

# Teaching and Outreach

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Vice-Chair of ELI-ERIC ISTAC



IMPULSE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871161.

1. Curriculum in Photonics at IST
2. National Courses in Photonics
3. Training programmes
4. Outreach

IST is the Engineering School of Universidade de Lisboa

10 Departments, 32 research units

12000 under and postgraduate students

New Teaching Model and Pedagogical Practices from 2021/22

**Physics Engineering Bachelor/Masters**

Funded by Mariano Gago in 1990's

~90 students per year

Consistently highest rankings nationally

Course supported by ~80 Physics professor (55 tenured)  
of which 21 part of Plasmas and Lasers area.



Physics Engineering  
3rd year students

3rd Advanced Physics  
Experiment at a Research  
Laboratory at Técnico  
since 2015,  
coordinated by Prof. João  
Mendanha Dias.

Since 2021, a separate, 3  
ECTS course



# Optica Quântica e Lasers

Physics Engineering 4th year students  
Minor in Photonics Technologies

- Theoretical course on fundamentals of optics & lasers
- Coordinated by Gonçalo Figueira since 2012
- About 40-50 students/year
- Contents:

Optics	Ray tracing, matrix optics Wave optics, photon optics Gaussian beams and resonators Electromagnetic optics
Lasers	Amplifiers and saturation Oscillators and mode-locking Pulse propagation, dispersion Ultrafast and nonlinear optics

# New LEFT curriculum since 2021

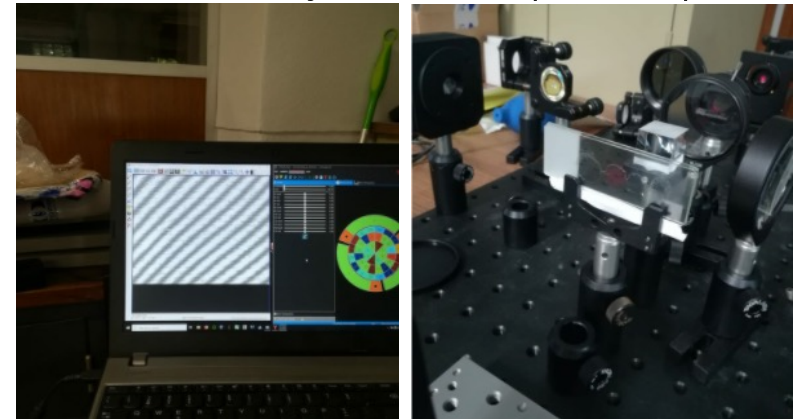
## 1st year students: Física da Terra e Universo

Marta Fajardo

In class demonstration

6 Research Projects in related topics

Interferometry and adaptive optics



## 2nd year students: Optics

MF, GF & JMD

Formal training ray and wave optics

Laboratory Projects: Experiments and Simulations

## Ongoing LEFT/MEFT advanced studies

Jorge Vieira - Introduction to Plasma Physics

Hugo Terças - Advanced Plasma Physics

Luís Silva - Advanced Computation

Open to students from all MSc (2nd cycle) degrees  
Starting Sept. 2022

Collaboration between Departments of Physics, Electrical Engineering & Biomedical Engineering  
Coordinated by Gonalo Figueira (Physics) and Paulo Andr  (Elec. Eng.)

Syllabus:

Year 1      Applied Optics  
              Principles of Biosignals and Biomedical Imaging

Year 2      Optics and Lasers  
              Medical Imaging  
              Optoelectronics  
              Optical Communication Systems

## Lionel Marraffa

Doctor Lionel Marraffa joined IST as an invited professor of the Department of Physics, in the scope of the program “Distinguishing Visiting Professor”, and as member of the scientific domain in Plasmas, Lasers and Nuclear Fusion, for a period of one year (October 2021 – October 2022).



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Helder Crespo, Ariel Guerreiro

- Nonlinear and Ultrafast Optics
- Lasers
- Optics

- Optical Materials and Devices
- Optical Metrology
- Optoelectronics
- Optical Communications
- Quantum Optics







Carlos Serpa, Luis Arnaut (Laserlab-PT)  
Teaching in Optics and Photonics at the **Department of Chemistry at UC:**

Chemists point of view:

Interaction between radiation and matter.

Light sources and spectroscopic equipment at Coimbra

Laser Lab (located at the Department of Chemistry) used in experiments designed for those courses.



Physical Chemistry II (BSc Chemistry, 6 ECTS)

Two of the three objectives of the course are, (i) to understand the interaction between radiation and matter and (ii) introduce the time variable in the transformation of matter; in both cases light sources and diagnostic techniques are explained and used experimentally.

