

euro

PHOTONICS
POESII
International Master in Photonics



Erasmus+



A*Midex
Initiative d'excellence Aix-Marseille



Spring School 2016

Ile de Porquerolles

from March 29th to April 1st, 2016



UNIVERSITAT POLITÈCNICA
DE CATALUNYA



UNIVERSITAT DE
BARCELONA

UAB
Universitat Autònoma de Barcelona

ICFO⁹
The Institute of Photonic
Sciences



CENTRALE
MARSEILLE

POLYTECH
MARSEILLE
Aix-Marseille Université



Aix-Marseille
université

Porquerolles Island Côte d'Azur, *France*

Hôtel Club IGESA



How to get to Porquerolles Island

The POESII-Europhotonics Spring school will be held in the **Hotel Club IGESA**, 300 meters far from the pier of the Island of **Porquerolles, Hyères, France**.

This is one of a three-island group directly to the South of Hyères, and South East of Marseille.

It is located in a natural park, one of the last intact naturalistic area in the Mediterranean basin.

In order to come to Porquerolles Island, you will need to arrive first at Hyères (see below ['By Plane'](#), ['By Train'](#) or ['By Car'](#)). **There, a ferry boat will take you to the island.**

Upon your arrival, at Hyères, you have to go to "**La Tour Fondue**", which is the harbour from where boats depart to Porquerolles. The crossing duration is around 10 minutes. <http://www.tlv-tvm.com/horaires-tarifs-horaires-14.html>

HORAIRE DÉPART DE LA TOUR FONDUE / PORQUEROLLES

Du 26 mars au 10 avril 2016

Départ de La TOUR FONDUE		Retour de PORQUEROLLES	
7h30 (1)	14h30	7h00 (1)	14h00
9h00	15h30	8h30	15h00
10h00	17h00	9h30	16h30
11h00	18h00	11h30	17h30
12h00			18h30
12h30			

➤By Plane

The closest airport is **the airport Toulon/Hyères**, which is served by most airlines companies. <http://www.toulon-hyeres.aeroport.fr>

Upon arrival, it is necessary to go to "**La tours fondue**", which is the port from where boats depart to Porquerolles.

It seems the only option is taking a taxi (tel +33494006000) which takes about 15 minutes and will cost you around 25 euros.

You can also chose to arrive at the **International Airport of Nice**, then take the train to Toulon (see below). This can be a good solution if you want to see the beautiful coastline during the pleasant train travel between Nice and Toulon.

<http://www.nice.aeroport.fr>

➤By Train

There are daily links by **TGV** (fast trains) between Paris and Marseille. Then, several express domestic trains (**TER**) will take you from any city in Provence Alpes Côte d'Azur to Hyères (Marseille, Nice, Toulon, Cannes,...)

<http://www.sncf.fr>

"**La tours fondue**" can be reached by bus (city line starting from the train station) or taxi (tel +33494006000)

