

HAPPENINGS

**New Funding  
for Vitsolc**

p.6

COLLABORATION

**300+ ICFO  
PhD graduates**

p.8

COLLABORATION

**Outreach  
Volunteers**

p.9

THE LAST WORD

**Interview with  
Jaime Martorell**

p.12

Community News  
Fall 2023

54

ICFO  
ORGANIZATION

# A Breath of Fresh Air

Meet the 2023 Summer Fellows



## Community News

## 54

## INDEX

## 02 Editor's Corner

## 03 Happenings

ICFO NEWCOMERS

ICFO NEWS

LATEST ADVANCES

BUSINESS NEWS

## 07 Collaboration

TRAINING

OUTREACH

IN FOCUS

COMMUNITY

## 11 People

GO &amp; FLY

COMMUNITY PICTURES

MYSTERY ICFONIAN

## 12 The Last Word

HIGH PROFILE

SCIENCE QUIZ

## Mystery ICFonian

Solution Ed #53

## Raul Vázquez

Front desk assistant

## Science Quiz

Answers from pg. 12

1:D 2:A 3:A 4:C

## ON THE COVER

## A breath of Fresh Air

Each year, ICFO welcomes undergraduate and Master's students who spend the summer at the institute, carrying out challenging research projects under the supervision of a Group Leader and with the assistance of Postdocs or PhD students. Meet the 17<sup>th</sup> cohort of Summer Fellows and learn what they got out of the program on pg. 7.

## EDITOR'S CORNER

## Where do you get your inspiration?

## ICFOrians are actively opening their minds through a variety of activities and also helping to inspire others by sharing their passions

Some people need music to work and concentrate. Somehow it blocks out the other noise and opens the creative synapses to inspire a question, a solution, a way forward. Others are most motivated when in motion, diving into a new challenge where they will learn something new. Who doesn't find inspiration looking at something beautiful, exploring a new destination, meeting new and different people?

**This edition takes a look at many different forms of inspiration- inspired achievements, inspiring others, or getting a change of scenery to clear out the cobwebs and make room for new ideas.**

ICFO strives, through a variety of programs that it offers for non-specialists, to share the passion that so many of our researchers have for science. Fundació Catalunya-La Pedrera, having made possible **seventeen editions of the ICFO Summer Fellows program**, has in recent years reached out to 16-18 year old's to offer them insights into the exciting world of research at leading centers around Barcelona. Through their **Barcelona International Young Science Challenge (BIYSC)** they are helping young participants, fueled by insatiable curiosity, to develop an incurable addiction to science that may lead them to careers in research. The batch that visited ICFO this summer for a two week adventure had a blast! (see pg. 9).

**Frontiers Research Schools** are part of a year-round training program that ICFO offers for university students and young researchers worldwide, introducing them to thematic areas where ICFO has expertise. These schools have been operating since 2016, in recent years expanding in frequency

and diversifying in structure and location thanks in part to collaborations that ICFO has established with scientists, sometimes ICFO alumni, who are conducting research at leading institutes around the world. The first "summer school" took place at ICFO in July focusing on Photonics with free electrons, however in September, we offered the 3<sup>rd</sup> edition of the ICFO-UNAM Frontiers School, on sight in Querétaro, Mexico, on a very different topic- NanoPhotonics. Exciting new schools are on the horizon so stay tuned!

All scientists know that in order for knowledge to expand, it needs to be shared, making science a highly collaborative and interactive activity. Giving talks in conferences, sharing results in seminars, and publishing are all necessary activities to grow as a scientist. Outreach is another hugely important way of sharing science and many ICFOrians take part in outreach activities throughout the year. We asked some of these volunteers what they get out of their participation, besides the great memories and chance to inspire people who may not otherwise have the slightest idea what frontier research may tell them about the world or offer for the future. Their responses may motivate you to get involved too (read more pg.9)!

Since this issue covers our summer months, it would not be complete without a selection of pictures from ICFOrians seeking inspiration where they can find it- and find it they did!

Thanks to everyone who makes ICFO such an inspirational place!



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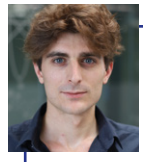


# Happenings

**ICFO NEWCOMERS**

# Welcome to ICFO

Many of us joined ICFO or took a new position at the institute between July and September



**Eduard Millat**  
Student



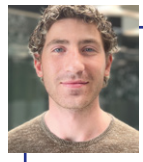
**Mohamed Ouali**  
Student



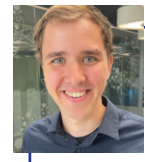
**Martin González**  
Student



**Renata Almeida Lei**  
Student



**Michael Reichenberg**  
Student



**Jelle Westerhof**  
Student



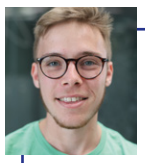
**Martina Berglund**  
Student



**Michele Miotto**  
Student



**Juan Manuel Sánchez**  
Student



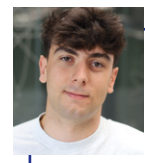
**Theo Dardier**  
Student



**Judith González**  
Student



**Beatriz Polo**  
Student



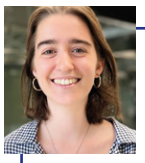
**Sergio Paniego**  
Summer Fellow



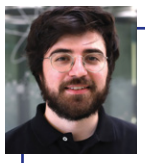
**Guillermo Gordillo**  
Summer Fellow



**Iván Salvador**  
Summer Fellow



**Georgina Tresanchez**  
PhD Student



**Giacomo Paganini**  
PhD Student



**Dibya Sarangi**  
PhD Student



**Mirko Fornasier**  
PhD Student



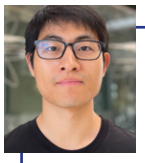
**Hana Medhat**  
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PhD Student



