulses)"

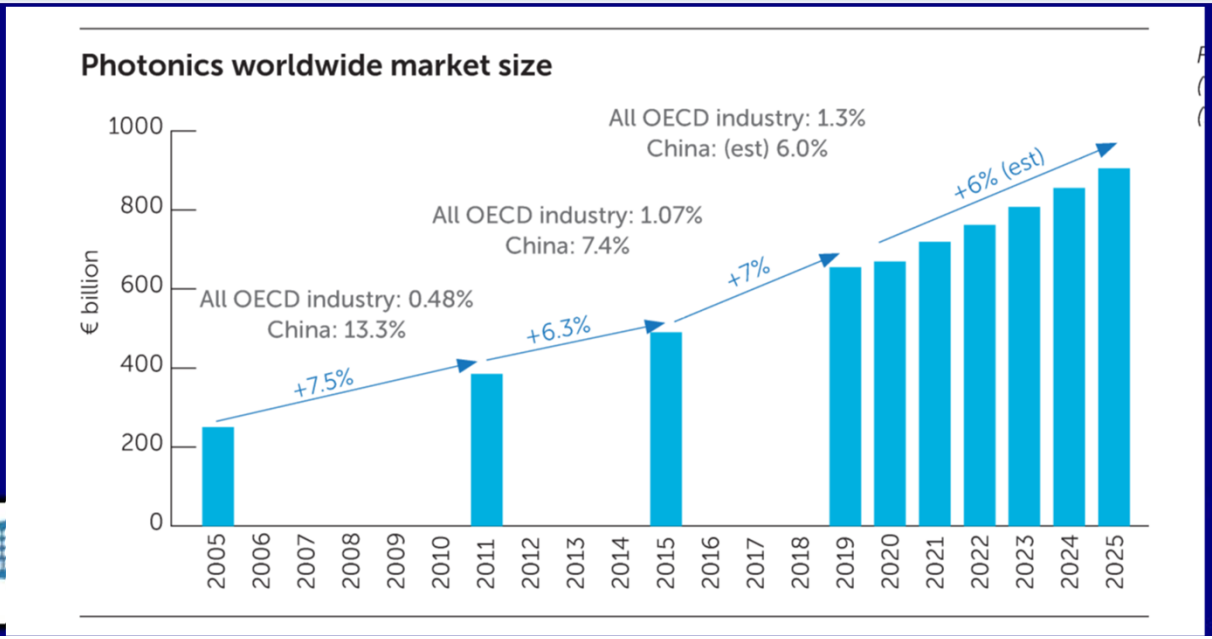


"for experiments pioneering quantum information science"

Functions that can be accomplished with photons

(source: “Market Data and Industry Report 2020 “ Photonics 21)





Optics & Photonics

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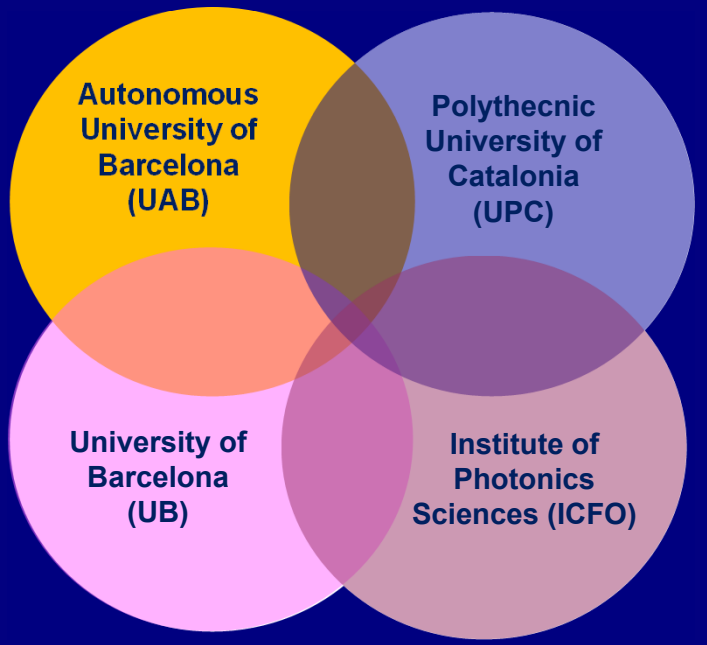
MSc Photonics – "PHOTONICS BCN"