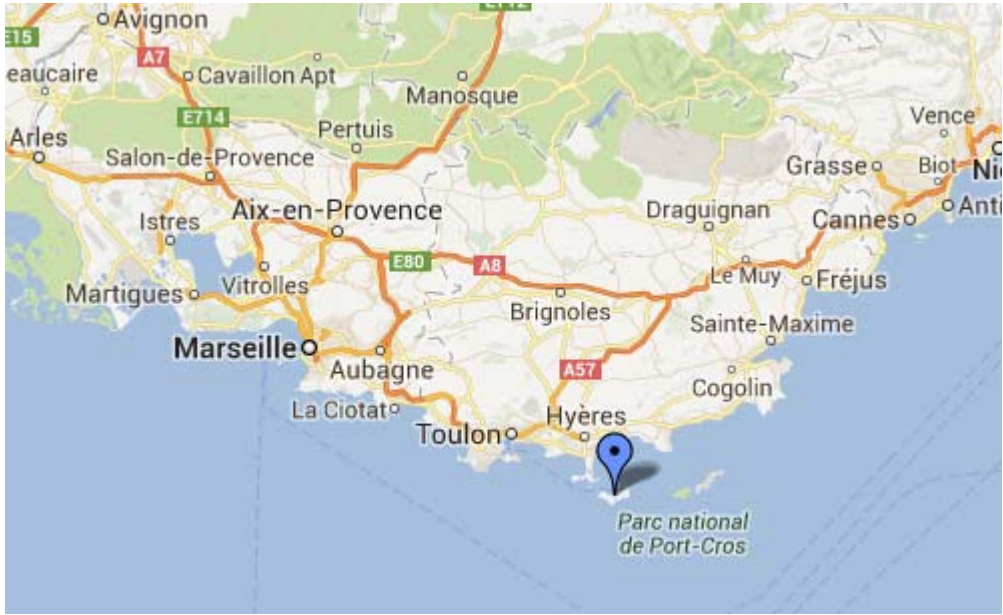
➤By Car

From Paris, take the highway **A7**, then the **A8** towards Aix en Provence/Toulon/Nice and then follow the **A570** as far as **Hyères** and **D97** to « **La Tour Fondue** » (pier to Porquerolles).

From Nice, take the highway **A8** as far as **Hyères** and the **D 97** to « **La Tour Fondue** » .

Ferryboat

A summary of this information, plus additional links, can be found at : <http://www.hyerestourisme.com/en/plan.asp>



Program

	March, Tuesday 29th	March, Wednesday 30th	March, Thursday 31st	April, Friday 1st	
7:15 am - 8:45 am		Breakfast	Breakfast	Breakfast	
09:00 am- 09:30 am		lecture 1 - Christian Wiebeler	lecture 5 - Francesco Minardi	lecture 8 - Xuequin Chen	
09:30 am- 10:00 am				PhD talk 8 - Kevin Schaedler	
10:00 am- 10:30 am					
10:30 am- 11:00 am		Coffee break	coffee break	coffee break	
11:00 am- 11:30 am		lecture 2 - Guillaume Gomard	lecture 6 - Kestutis Staliunas	lecture 9 - Robert Sewell	
11:30 am- 12:00 am					
12:00 am- 12:30 pm					
12:30 pm- 1:00 pm		lunch	lunch	lunch	
1:00 pm- 1:30 pm					
1:30 am- 2:00 pm					
2:00 pm- 2:30 pm		lecture 3 - Alexander Lorenz	Free time		
2:30 pm- 3:00 pm					
3:00 pm- 3:30 pm		PhD talk 1 - Liu Quan			
3:30 pm- 4:00 pm		PhD talk 2 - Simon Coop	coffee break		
4:00 pm- 4:30 pm	Arrival : Room keys and Registration	coffee break	PhD talk 5 - Bingxia Wang		
4:30 pm- 5:00 pm		PhD talk 3 - Susmita Sridhar	PhD talk 6 - Anna Ovvyan		
5:00 pm- 5:30 pm		PhD talk 4 - Ali Gheisari	PhD talk 7 - Diana Poala Rueda Delgado		
5:30 pm- 6:00 pm		lecture 4 - César Augusto Valdes Cruz	lecture 7 - Radwanul Hassan Siddique		
6:00 pm- 6:30 pm	Free time				
6:30 pm- 7:00 pm		Free time			
7:00 pm-7:30 pm	dinner 7:15 pm	dinner 7:15 pm	dinner 7:15 pm		
7:30 pm- 8:00 pm					
8:00 pm- 8:30 pm					
8:30 pm- 9:00 pm		poster session	Free time		
9:00 pm- 9:30 pm					
9:30 pm- 10:00 pm					
10:00 pm- 10:30 pm					
10:30 pm- 11:00 pm					

Lectures

Lecture 1

Conjugated polymers: applications in organic photovoltaics, atomistic modeling, and nonadiabatic ab initio molecular dynamics

“[...] Conducting (or conjugated, author’s note) polymers offered the promise of achieving a new generation of polymers: Materials which exhibit the electrical and optical properties of metals and semiconductors and which retain the attractive mechanical properties and processing advantages of polymers” [1]. These materials are of special interest in technological applications, e.g. organic photovoltaics (OPV) and as an exemplar the working principle of bulk heterojunction solar cells (BHJSCs) compared to semiconductor-based solar cells will be explained.

In order to design BHJSCs with high efficiency, the electronic and optical properties of conjugated polymers that are used as donors in the bulk material have to be understood. For this purpose, (time-dependent) density functional theory calculations are employed to understand the optical signatures found in ultra-fast time-resolved experiments for neutral and charged molecules [2].

Furthermore, the influence of chain length and excess excitation energy on ultrafast charge generation can be explained based on these static calculations [3].