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PhD Student



**Hao Wu**  
PhD Student



**Martina D'Andrea**  
PhD Student



**Harini Raghavan**  
PhD Student



**Ludovica Donati**  
Visiting PhD Student



**Tamás Kriváchy**  
Postdoctoral Research



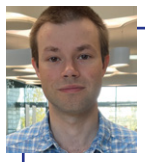
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**Mohit Lal Bera**  
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Postdoctoral Research



**Alexander Poshakinskiy**  
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**Subhajt Sinha**  
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**Rémy Vatré**  
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**Anjali Prabhakaran**  
Postdoctoral Research



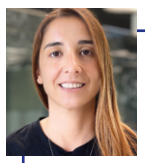
**Nicolás Mateos**  
Research Engineer



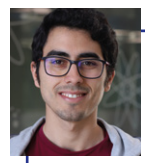
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Research Engineer



**Eric Calatayud**  
Research Engineer



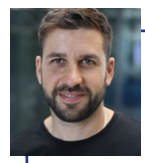
**Sofia Martins**  
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**Pierpaolo Fontana**  
Visiting scientist



**Donato Farina**  
Visiting scientist



**Cesar Bravo**  
IT Staff



**Patricia An Peña**  
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Communications



**Desirée Gutiérrez**  
Travel Support



**Laura Hage**  
Legal Counsel



**Eylem Ozkaramani**  
Librarian Assistant

**Not pictured**

**Diksha Mittal**  
Student

**Weronika Wiesiołek**  
Student

**Lucía Verdegay**  
Student

**Marcelo Terán**  
Visiting PhD Student

**Xinyang Liu**  
Visiting PhD Student

**Riccardo Castellano**  
Student

**Elsa Renirie**  
Student

**Dannareli Barron Ortiz**  
PhD Student

**Poppy Joshi**  
Visiting PhD Student

**Amir Yacoby**  
Visiting Scientist

## Happenings

### ICFO NEWS

### ICFO hosts the meeting on EuroQCI-Spain's deployment



The EuroQCI-Spain consortium partners from ICFO, UPM, CSIC, Telefonica, Indra, Tecnobit (Grupo Oesia), and Cellnex Telecom, **coordinated by ICREA Prof. at ICFO Valerio Pruneri** and Prof. Vicente Martín from the Universidad Politécnica de Madrid, gathered in Barcelona to **work on the progress of the project aimed at deploying a secure quantum communication infrastructure**, first in Madrid and Barcelona, and then expanding to other cities in Spain. They came together to discuss the **established strategies**, mainly on the design of different architectures, on how to deploy the inter and intra city networks, and define the roadmap for the upcoming months.

**EuroQCI-Spain is one of the 26 pieces of the secure quantum communication infrastructure** (EuroQCI) that covers the entire European Union, including its overseas territories. The goal is to provide European regions with quantum technologies, enabling a digital sovereignty and industrial competitiveness for the region at a worldwide level, as well as helping to meet Europe's Digital Decade target of being at the cutting edge of quantum capabilities by 2030.



### The VASCOVID project comes successfully to an end

The EU-funded project ends after two and a half years, having successfully **developed a portable, non-invasive and real-time photonics platform that monitors the microvascular health of critically-ill patients**. After several months of clinical testing in patients admitted to the intensive care unit, the device will continue the road towards commercialization, and clinicians will use it for further studies of patients with other illnesses.



### ICFO in PERTE Chip Advisory Board

The First Vice President and Minister of Economic Affairs and Digital Transformation, Nadia Calviño, chaired the constitutive meeting of the **Expert Group for the Strategic Project (PERTE) Chip** which is charged with advancing the governance of the strategic microelectronics and semiconductors project.

This advisory board will empower the PERTE Chip with the support of renowned experts, ensuring the coordination and effectiveness of the investments and actions that will be carried out within this project, and providing information and strategic guidance to maximize impact around microchip design and manufacturing.

**ICFO Director Lluís Torner is one of the eleven members of this advisory body appointed by the first vice president**, all of whom are international experts in the microelectronics and semiconductors from academia and industry.

### The US CHIPS Program office visits ICFO



**ICFO welcomed Ms. Frances Chang and Mr. William Stange, both senior members of the United States' CHIPS Program Office (CPO) working in the area of International Engagement**, as well as Mr. Jaime Martorell, the special commissioner PERTE Chip.

The visit allowed ICFO researchers with consolidated research expertise related to this field to give an overview of areas of mutual interest. Evolving projects that aim at making important contributions to PERTE Chip such as PIXSpain that focuses on the **development of photonic integrated chips**, could provide especially promising opportunities for collaboration. Visitors also met with the leaders of ICFO's spin-off Quside and Quv and visited selected quantum photonic chips facilities.