Thermodynamics and Kinetics (MSc Chemistry, 5 ECTS) Emphasis on chemical kinetics studies and on the use of ultra-fast instruments in reactivity studies.

Photochemistry and Spectroscopy (MSc Chemistry, 5 ECTS) The fundamental aspects of the interaction between light and matter at the molecular level are explored.

Doctoral course "Polythea – How light save lives", whose scope is in Photodynamic Therapy, which uses continuous and pulsed light sources in conjunction with photosensitizers molecules for human health and food security applications.





NOVA SCHOOL OF  
SCIENCE & TECHNOLOGY  
DEPARTMENT OF PHYSICS

# Optics and Photonics R&D activities within



Laboratory for Instrumentation, Biomedical Engineering and  
Radiation Physics (LIBPhys) (lab. Associado)



Center of Physics and Technological Research



Centro de Investigação de Materiais (Lab. Associado I3N)



Optical materials and devices

Thin film Optics

Optical storage devices

Energy Harvesting optical devices

Optical, sensor devices

Transparent optics

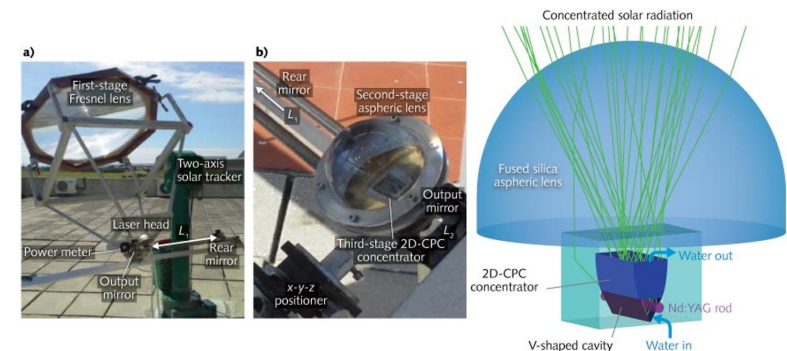
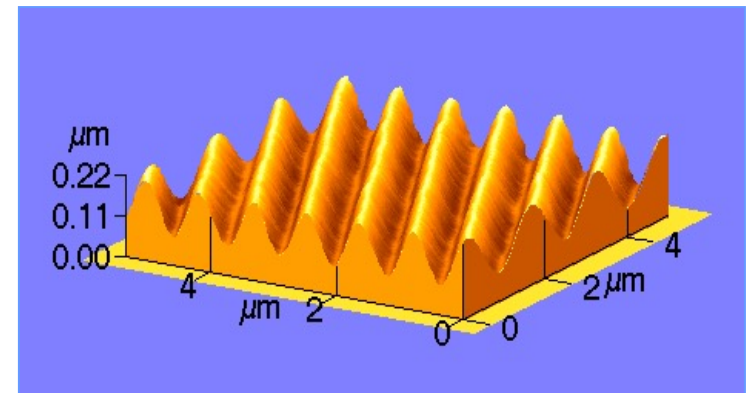
Graphene base Optics