However, to fully understand the ultrafast photophysical processes, the dynamics after photoexcitation have to be investigated. For this purpose, we are using nonadiabatic ab initio molecular dynamics based on trajectory surface hopping to model the ultrafast process of charge separation that is observed in neat films of conjugated polymers [3,4]. In the end, the current consensus and controversy regarding charge generation in OPV will be summed up [5].

Literature:

[1] A. J. Heeger, *Angew. Chem. Int. Ed.* 2001, 40, 2591 (Nobel Lecture).

[2] C. Wiebeler et al., *J. Phys. Chem. B* 2013, 117, 4454.

[3] R. Tautz, E. Da Como, C. Wiebeler, et al., *J. Am. Chem. Soc.* 2013, 135, 4282.

[4] C. Wiebeler, F. Plasser, and S. Schumacher. “Ultrafast Nonadiabatic Dynamics of Intramolecular Charge Separation in a PCPDT-BT-based Oligomer” (in preparation).

[5] F. Gao and O. Inganäs, *Phys. Chem. Chem. Phys.* 2014, 16, 20291.

Christian Wiebeler

University Paderborn, Germany

Lecture 2

Photonic strategies for improving light management in optoelectronic devices

The efficiency of optoelectronic devices can be severely limited by optical losses, which calls for adapted (nano)photonic solutions. This aspect will be exemplified by focusing on two types of devices: photovoltaic solar cells, for which the light needs to be efficiently harvested and absorbed regardless of the illumination conditions, and the reciprocal devices, light-emitting diodes, in which the generated photons have to be outcoupled to the free space. This lecture will be the occasion to review several concepts currently considered for that purpose, including for example disordered assemblies, bio-inspired photonic structures, or multi-periodic photonic crystals.

Guillaume Gomard

KIT; Light Technology Institute/Institute of Microstructure Technology, Germany

Lectures

Lecture 3

Liquid crystals for photonics: Properties, applications, challenges

Liquid crystals are soft materials with highly responsive optical properties. The physics behind their main applications in display technology and beyond is shortly discussed. Beyond their now classical electro-optical effects, liquid crystals (with a tweak) still have great prospects to solve present challenges in lighting, 3D imaging, and augmented reality.

Alexander Lorenz

University Paderborn, Germany

Lecture 4

From single molecule orientation to 3D intracellular tracking

In this lecture, I will present the main results of my PhD research regarding nanoscale imaging of orientational order in biological filaments using polarized d-STORM microscopy. In addition, I will introduce part of my Postdoc project, concerning 3D intracellular tracking using lattice light sheet microscopy.

Cesar Augusto Valades Cruz

Institut Curie, Paris

Lecture 5

Cold atoms in photonic structures

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**Francesco Minardi**

LENS / INO, Firenze Italy

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## Lecture 6

### **High Brightness Microchip Photonic Crystal Lasers**

*Microchip lasers are very efficient and convenient sources of coherent light. However they have a serious disadvantage that, especially in high power regimes, the emitted beam structure is relatively bad (large angular divergence). We recently show that the intracavity photonic crystals with spatial filtering functionality, can strongly improve the spatial characteristics of microchip laser. The angular divergence of the emitted beam is strongly reduced, and the radiation brightness is significantly increased due to the intracavity photonic crystal filter.*

*In the lecture I will make introduction to spatio-temporal light dynamics in microchip lasers. Then I will make a review on photonic crystal spatial filtering. And finally I will show dynamics of a combined device, the "Microchip Photonic Crystal Lasers."*

**Kestutis Staliunas**

ICREA & UPC, Barcelona Spain

# Lectures

## Lecture 7

### **Optical Biomimetics: Multifunctional Bio-inspired Photonic Surfaces**

*Since the 20th century, scientists have been controlling and manipulating light with artificial photonic materials in order to devise new optical applications. However, millions of years of evolution in the biological world has developed their own photonic structures in the form of vivid 'structural color'. For a long time, studies focusing on photonic micro and nano-architectures of biological origin were regarded as exotic and popular mostly among biologists with an affinity for physics. Until recently, the vigorous development of nanoscience and nanotechnology, together with the fast convergence of physics and materials science with biology, has grown interest in mimicking naturally occurring multifunctional photonic surfaces. Taking butterflies as 'blueprints', this talk will cover few examples of novel physical principles underlying the structural coloration, and further discuss possible fabrication solutions for diverse optical applications.*