### Coordinated project to improve hydrogen production through electrolysis

**ICFO Prof. F. Pelayo García de Arquer will coordinate the new project titled Hydrogen production from purified wastewater through electrochemical treatments (RES2H2)**, with a consortium formed by experts from ICFO, DAM Group and the companies Sixsenso, Technologies S.L. and APRIA Systems S.L., **organizations that cover the entire hydrogen value chain for the proposed solution**, facilitating an effective collaboration and technology transfer between the business sector and the scientific community.

The project aims to improve the production of hydrogen from wastewater by developing electrolyzers that do not depend on highly purified and deionized water, and allow their implementation in different areas.



**The project is financed by the PERTE NextGenerationEU recovery plan for Renewable Energy, Renewable Hydrogen and Storage.**

### RSEF-BBVA Foundation Physics Awards

The Royal Spanish Society of Physics-BBVA Foundation Physics Awards have recognized creativity, effort and achievement in the field of physics annually since 2008 in order to serve as a stimulus tova.

On Monday, 25 September, **Dr. Valerio Pruneri**, ICREA professor at ICFO, Corning, Inc. Chair and leader of the Optoelectronics research group was named the **recipient of the award in the area of Physics, Innovation and Technology**, citing his "outstanding scientific and technological career at an international level at the intersection of materials physics with photonics."

The award ceremony in which Prof. Pruneri and the other awardees will receive their prize will take place in Madrid in December, 2023.

### National Young Research Award 'Felisa Martín Bravo'



The acting Minister of Science and Innovation of the Government of Spain, Diana Morant, announced the **winners of the 2023 National Research Awards**, the country's most important recognition in the field of scientific research. These awards distinguish researchers in Spain who stand out for their career and international relevance in their respective areas of research, and also recognize the merit of researchers 40 years of age or younger who have accomplished relevant achievements in the early stages of their careers.

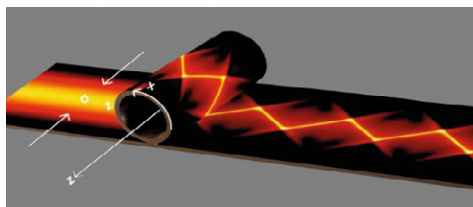
**ICFO Prof. F. Pelayo García de Arquer**, leader of the CO<sub>2</sub> Mitigation Accelerated by Photons research group, was named recipient of the 'Felisa Martín Bravo' National Research Prize for Young researchers, in the area of Physics, Materials and Earth Sciences, for his pioneering and interdisciplinary contributions to the fields with relevant applications in the generation of clean energy and the development of optoelectronic elements.

**The award cites his contributions to the manipulation of nanostructured materials, controlling their structural, physicochemical, optical and electronic properties, which have opened new approaches to the design of highly efficient solar cells, photodetectors and light-emitting diodes.**



## Happenings

### LATEST ADVANCES



### Photonic snakes give rise to a novel type of 2D frequency combs

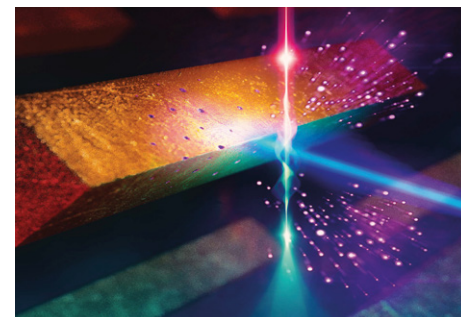
In a study published in *Nature Photonics*, a team of researchers, including ICFO Director **Prof. Lluís Torner** and several ICFO Alumni including Carles Milián, now a Professor at the Institut Universitari de Matemàtica Pura i Aplicada, Universitat Politècnica de València, Salim B. Ivars and Dr. Yaroslav V. Kartashov, have obtained two important theoretical results in the field of nonlinear optics. Firstly, they **discovered how to control the snake instabilities in cylindrical micro-resonators**. That is, by using theoretical approaches and numerical simulation tools, they engineered the micro-cavity in which they let the snake instability occur and then by “freezing” its effects, they were able to achieve a perfectly stationary spatio-temporal zig-zagged optical wave, robust and permanent in time, which they coined “Photonic Snake”. Secondly, they **theoretically showed that these photonic snakes correspond to an unprecedented two-dimensional arrangement of heterogeneous photonic rulers** or 2D frequency combs, which are all inherently synchronized and individually accessible, leading to a novel and most sophisticated optical ruler.

These findings represent a novel paradigm for frequency comb formation and pave the way towards a new research approach on frequency combs as well as on the in-depth understanding and control of dynamical instabilities in dissipative systems.

### Analyzing ultra-fast dynamics of nano structure surfaces with intense light and electron plasmas

In a study published in *Nanoscale Advances* ICFO researchers **Eduardo Dias** and **ICREA Prof. at ICFO Javier García de Abajo**, in collaboration with researchers from Ecole Polytechnique Fédérale de Lausanne, University of Geneva, Israel Institute of Technology, and University of Milano-Bicocca have developed a comprehensive microscopic theory for understanding and describing the spatial, temporal, and spectral characteristics of the generation of intense Terahertz (THz) fields on a metallic surface through the use of laser-pulse-induced electron plasmas.