Solar pumped Laser Systems and Devices

Imaging processing and devices

Optical medical devices

Environmental Monitoring Optical Systems





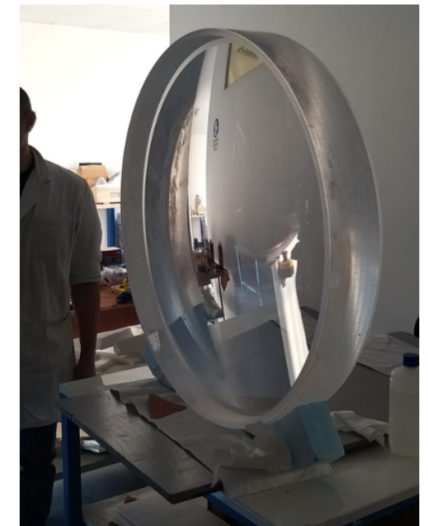
**Ciências  
ULisboa**

Faculdade  
de Ciências  
da Universidade  
de Lisboa

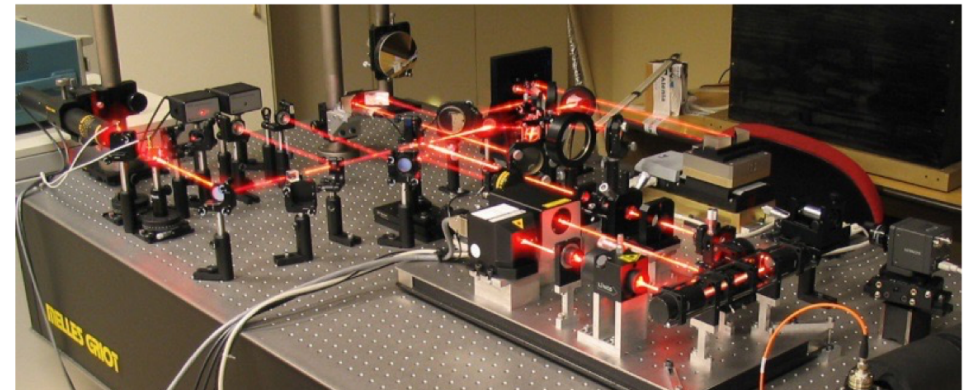
Manuel Abreu, José Rebordão

## Optics and Photonics @ FCUL

- Strong set of options in Optics and Photonics at level of Physics Engineering BsC and MsC
- Formal training Optics and Waves at BsC level
- Applied Optics and Lasers, Optical Instrumentation, Optoelectronics, Optical sensors and Systems at MsC level
- Masters thesis themes in Optics and Photonics supported by two Research Centers (Institute of Astrophysics and Space Sciences and CENTRA) in Optical Instrumentation for Space and Ground Astronomy, Optical metrology, Optoelectronics
- 500 sq meters in Labs dedicated to Optics and Photonics



Fully engaged in Big Science projects from ESA and ESO, involving Optical Instrumentation for space and ground instruments



Rogério Nogueira - U Aveiro

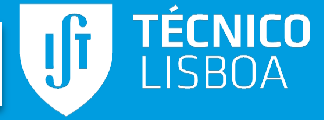
Bernardo Almeida, Luis Gonçalves - U Minho