**Radwanul Hasan Siddique**

*KIT, Karlsruhe, Germany*

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## Lecture 8

### **Transition from academia to industry – Experience sharing**

*The difference of doing research in academia and in industry is primarily caused by their motivations, which then affect all the aspects in the research and life. The speaker did her PhD of bio-optics in Institut Fresnel, worked on biological applications of nonlinear microscopies. From 2015, she started her career in L'Oréal Advanced Research, mainly working on Raman spectroscopy as a research scientist. She will share her experiences of the transition from academia to industry, in the field of research and other aspects of life.*

**Xueqin Chen**

*l'Oréal, Paris*

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## Lecture 9

### **Quantum Metrology, from LIGO to your GPS**

*The stunning observation of gravitational waves at the LIGO observatory involved exquisitely precise measurements made with km-scale optical interferometers operating at the quantum-limits of measurement sensitivity. In the lecture I explain what "the quantum-limits of measurement sensitivity" are, giving a brief history of the field of quantum metrology, and an outlook on its applications to devices including the clocks that keep your GPS in sync.*

**Robert Sewell**

*ICFO, Barcelona Spain*



# PhD Talks

## Talk 1

**Optical architectures for enhanced light-harvesting in polymer solar cells**

Liu Quan

ICFO/KIT

## Talk 2

**A Quantum Phase Transition in a Bose-Einstein Condensate, or,  
weird behaviour of atoms in a laser beam**

Simon Coop

ICFO/LENS

## Talk 3

**Elliptically polarized light imaging for probing depth in biological tissues**

Susmita Sridhar

Fresnel/ICFO

## Talk 4

**Advanced Light Microscope for in vivo Imaging of Zebrafish Neuronal System**

Ali Gheisari

LENS/KIT

## Talk 5

**Ultra short pulse characterization, a new in-situ approach using disordered  
nonlinear ferroelectric crystals**

Bingxia Wang

UPC/FRESNEL

## Talk 6

**Thermo-optic cascaded Mach-Zehnder interferometer on Si<sub>3</sub>N<sub>4</sub>**

Anna Ovvyan

KIT/LENS

## Talk 7

**Light soaking induced enhancement of carrier lifetime in CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> layers**

Diana Paola Rueda Delgado

KIT/ICFO

## Talk 8

**Hybrid Nano-Optomechanics with 2D Resonators**

Kevin Schädler

ICFO/LENS

# Posters

## Poster 1

**NIR Kerr effect in polymer-stabilized blue phase liquid crystals**

**Bernhard Atorf**

**University Paderborn Germany**

## Poster 2

**Free-standing H1/L3 photonic crystal cavities in cubic AlN/GaN**

**Sarah Blumenthal**

**University Paderborn Germany**

## Poster 3

**Sub-20 nm surface patterning by block copolymer lithography**

**Katharina Brassat**

**University Paderborn Germany**

## Poster 4

**Concept for the fabrication of metasurface-based optical devices with a low-cost technique**

**Christoph Brodehl**

**University Paderborn Germany**

## Poster 5

**Tailored waveguide fabrication for quantum optical devices**

**Christof Eigner**

**University Paderborn Germany**

## Poster 6

**High-Q Whispering Gallery Microdisk Resonators Based on PECVD-Silicon**

**Thomas Hett**

**University Paderborn Germany**

## Poster 7

**Maskless Reduction of Crosstalk Suitable for Flexible Electronics**

**Thorsten Meyers**

**University Paderborn Germany**

## Poster 8

**Confocal Raman spectroscopy for spatially resolved material analysis**

**Michael Rüsing**

**University Paderborn Germany**

## Poster 9

**Spatially variable polarization modulation of Laguerre-Gaussian beams**

**Christian Schlickriede**

**University Paderborn Germany**

# Posters

## Poster 10

Synthesis, Characterization and Application of Bay-Extended Perylene Derivatives

Joachim Vollbrecht

University Paderborn Germany

## Poster 11

Photonic crystal fibres infiltrated with liquid crystalline blue phases

Markus Wahle

University Paderborn Germany

## Poster 12

15.000-fold fluorescence enhancement in plasmonic nanogap antennas

Raju Regmi

Institut Fresnel, France / ICFO, Spain

## Poster 13

PT-symmetry in axisymmetric nanophotonic structures

Waqas Waseem Ahmed

UPC Spain / LENS Italy

## Poster 14

Time-resolved characterization of photonic circuits

Dmitry Nuzhdin

LENS Italy / KIT Germany

## Poster 15

Spectral phase and amplitude shaping for excitation spectroscopy of single light harvesting complexes