The researchers carried out a thorough theoretical analysis of the spatiotemporal dynamics of the electron plasma created from the illumination of an infrared laser-pulse source ( $\lambda=800\text{nm}$ ) on a metal wedge. They specifically studied and presented **a theoretical framework that showed how the electron plasma was generated due to the illumination of the laser-pulse on the metallic surface, and how, under different conditions, this plasma evolved and behaved**. The evolution and behavior of the plasma was monitored by an electron probe that analyzed the electron plasma dynamics and the generation of the THz light radiation.

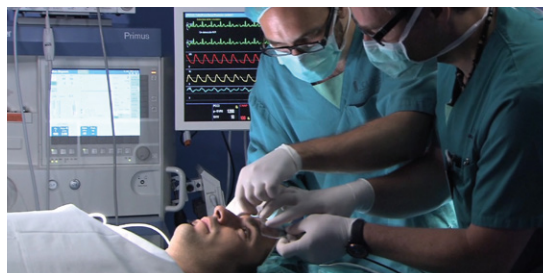


They took electron beam pulses, defined different scenarios of trajectories for the electron and for each trajectorial scenario, they studied the interaction of the electron with the plasma for trajectories that depend on the angle of approach to the metallic surface and the distance from it.

The resulting work of this study enables new approaches and insights on the generation and dynamics of electron plasmas close to metallic surfaces, and permits advancements in important applications such as sensing, spectroscopy, imaging, and in particular for understanding and describing ultrafast dynamics of complex nanoscale systems, through the use of ultrafast electron microscopes.

### Faster and efficient in-vivo measurements using a new time-domain diffuse correlation spectroscopy system

ICFO researchers **Veronika Parfentyeva** and **Marco Pagliuzzi**, led by **ICREA Prof. at ICFO Turgut Durduran** with researchers at Politecnico di Milano, Single Quantum BV and Swabian Instruments GmbH describe in *Scientific Reports* a novel system that addresses conventional limitations in time-domain diffuse correlation spectroscopy.



The reported system utilizes a superconducting nanowire single-photon detector that offers enhanced performance when compared to conventional detectors. It has a higher efficiency in detecting the photons; lower dark count noise, making the measurements more reliable; fast after-pulsing decay time, allowing for a quick recovery and faster measurements, and more precise timing of detected photons.

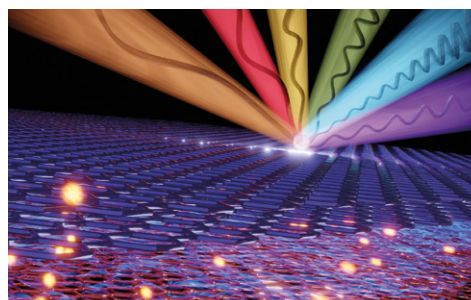
These improvements in sensitivity and speed offer promising potential for various medical applications, including monitoring cerebral hemodynamics.

The reported studies have led to the start of **FastMOT**, a funded European project where six partners will join forces to develop an ultra-high performance light sensor in different imaging techniques, aiming to radically improve the performance of deep imaging with diffuse optics.

### Researchers show radical improvement of ultra-broadband photodetection with a device based on Twisted Double Bilayer Graphene

In a new study published in *Nature Photonics*, researchers **Hitesh Agarwal** and **Krystian Nowakowski** in the **Quantum Nano-Optoelectronics group at ICFO** led by postdoc researcher **Dr. Roshan Krishna Kumar** and ICREA Prof. at ICFO **Frank Koppens**, in collaboration with researchers in the Quantum NanoElectronics and NanoMechanics group at ICFO led by **Prof. Adrian Bachtold**, and researchers at **ETH Zurich, the University of Manchester (UK), NIMS (JP) and CNRS (FR)**, report on the development of a novel **Twisted “Double” Bilayer Graphene (TDBG) ultra-broadband photodetector** capable of detecting light very efficiently in a spectral range that spans from the far-terahertz ( $100\ \mu\text{m}$  wavelength, equivalent to 3 THz) all the way to near-infrared ( $2\ \mu\text{m}$  wavelength or 150 THz) and with a good

continuous efficiency in all the range, without any gaps. The ultra-broadband photodetector has shown to have a **good internal quantum efficiency**, an enhancement of photoconductivity by interlayer screening, and **scalability** of TDBG because no gates are needed to apply the electric field in order to get the electronic bandgap.



In their experiment, the researchers carried out a thorough and comprehensible study of photo-response in TDBG. They fabricated multiple devices of TDBG and studied their photoconductivity. The methods and results of this study can serve as a guide and a benchmark for other scientists using light for studying these fascinating twisted materials. The explanation of conductivity enhancement by interlayer screening, the method to differentiate between bolometric and photoconductive response and the proposed idea of 3-dimensional stacking put forward in this paper may well be used as a basis for further research on other two-dimensional materials.

## Happenings

### BUSINESS NEWS

# A streak of new funded projects for Vitsolc

ICFO's 11<sup>th</sup> Spin-off company advances towards market solutions in transparent PV technologies



“

VITSOLC is moving forward in our quest to develop and commercialize our transparent photovoltaic technology. The support we have received through these grants over the past year has been enormously helpful in achieving our goals and also to allow us to access additional private funding that is essential for our company's growth.