- **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 14th edition**
- **Official 60 ECTS (1 year) Spanish Degree.**
- **More that 50 professors & researchers**
- **All courses are taught in English.**
- **Tax/year: €2,766 (€4,149 for non-EU residents).**



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Universitat Politècnica de Catalunya (UPC)

Universitat Autonòma de Barcelona (UB)

Universitat de Barcelona (UB)

ICFO – The Institute of Photonic Sciences

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 and Biomedical Engineering
- Department of Quantum Physics and Astrophysics

Institut de Ciencies Fotòniques (ICFO) (17 group leaders)

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CD6 Centre for Sensors, Instruments and Systems Development
UNIVERSITAT POLITÈCNICA DE CATALUNYA
Shaping light to your needs

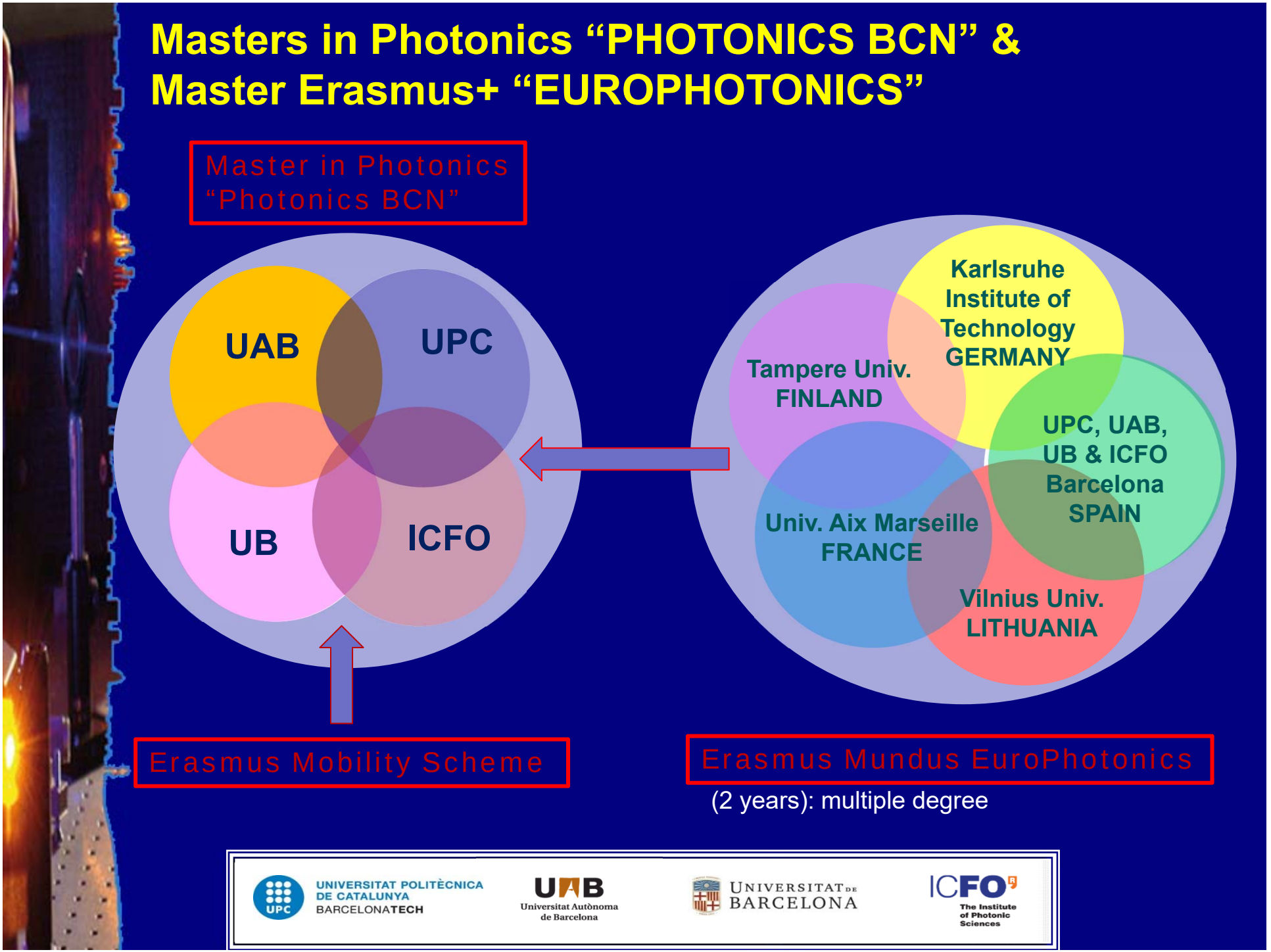
- Optical engineering: sensors, vision, metrology, opt. design, adaptive optics, color science
- Image processing, liquid crystal, machine vision
- Nonlinear optics and dynamics
- Nanomaterials, Remote sensing
- Optical Fiber Communications & networks
- Integrated photonics