Vikas Remesh

ICFO, Spain / Institut Fresnel, France

## Poster 16

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Marin Pablo Palomo

KIT Germany / ICFO Spain

## Poster 17

Three-dimensional fluorescence microscopy using speckle illuminations

Awoke Atena Negash

Institut Fresnel, France / ICFO, Spain

## Poster 18

Stabilization of semiconductor amplifiers with large linewidth enhancement factors

Kumar Shubham

UPC Spain

# Participants list

| First Name        | Family Name               | email address                                                                                      | Institution          | Function                   | Pavs                               |
|-------------------|---------------------------|----------------------------------------------------------------------------------------------------|----------------------|----------------------------|------------------------------------|
| Mohammed          | ABDEIDAM                  | <a href="mailto:a.abdeidam@hotmail.fr">a.abdeidam@hotmail.fr</a>                                   | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Doha              | ABDELRAHMAN               | <a href="mailto:abdelerahman@zweilkyby.edu.qa">abdelerahman@zweilkyby.edu.qa</a>                   | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Bharath Reddy     | ADAPA                     | <a href="mailto:bharathreddy129@gmail.com">bharathreddy129@gmail.com</a>                           | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Nadeeda           | AFONKINA                  | <a href="mailto:nadeeda72@rambler.ru">nadeeda72@rambler.ru</a>                                     | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Waqas Waseem      | AHMED                     | <a href="mailto:wqas.waseem29@gmail.com">wqas.waseem29@gmail.com</a>                               | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Fadi              | AL SALTI                  | <a href="mailto:eng_fadi77@hotmail.com">eng_fadi77@hotmail.com</a>                                 | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Md. Mahbub David  | ALAM                      | <a href="mailto:mam.mahbub42@yahoo.com">mam.mahbub42@yahoo.com</a>                                 | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Bernhard          | ATORF                     | <a href="mailto:bernhard.atorf@uni-paderborn.de">bernhard.atorf@uni-paderborn.de</a>               | POE5H-Europhotronics | Partner                    | ICFO, Spain                        |
| Neily             | BARDET                    | <a href="mailto:neily.bardet@fresnel.fr">neily.bardet@fresnel.fr</a>                               | Paderborn University | PHD Student                | Germany                            |
| Aleksandr         | BARULIN                   | <a href="mailto:aleksandrbarulin@gmail.com">aleksandrbarulin@gmail.com</a>                         | POE5H-Europhotronics | Administrative Assistant   | Institut Fresnel Marseille, France |
| Sarah             | BLUMENTHAL                | <a href="mailto:sarah.blumenthal@uni-paderborn.de">sarah.blumenthal@uni-paderborn.de</a>           | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Emilie            | BORIES                    | <a href="mailto:emilie.bories47@gmail.com">emilie.bories47@gmail.com</a>                           | Paderborn University | PHD Student                | Germany                            |
| Sophie            | BOUNISSOU                 | <a href="mailto:sophie.bounissou@centrale-marseille.fr">sophie.bounissou@centrale-marseille.fr</a> | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Antoine           | BOURGADE                  | <a href="mailto:antoine.bourgade@centrale-marseille.fr">antoine.bourgade@centrale-marseille.fr</a> | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Katharina         | BRASAT                    | <a href="mailto:kbrassat@mail.upb.de">kbrassat@mail.upb.de</a>                                     | Paderborn University | PHD Student                | Germany                            |
| Sophie            | BRASSELET                 | <a href="mailto:sophie.brassellet@fresnel.fr">sophie.brassellet@fresnel.fr</a>                     | POE5H-Europhotronics | Director                   | Institut Fresnel Marseille, France |
| Christoph         | BRODEHL                   | <a href="mailto:brodehl@mail.upb.de">brodehl@mail.upb.de</a>                                       | Paderborn University | PHD Student                | Germany                            |
| Josep             | CAREDO BRU                | <a href="mailto:carcedo@icfo.es">carcedo@icfo.es</a>                                               | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Kwamin            | CHEN                      | <a href="mailto:KUCHEN@tud.konstanz.de">KUCHEN@tud.konstanz.de</a>                                 | L'Oréal              | Invited Lecturer           | France                             |
| Crina             | COIDOCARU                 | <a href="mailto:crina.maria.coiocaru@upc.edu">crina.maria.coiocaru@upc.edu</a>                     | POE5H-Europhotronics | Partner                    | UPC, Spain                         |