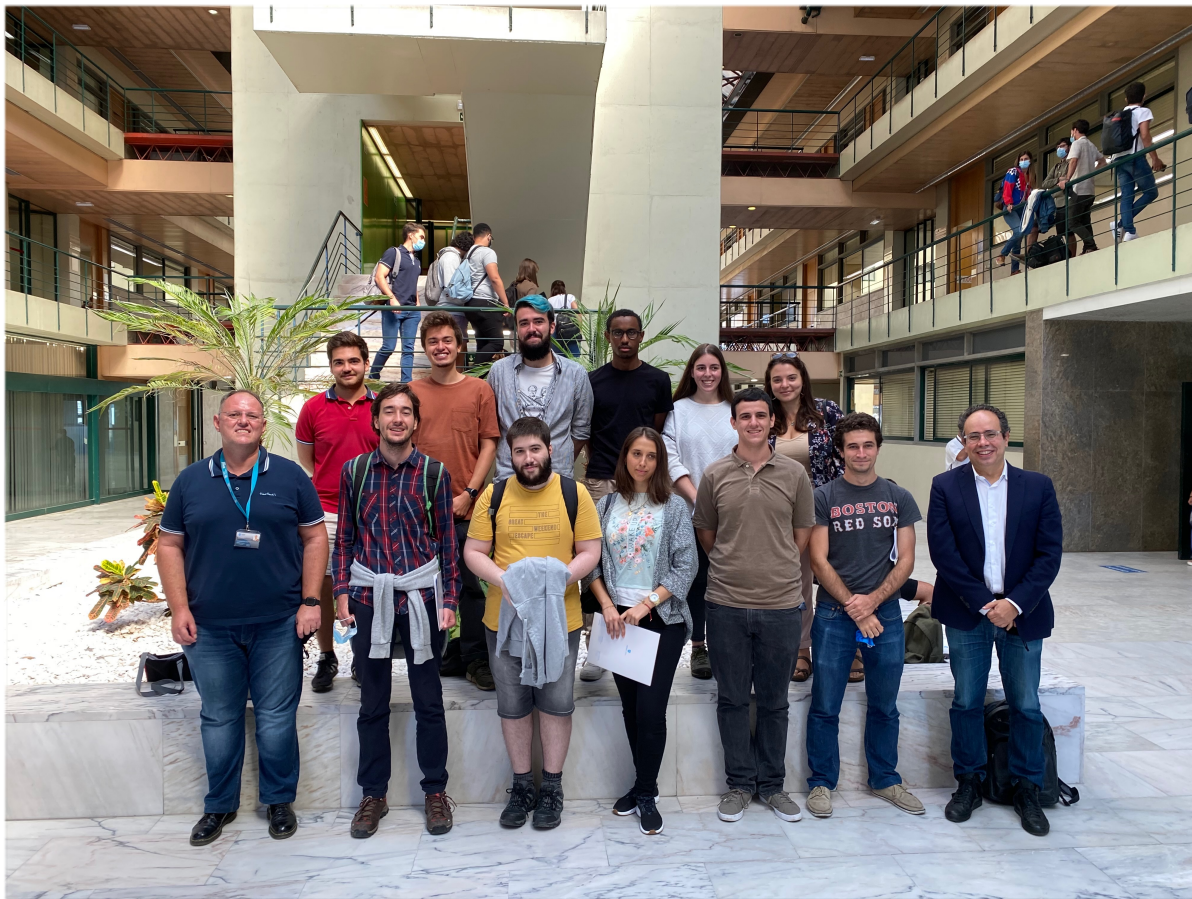


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# IPFN Science Summer Camp 2021



<https://www.ipfn.tecnico.ulisboa.pt/summercamp/>



	Date & Time & Duration	Room	Description	Attendees/Hosts
Kick-off session	Aug 30, 9h30m (30')	TBD	Welcome session, IPFN presentation, and participant/supervisor pairing	BG, LOS, supervisors
Lightning Round + Workshop on Ethics in Science	Sep 3, 10h30m (90')	TBD	Discussion session on Ethics in Science	LOS
Lightning Round + Science Infrastructures in PT and EU	Sep 10, 10h30m (30'+90')	TBD	Presentation of EU infrastructures of relevance for IPFN + Lab Tour @ Alameda	LOS, BG, MF, hosts of L2I, VOXEL, PEL, ISTTOK
Lightning Round + Workshop on Science Writing	Sep 17, 10h30m (90')	TBD	Workshop on Science Writing	LOS
Lightning Round + Workshop on Science Presentations	Sep 24, 10h30m (90')	TBD	Workshop on Science Presentations	LOS, MF
Closing session	Sep 30, 10h30m (90')	TBD	Final pitch presentation (5' per participant) Feedback to organization Award of certificates	BG, LOS, supervisors





Undergraduate level, awards credits



# Plasma Surf –Every Summer since 2013

The summer school on Plasma  
Physics, Intense Lasers and  
Nuclear Fusion

30 MSc / PhD Students from  
Europe and elsewhere every  
year



<http://plasmasurf.tecnico.ulisboa.pt>

Coordinated by Horácio Fernandes, IPFN

<http://xgolp.tecnico.ulisboa.pt/opportunities/>



5 Scholarships offered for 2021 for Masters research project

Applications due 30th November 2020

Students from any national University

Co-advisory from an ELI researcher preferred



# APPLAUSE Doctoral Programme



<https://www.ipfn.tecnico.ulisboa.pt/APPLAuSE/>

Coordinator: Vasco Guerra

Funded by the Portuguese  
Foundation for Science and  
Technology (FCT)

Total of 6 calls, 47 grants  
Currently: 3 PhDs /year  
funded.

## Curricular units

Fundamentals(7.5 ECTS)  
Diagnostic Methods for Plasmas (7.5 ECTS)  
Advanced Topics in Plasma Physics, Nuclear  
Fusion and Lasers (7.5 ECTS)  
Advanced Computation in Physics and  
Engineering (7.5 ECTS)

## Laboratory rotations

Each student undergoes two rotations  
In each rotation (4 weeks) a small project is  
developed and presented.

## Transverse skills package

3 and half years research programme



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# Valorization - Lab2Market



**The Value Proposition Canvas**

**Lab2Market@Técnico 2021**

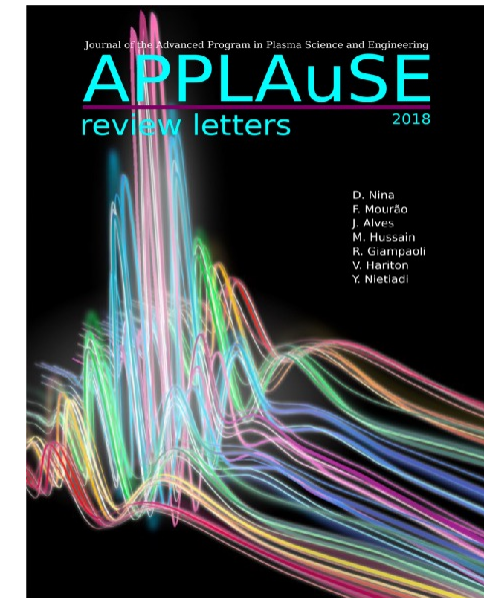
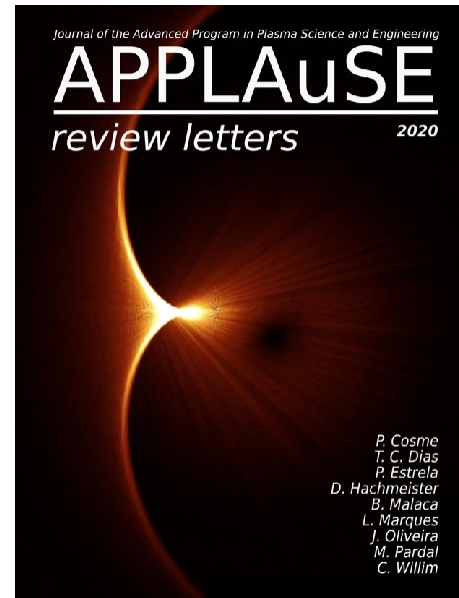
Applications until February 12th