- 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"



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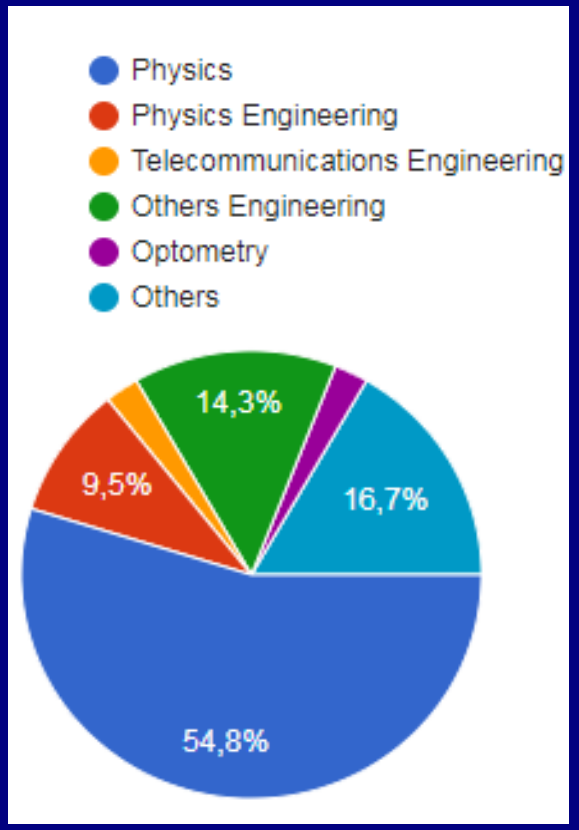
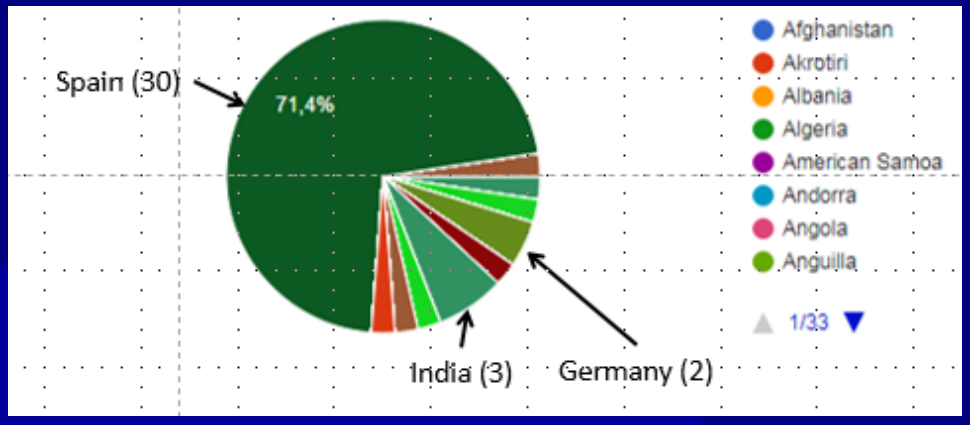
Multidisciplinarity