| Simon             | COOP                      | <a href="mailto:simcoop@gmail.com">simcoop@gmail.com</a>                                           | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Richard           | CUCCHI                    | <a href="mailto:richard.cucchi1@gmail.com">richard.cucchi1@gmail.com</a>                           | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Andrés            | DE LOS RÍOS SOMMER        | <a href="mailto:andres@ciencias.usm.mx">andres@ciencias.usm.mx</a>                                 | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Chiara            | DECAROLI                  | <a href="mailto:chiara@icfo.es">chiara@icfo.es</a>                                                 | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Liliana           | DIURDIEVIC                | <a href="mailto:liliana@icfo.es">liliana@icfo.es</a>                                               | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Hung              | DO THI XUAN               | <a href="mailto:hung.dothixuan@gmail.com">hung.dothixuan@gmail.com</a>                             | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Christof          | EIGNER                    | <a href="mailto:christof.eigner@uni-paderborn.de">christof.eigner@uni-paderborn.de</a>             | Paderborn University | PHD Student                | Germany                            |
| Emmanuelle        | FERRAROTTO                | <a href="mailto:emmanuelle.ferrarotto@upb.de">emmanuelle.ferrarotto@upb.de</a>                     | Paderborn University | PHD Student                | Germany                            |
| Jülia             | FERRER ORTAS              | <a href="mailto:juliaferrerasortas@hotmail.com">juliaferrerasortas@hotmail.com</a>                 | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Ali               | SHEHARI                   | <a href="mailto:alishari@gmail.com">alishari@gmail.com</a>                                         | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Huawei            | SIOVANNINI                | <a href="mailto:huaweio@icfo.es">huaweio@icfo.es</a>                                               | POE5H-Europhotronics | Director                   | Institut Fresnel Marseille, France |
| Lesly Marcela     | SIRALDO CASTANO           | <a href="mailto:leslysc@icfo.es">leslysc@icfo.es</a>                                               | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Guillaume         | SOARD                     | <a href="mailto:guillaume.soard@icfo.es">guillaume.soard@icfo.es</a>                               | KIT                  | Invited Lecturer           | KIT, Germany                       |
| Nadège            | SULLEM                    | <a href="mailto:nadegesullem@fresnel.fr">nadegesullem@fresnel.fr</a>                               | POE5H-Europhotronics | Administrative Coordinator | Aix Marseille Université, France   |
| Aya               | HALLAK ALWAN              | <a href="mailto:aya.hallak@upb.de">aya.hallak@upb.de</a>                                           | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Thomas            | HETT                      | <a href="mailto:thet@pavonius.uni-paderborn.de">thet@pavonius.uni-paderborn.de</a>                 | Paderborn University | PHD Student                | Germany                            |
| André             | HILDEBRAND                | <a href="mailto:andrehil@icfo.es">andrehil@icfo.es</a>                                             | Paderborn University | PHD Student                | Germany                            |
| Mohamed           | ISMAIL                    | <a href="mailto:m.ismail@icfo.es">m.ismail@icfo.es</a>                                             | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Lin               | IN                        | <a href="mailto:lin.lin722@outlook.com">lin.lin722@outlook.com</a>                                 | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Stallanus         | KESTUTIS                  | <a href="mailto:kestutis.stallanus@icfo.es">kestutis.stallanus@icfo.es</a>                         | UPC                  | Invited Lecturer           | Spain                              |
| MD Shofiqul Islam | KHAN                      | <a href="mailto:shofiqul@icfo.es">shofiqul@icfo.es</a>                                             | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Heinz             | KITZEROW                  | <a href="mailto:heinz.kitzerow@upb.de">heinz.kitzerow@upb.de</a>                                   | Paderborn University | Professor                  | Germany                            |
| Dmitry            | KUSHNKOVIKY               | <a href="mailto:dmitry.kushnko@upb.de">dmitry.kushnko@upb.de</a>                                   | Paderborn University | PHD Student                | Germany                            |
| Jörg              | LINDNER                   | <a href="mailto:joerg.lindner@upb.de">joerg.lindner@upb.de</a>                                     | Paderborn University | Professor                  | Germany                            |
| Itay              | LONG                      | <a href="mailto:itayl@outlook.com">itayl@outlook.com</a>                                           | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Alexander         | LORENZ                    | <a href="mailto:alexander.lorenz@uni-paderborn.de">alexander.lorenz@uni-paderborn.de</a>           | Paderborn University | Invited Lecturer           | Germany                            |