[tt.tecnico.ulisboa.pt](http://tt.tecnico.ulisboa.pt)

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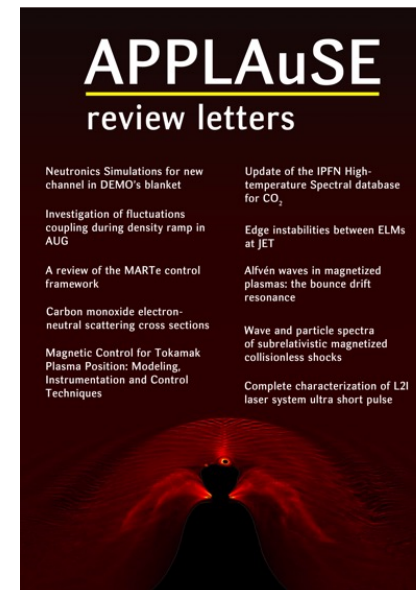
attitude makes the difference

# Transverse skills training



A 1-week intensive training on ethics and communication/presentation skills (1.5 ECTS), complemented by the programs offered to all IST PhD students (IST Bootcamp on Entrepreneurship /Innovation/Communication (1.0 ECTS) and the IST PhD Students Research Day).

Became part of offer to all Physics PhD students since 2020



**PAVILHÃO DO  
CONHECIMENTO**  
CENTRO CIÊNCIA VIVA

**INÍCIO** **VISITE-NOS ▾** **EXPOSIÇÕES ▾** **EDUCATIVO ▾**



GÉRARD MOUROU



## PAIXÃO EXTREMA, LUZ EXTREMA

Gérard Mourou · Nobel da Física 2018

Palestra e Debate | 23 Abril · 14h30 · Pavilhão do Conhecimento



## Invited scientists - Primary school children



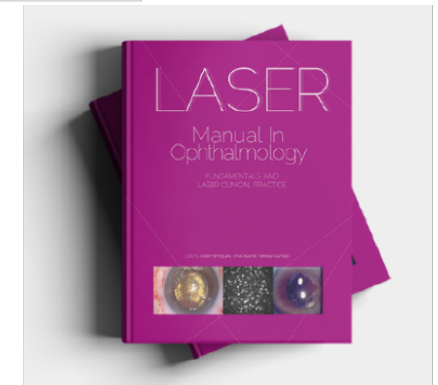
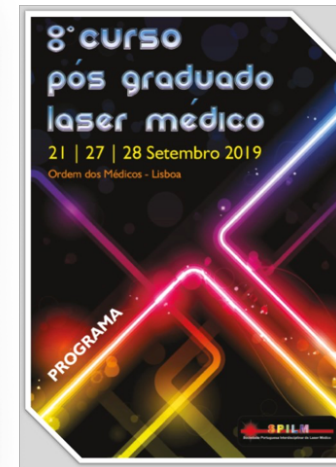
Gonçalo Figueira





# Lifelong learning: Medical Lasers

João Mendanha Dias coordinates courses for Ophthalmologists and other MDs since 1999, training around 200 MDs on lasers





# National Societies



Portuguese ecosystem is established regarding:

- Undergraduate courses
- Graduate courses
- Lifelong Training
- Outreach

The time is right for a **national** Advanced Programme in Photonics in connection with ELI

Training: Leveraging on **National Roadmap for Infrastructures** and also “**Associated Laboratories**”

- Pilot: IMPULSE Masters
- Submitted: Marie Curie ITN - Led by Luca Volpe

- National Photonics Masters programme
- National Photonics PhD programme
- Iberian PhD
- Local ELI ERA Chairs, EU PhD or Master programmes
- Cooperation with National entities (Ciência Viva, SPF...) for Lifelong Training