We have a winning technology and are very optimistic about the advances we have made in just over two years since our constitution.

Oscar Aceves  
CEO of VITSOLC



In March 2022, after ten years of intense research from the Organic Nanostructured Photovoltaics researcher group led by Prof. Jordi Martorell, ICFO transferred to VITSOLC, ICFO's 11<sup>th</sup> spin-off company, its patented technology to produce unique transparent photovoltaic (PV) technology where visible light transmission can be largely decoupled from energy conversion.

Since that time, members of the VITSOLC team have continued to work to improve the TRL of the PV technology. Over the past months, they have received funding and new projects that will increase the marketability of their products.

### ACCIÓ Start-up Capital grant

VITSOLC is one of 20 companies to receive funding in the 2023 call for ACCIÓ's start-up capital grants. This program provides up to €100k in direct support for emerging technology start-ups that need financing to carry out the initial phases of the business, develop their product or service and validate the business model to reach the market. Beneficiaries of the first 4 calls have created 500 jobs. These same companies have gone on to secure 33.5M€ in private funding.

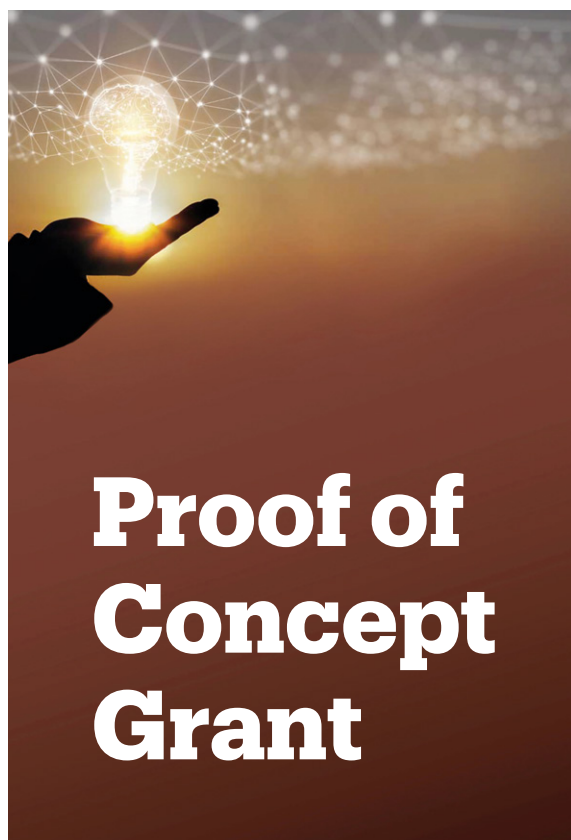
### RETOS Public-Private Collaboration

VITSOLC and ICFO were recipients of a RETOS grant from the Ministry of Science and Innovation and the The State Research Agency (Agencia Estatal de Investigación) to carry out a joint R+D+i project titled "Transparent photovoltaic windows for the Electric Vehicle" (TEV).

Funding for this project was awarded within the 2021-2023 state program to promote scientific-technical research and its transfer.

### Neotec-CDTI

The Ministry of Science and Innovation, within the plan for Recovery, Transformation and Resilience (Plan de Recuperación, Transformación y Resiliencia) financed the Neotec Projects to help launch new start-up businesses that which require the use of technologies or knowledge developed from research activity and in which the business strategy is based on the development of technology.



## Proof of Concept Grant

### ICFO Prof. Michael Krieg receives ERC funding to develop a light-efficient microscope for fast volumetric imaging of photon starved samples

The European Research Council, in its efforts to help ERC grant-holders to bridge the gap between their research and the earliest stage of a marketable innovation, created the Proof of Concept (PoC) funding scheme for researchers who have already been awarded an ERC grant. The grants are part of the EU's research and innovation program, Horizon Europe. Not only does this program help bring ERC grantees closer to the possibility of commercializing their research findings, the program complements the efforts of ICFO's Knowledge and Technology Transfer Unit (KTT), which proactively searches for ways to translate newly generated knowledge into new technologies.

The ERC has announced the 66 new PoC Grants in the second round of the 2023 competition, including a grant for ICFO Prof. Michael Krieg, leader of the Neurophotronics and Mechanical Systems Biology group, to finance the project titled **LowLiteScope**.



This project aims to develop a light-efficient microscope for fast volumetric imaging of photon starved samples. Currently, commercial solutions for bioluminescence imaging suffer from low spatiotemporal resolution, due to photon-starved samples. LowLiteScope aims to overcome these limitations by radically redesigning the optical path, data acquisition and post processing based on artificial intelligence.

## Collaboration

TRAINING

# ICFO Summer Fellows 2023

**ICFO welcomed 10 undergraduate and Master's students to spend the summer at the institute, carrying out challenging research projects under the supervision of a Group Leader and with the assistance of Postdocs or PhD students**

The Summer Fellows attended a full program of activities, including a series of Summer Lectures that introduce newcomers to the many different research lines at ICFO, as well as lab tours and other activities that allow young scientists to experience ICFO as a researcher.