| Philippa          | LUANGPRASERT              | <a href="mailto:philippa.l@icfo.es">philippa.l@icfo.es</a>                                         | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Isavier           | LUNA-LABRADOR             | <a href="mailto:isaviel@icfo.es">isaviel@icfo.es</a>                                               | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Sandipan          | MAITI                     | <a href="mailto:sandipanm@icfo.es">sandipanm@icfo.es</a>                                           | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Pablo             | MARIN PALOMO              | <a href="mailto:pablo.marin@icfo.es">pablo.marin@icfo.es</a>                                       | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Thorsten          | MEYERS                    | <a href="mailto:thorsten.meyers@icfo.es">thorsten.meyers@icfo.es</a>                               | Paderborn University | PHD Student                | Germany                            |
| Elena             | MIKHEEVA                  | <a href="mailto:elena.mikheeva@icfo.es">elena.mikheeva@icfo.es</a>                                 | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Francesco         | MINARDI                   | <a href="mailto:francesco.minardi@icfo.it">francesco.minardi@icfo.it</a>                           | LENS/INO             | Invited Lecturer           | Italy                              |
| Charles           | MOISSET                   | <a href="mailto:charles.moisset@gmail.com">charles.moisset@gmail.com</a>                           | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Ilean-Yves        | NATOLI                    | <a href="mailto:ilyan.yves.natoli@fresnel.fr">ilyan.yves.natoli@fresnel.fr</a>                     | POE5H-Europhotronics | Director                   | Institut Fresnel Marseille, France |
| Awoke Atena       | NEGASH                    | <a href="mailto:awoke.negash@icfo.es">awoke.negash@icfo.es</a>                                     | POE5H-Europhotronics | PHD Student                | France-Germany-Spain               |
| Ho Nhu Y          | NGUYEN                    | <a href="mailto:nguyennhu1604@gmail.com">nguyennhu1604@gmail.com</a>                               | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Dmitry            | NUZHON                    | <a href="mailto:dmitry.nuzhon@icfo.es">dmitry.nuzhon@icfo.es</a>                                   | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Tudor             | DLARIU                    | <a href="mailto:tudor@icfo.es">tudor@icfo.es</a>                                                   | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Anna              | DVIVYAN                   | <a href="mailto:anna.dvivyana@icfo.es">anna.dvivyana@icfo.es</a>                                   | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Marta             | PADOWSKA                  | <a href="mailto:marta.padowska@icfo.es">marta.padowska@icfo.es</a>                                 | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Rastko            | PAJKOVIC                  | <a href="mailto:rastko.pajkovic@icfo.es">rastko.pajkovic@icfo.es</a>                               | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Venkata Anirudh   | PAMMI                     | <a href="mailto:anirudh.pammi@gmail.com">anirudh.pammi@gmail.com</a>                               | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Alok Kumar        | PANDEY                    | <a href="mailto:alok.pandey@icfo.es">alok.pandey@icfo.es</a>                                       | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Martina           | POSTNIKOVA                | <a href="mailto:martina.postnikova@gmail.com">martina.postnikova@gmail.com</a>                     | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Lia               | QUAN                      | <a href="mailto:lia.quan@icfo.es">lia.quan@icfo.es</a>                                             | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Riku              | REGMI                     | <a href="mailto:regmi@icfo.es">regmi@icfo.es</a>                                                   | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Vikaz             | REMESH                    | <a href="mailto:vikaz.remesh@gmail.com">vikaz.remesh@gmail.com</a>                                 | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Carlos            | REYES                     | <a href="mailto:carlosreyesdelo@gmail.com">carlosreyesdelo@gmail.com</a>                           | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Lisamudra         | ROY                       | <a href="mailto:lisamudra.roy73@gmail.com">lisamudra.roy73@gmail.com</a>                           | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Diana Paola       | RUSDA DELGADO             | <a href="mailto:diana.rusda@icfo.es">diana.rusda@icfo.es</a>                                       | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Michael           | RUSING                    | <a href="mailto:michael.rusing@upb.de">michael.rusing@upb.de</a>                                   | Paderborn University | PHD Student                | Germany                            |