ADDRESSED TO:

Academic year	Master in Photonics	Europhotonics	Erasmus Mobility	Total
2011-12	26	18	2	**46**
2012-13	26	5	6	**37**
2013-14	27	5	4	**36**
2014-15	23	7	4	**34**
2015-16	29	4	4	**37**
2016-17	28	5	14	**46**
2017-18	26	6	14	**46**
2018-19	26	2	9	**37**
2019-20	27	1	5	33
2020-21	26	7	5	**34**
2021-22	30+5	7	7	**49**
2022-23	**27+4**	**3+1**	**7**	**42**





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.

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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) — 21 ECTS
- Optical Engineering (OPTENG) — 15 ECTS
- Telecomm. & Photonics Circuits (TELPHO) — 9 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
Quantum light-matter interfaces: modern systems and applications	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

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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.

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MSc Thesis 16 ECTS

- 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)

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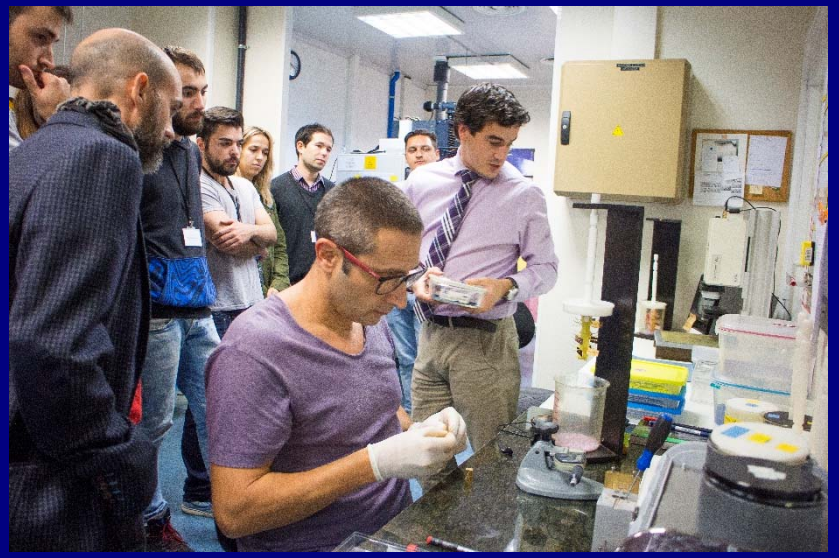
SPECIAL FEATURES

- **TRANSVERSAL or COMPLEMENTARY skils: 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,…



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ICFO The Institute of Photonic Sciences

SPECIAL FEATURES

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- **Activity weeks:** visits to labs. or companies, presentations, simulations, experiments,…

- **Seminars and visiting professors**

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SPECIAL FEATURES

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UAB Universitat Autònoma de Barcelona

Calendar

- from **September 12th** to **October 10th** only core courses;

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

- from **April 24th** full time Master Thesis

- Two presentation date options: July or beginning of September

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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.

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All information about:

- **Content of each course:**

https://photonics.masters.upc.edu/en/curriculum-2022-23

- **Timetable for the academic year 2021_2022:**

https://photonics.masters.upc.edu/en/shared/contents/academic_year_2022-23/timetable_2022-23.pdf

- **Master Thesis proposals for the academic year 2021_22**

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

- **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

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Master in Photonics ranked with the maximum evaluation **"EXELENCE"** in the last two evaluations.

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AQU Catalunya está inscrita en EQAR

Agència per a la Qualitat del Sistema Universitari de Catalunya

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.

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Master in PHOTONICS
"Photonics BCN"

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Thank you for the attention!

Crina Cojocaru:
e-mail: crina.maria.cojocaru@upc.edu
phone:+34 937398571

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