**Paula García-Mochales**

Quantum Nano-Optoelectronics group led by ICREA Prof. at ICFO Frank Koppens

“

*During this fellowship I have learnt how a research group works, the dynamics between people in the same group and collaborators and how progress in physics can be achieved.*

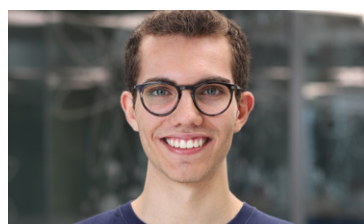


**Guillermo Gordillo Núñez**

Ultracold Quantum Gases group led by ICREA Prof. at ICFO Leticia Tarruell

“

*I did not have the opportunity to enjoy a real experimental module during my undergraduate studies, which are always more focused on theoretical work, and I wanted to know how to work in a laboratory.*



**Luis Castillo González**

Ultracold Quantum Gases group led by ICREA Prof. at ICFO Leticia Tarruell

“

*One month before I would start my position as a Summer Fellow in the Ultracold Quantum Gases group, I was invited by the group leader, Prof. Dr. Leticia Tarruell, to visit their laboratories. This friendly welcome reinforced my decision of applying to their group and helped me to fearlessly integrate into their working atmosphere.*



**Salma Zian Jamoldinova**

CO<sub>2</sub> Mitigation Accelerated by Photons group led by Prof. F. Pelayo García de Arquer

“

*I have wanted to do research since I was little. This was the perfect opportunity to experience it in first person for a considerable amount of time. The best thing about partaking in this program was seeing how it actually promotes creativity and critical thinking, very much needed in the current world.*



**Sergio Paniego**

Quantum Information Theory group led by ICREA Prof. at ICFO Antonio Acín

“

*I was struck from the beginning by the dynamic and lively environment. There is always something going on and people are very open to conversation. Where I expected a serious and formal workplace, I found myself in a more relaxed one which fosters creativity and imagination.*

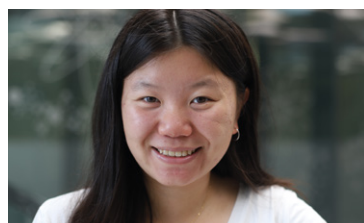


**Rafael José Fernández-Delgado Ruiz**

Quantum Nano-Optoelectronics group led by ICREA Prof. at ICFO Frank Koppens

“

*I can use everything I have learned about programming later in my final degree projects, and carrying out a project without so much supervision introduces me to what the life of a researcher is like. When I finish my degree this year, my plan is to do a Master's degree if possible in mathematics and then do a PhD in mathematics.*

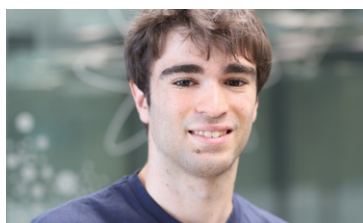


**Laia Xiao Planas**

Quantum NanoElectronics and NanoMechanics group led by Prof. Adrian Bachtold

“

*I liked the idea of research but I wanted an immersive experience in a real research project. I knew ICFO and all the excellent research lines from before and I wanted to spend a summer here learning about research, science and people.*



**Lluís Martínez Fortuño**

Neurophotonics and Mechanical Systems Biology group led by Prof. Michael Krieg

“

*My data analysis skills have massively improved. I have learnt how to manage big databases, my coding analysis have improved and I have learnt a lot of image processing and machine learning. Now I also have experience working in a Biology laboratory.*



**Emilia Topp-Johnson**

Quantum Optics Theory group led by ICREA Prof. at ICFO Maciej Lewenstein

“

*I applied to the Summer Fellows program as I wanted to gain experience in theoretical quantum physics and to meet other scientists, as well as to have an international experience in Barcelona.*



**Ivan Salvador García**

Quantum Information Theory group led by ICREA Prof. at ICFO Antonio Acín

“

*One of my greatest achievements during the program was understanding research topics that I had not faced during my undergraduate, and learning about some open problems/questions on the field of Quantum Information Theory.*

## Collaboration

### TRAINING

# Frontiers Research Schools

The schools have been operating since 2016, in recent years expanding in frequency and diversifying in structure and location



Training the next generation of scientists and technologists has always been at the center of ICFO's mission and Frontiers Research Schools play an important role in introducing **thematic research to students worldwide**, as well as offering a taste of in an international research environment. ICFO is able to magnify the reach of these schools, which incorporate a dynamic and social learning environment including lectures, group discussions, direct interactions with the lecturers, student talks, and poster presentations, by partnering with leading international organizations.

The **SPIE@ICFO Chair for Diversity in the Photonic Sciences** further strengthens these schools by making possible a number of **Travel Fellowships** for students to attend the schools, and **Research Internships** for selected outstanding students who attend a school to conduct a project with an ICFO research group.

# 300+ successful ICFO PhD graduates

## An important institutional milestone and achievement

On September 27<sup>th</sup>, twenty-two+ years after ICFO set sail on course to become a frontier research center with a mission to provide exceptional scientific training through a world leading research program, we passed the 300 ICFO PhD milestone.

This is a moment in ICFO's history to celebrate because offering the best opportunities to PhD students is one of our central missions. The PhD degree itself, the knowledge and experience gained while pursuing it, the time spent at the Institute and in Barcelona, and the friends made on the way, are all intended to boost the professional careers and personal lives of the graduates.