| Ivan Alexis       | SANCHEZ SALAZAR CHAVARRIA | <a href="mailto:ivan@icfo.es">ivan@icfo.es</a>                                                     | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Kevin             | SCHADLER                  | <a href="mailto:kevin.schadler@europhotronics.org">kevin.schadler@europhotronics.org</a>           | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Christan          | SCHLICKRIEDE              | <a href="mailto:christian.schlickriede@icfo.es">christian.schlickriede@icfo.es</a>                 | Paderborn University | PHD Student                | Germany                            |
| Ryan              | SENTOSA                   | <a href="mailto:ryan.sentosa@icfo.es">ryan.sentosa@icfo.es</a>                                     | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Robert            | SEWELL                    | <a href="mailto:robert.sewell@icfo.es">robert.sewell@icfo.es</a>                                   | ICFO                 | Invited Lecturer           | Spain                              |
| Kumar             | SHUBHAM                   | <a href="mailto:kumar.shubham@icfo.es">kumar.shubham@icfo.es</a>                                   | UPC                  | PHD Student                | Spain                              |
| Radeemul Hasan    | SIDDIQUE                  | <a href="mailto:radeemul.siddique@icfo.es">radeemul.siddique@icfo.es</a>                           | KIT                  | Invited Lecturer           | Germany                            |
| Md. Ismail Alam   | SOB                       | <a href="mailto:ismail.sob@icfo.es">ismail.sob@icfo.es</a>                                         | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Suamita           | SREHAR                    | <a href="mailto:suamita.srehar@gmail.com">suamita.srehar@gmail.com</a>                             | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Ashish            | THATAVARTHY               | <a href="mailto:thatavarthys@icfo.es">thatavarthys@icfo.es</a>                                     | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Cesar Augusto     | VALADES CRUZ              | <a href="mailto:cesar.valades@icfo.es">cesar.valades@icfo.es</a>                                   | ICFO Paris           | Invited Lecturer           | France                             |
| Richard Nicolas   | VIBRONE                   | <a href="mailto:richard.vibrone@icfo.es">richard.vibrone@icfo.es</a>                               | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Isabelle          | VIGIAN                    | <a href="mailto:isabelle.vigian@icfo.es">isabelle.vigian@icfo.es</a>                               | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Joachim           | VOLKBRICHT                | <a href="mailto:joachim.volkbricht@upb.de">joachim.volkbricht@upb.de</a>                           | Paderborn University | PHD Student                | Germany                            |
| Tatyana           | VUVETS                    | <a href="mailto:tatyana.vuvets@icfo.es">tatyana.vuvets@icfo.es</a>                                 | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Markus            | WAHLE                     | <a href="mailto:markus.wahle@uni-paderborn.de">markus.wahle@uni-paderborn.de</a>                   | Paderborn University | PHD Student                | Germany                            |
| Binzola           | WANG                      | <a href="mailto:binzola.wang@icfo.es">binzola.wang@icfo.es</a>                                     | Europhotronics       | PHD Student                | France-Germany-Spain               |
| Christian         | WIEBELER                  | <a href="mailto:christian.wiebel@icfo.es">christian.wiebel@icfo.es</a>                             | Paderborn University | Invited Lecturer           | Paderborn University, Germany      |
| Ting              | XIAO                      | <a href="mailto:ting.xiao@icfo.es">ting.xiao@icfo.es</a>                                           | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Hemock Demestie   | FALLEW                    | <a href="mailto:hemock@icfo.es">hemock@icfo.es</a>                                                 | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Chao              | FANG                      | <a href="mailto:chao.fang@icfo.es">chao.fang@icfo.es</a>                                           | Europhotronics       | Master 2 Student           | France-Germany-Spain               |
| Zeki              | ZIRAN                     | <a href="mailto:zeki.ziran@icfo.es">zeki.ziran@icfo.es</a>                                         | UPC                  | Master Student             | Spain                              |
| Gebrehawot Tesfay | ZEWELDI                   | <a href="mailto:gebrehawot@icfo.es">gebrehawot@icfo.es</a>                                         | POE5H-Europhotronics | Master 1 Student           | France-Germany-Spain               |
| Ping              | ZHANG                     | <a href="mailto:ping.zhang@icfo.es">ping.zhang@icfo.es</a>                                         | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Anfu              | ZHANG                     | <a href="mailto:anfu.zhang@icfo.es">anfu.zhang@icfo.es</a>                                         | POE5H-Europhotronics | Master 2 Student           | France-Germany-Spain               |
| Di                | ZHANG                     | <a href="mailto:di.zhang@icfo.es">di.zhang@icfo.es</a>                                             | Europhotronics       | Master 2 Student           | France-Germany-Spain               |