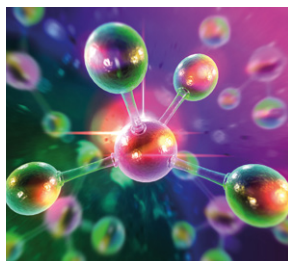
“

Reaching this milestone has been possible first and foremost thanks for the efforts, motivation and dedication of the students, but also thanks to the support of all the more experienced researchers- group leaders, post-doctoral researchers, project researchers, etc. - , and all members of ICFO's wonderful technical and management departments.

We, all together, over 22 years, made it possible that 300 of us accomplished an important professional goal.

Luis Torner  
ICFO Director

We celebrate the accomplishment of all 300+ PhD graduates, as well as the professional dedication of 2000+ ICFOnians who have helped to make these accomplishments possible!



## ICFO-UNAM International School on the Frontiers of Light: Photons in the NanoWorld

September 18-22

CFATA, Querétaro, Mexico

In 2019, ICFO teamed up with the **Centre for Applied Physics and Advanced Technology of the Universidad Nacional Autónoma de México (CFATA-UNAM)** in Querétaro, Mexico, to organize the first of a series of schools geared toward young researchers interested in light sciences and related technologies. The first School, focusing on **BioPhotonics**, was inspired by ongoing collaborations with ICFO Alumnus now a professor at UNAM, Remy Fernand Avila Foucat (Centro de Física Aplicada y Tecnología). In 2021, the series continued with a program focused on **Quantum Challenges (2021)** and this year, the third edition focused on **Photons in the NanoWorld**.

This intensive one week course that took place from September 18-22, was directed at university students wishing to enter the vibrant field of NanoPhotonics and focused on:

- **Molecular Nanophotonics.**
- **Photon Harvesting in Plants and Biomolecules.**
- **Single Molecule Biophotonics.**
- **Medical Optics.**
- **Biological applications of upconversion fluorescence nanomaterials.**
- **2D materials.**
- **Optical trapping and applications.**

### Scientific Organizers

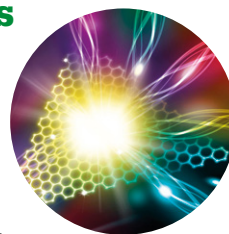
Dr. Remy Avila (UNAM); Dr. Robert Sewell (ICFO); Prof. Gonzalo Ramírez García (UNAM)

## ICFO-International School on the Frontiers of Light: Photonics with free electrons

July 5-7

ICFO

The summer began with a 3-day School, located at ICFO from July 5-7, devoted to Photonics with free electrons, providing an overview on this emerging field based on lectures by leading researchers over a wide variety of specific subjects.

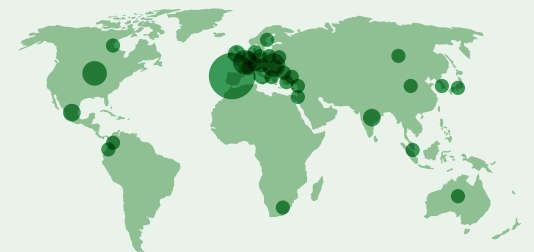


- **Instrumentation and advanced electron spectroscopies.**
- **Correlation and coherence in electron-beam interaction with photonic materials.**
- **Imaging and spectroscopy of nanomaterials.**
- **Ultrafast electron-based microscopy and spectroscopy.**

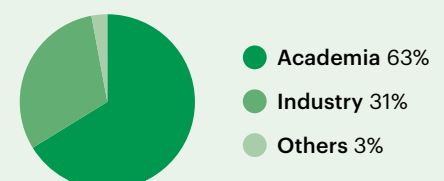
### Scientific Organizers

ICREA Prof. Javier García de Abajo (ICFO), Prof. Robert Sewell (ICFO), Dr. Giovanna Petrillo (ICFO)

### Map of where ICFO's PhD graduates are today



### PhD graduates follow careers both in academia and industry





# Collaboration

## OUTREACH



## Barcelona International Youth Science Challenge

### ICFO welcomes BIYSC students in collaboration with the Fundació Catalunya- La Pedrera

BIYSC is a two-week international science program for young people aged 16 to 18, providing the opportunity to immerse themselves in leading research centers. During the program, participants collaborate with active researchers and scientists to develop research projects.

From July 3- 14, **ICFO hosted 9 students** who were introduced to quantum cryptography as starting point to explore the different aspects of quantum physics and research. The project entitled **Quantum Physics: A Tool for New Upcoming Technologies**, included a brief introduction to linear algebra, by ICFO PhD student Antonio Sampaoli, gaining the necessary mathematical language in order to understand and operate within quantum mechanics. Then the basic principles of classical cryptography and quantum physics were introduced by ICFO Postdoctoral Researcher Dr. Samuele Grandi in order to grasp how perplexing features boost the security of communications. Finally, they applied the knowledge acquired in a computer simulation directed by ICFO Postdoctoral Researcher Dr. Javier Argüello Luengo and completed the experimental implementation of the first quantum cryptography protocol, the BB84, with ICFO PhD students Eduardo Beattie, Enes Aybar, Jonathan Hänni, Laura Zarraoa, Leo Feldmann, and María Hernández Ruiz. The BIYSC students had a unique opportunity to interact with ICFOnians and participate in hands-on, eye opening experiments, and later were able to share their experience in an enjoyable way with other BIYSC peers from around the world.

In addition, the students had the chance to explore hot topics like quantum computing, quantum communication, and quantum optics, with the help of ICFO researchers. ICFO spin-off companies LuxQuanta and Quside also opened their doors, showing their facilities and explaining their products. This exposure allowed the students to get a deeper appreciation for the research and innovation process in quantum technologies and learn how it can translate into practical applications that protect our communications.

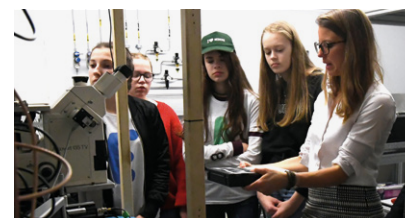


Carla Caro Villanova, a two-time ICFO Summer Fellow as well as alumna of the BIYSC program, was a great asset to the BIYSC team as a guide to this year's participants at ICFO, exemplifying collaboration and the impact of such programs.

# Outreach Volunteers

## Building skills for careers in and out of academia while sharing our passion for science with society

Participating in Outreach activities is not only rewarding, but also useful for ICFOnians' future careers. Being able to adapt the way you communicate your scientific findings to different audiences is a necessary skill valued over a wide range of career paths, as these ICFOnians can attest.



“

*Beyond the great memories, Outreach allowed me to strengthen my communication skills with immediate feedback which has been valuable to grow as a scientist.*

ICFO Alumna **Dr. Pamina Winkler**  
Postdoctoral Researcher  
at SuNMIL, EPFL



“

*When I go to a school or a community center, I must pinpoint the main idea, strip my work of technical jargon, and make it relevant for a general audience that may come in thinking quantum physics is something magical or mysterious.*

**Dr. Javier Argüello Luengo**  
Postdoctoral Researcher in  
Quantum Optics Theory group



“

*You must have very clear ideas if you want to be able to inspire someone who isn't an expert in science like you. This exercise not only makes you a better scientist, it also makes it easier to convince people to collaborate with you or fund your project.*

ICFO Alumna **Dr. Federica Beduini**  
Teacher in Training



“

*In industrial research, you may have to explain your project to a group of VIPs with no background in physics who can stop your project with the blink of an eye. You must be able to simplify everything to the most basic level, without losing the main message, to make everyone understand.*

ICFO Alumnus **Dr. Jan Huwer**  
Research and Development  
at ZEISS

### Thank you ICFO Outreach Volunteers

The following ICFOnians participated in outreach activities (July – September 2023) sharing their enthusiasm for science with new audiences:

Dr. Álvaro Cuevas, Ana Perez Barrera, Antonio Sampaoli, Dr. Bárbara Burlini Polesso, Dr. Clara Vilches Caubet, Costanza Agazzi, Diksha Mittal, Dilan Perez Paredes, Eduardo Beattie, Enes Aybar, Dr. Javier Argüello Luengo, Joana Fraxanet Morales, Jonathan Haenni, Jose-Javier Ruiz Gonzalez, Dr. Katerina Nikolaidou, Laura Zarraoa Sardon, Leo Feldmann, Lorenzo Orsini, Lukas Lau, Dr. Luis Trigo Vidarte, Dr. Marcio Taddei, María Hernández Ruiz, Mariona Bonàs Vera, Dr. Mariona Dalmases, Dr. Marta Zanoletti, Miguel Dosil, Dr. Nishigandha Patil, Dr. Raja Yehia, Rajashree Haldankar, Dr. Samuele Grandi, Tomas Lamich, Victor Roman Oliver.

📩 **Become an Outreach Volunteer**  
outreach@icfo.eu

## Collaboration

### IN FOCUS

# The Women for Africa Foundation

Supporting African women scientists like Dr. Adelaide Nicole Kengnou Telem



ICFO has had the honor of participating in the “**Science by Women**” program of the **Women for Africa Foundation** since its first edition in 2016. The program has brought senior women

scientists to ICFO to collaborate with research groups on projects of mutual interest and is an opportunity for ICFO to expand and diversify our research network, learning from colleagues with whom we might not otherwise collaborate. Through this program, the Women for Africa Foundation seeks to enable African women researchers to play a leading role in the transition of Africa to a knowledge-based and innovation-led economy through research that can be transferred into products, processes, services and technologies having impact on people’s lives.

**Dr. Adelaide Nicole Kengnou Telem** joined the **Medical Optics** research group at ICFO led by ICREA Prof. at ICFO Turgut Durduran in May 2023 for a six-month sabbatical stay. She is an electrical engineer currently employed at the University of Buea, Cameroon, within the Electrical and Electronic Department of the College of Technology. In her role as a lecturer, she is actively engaged in teaching through lectures and supervising projects at different levels, including B.tech, M.tech and Ph.D. Her primary research focus lies in the domain of Biomedical Signal and Image Processing, where she harnesses the potential of chaos systems and Artificial Intelligence (AI) techniques. Machine Learning (ML) and Deep Learning (DL), as integral components of AI, offer valuable tools for enhancing healthcare by assisting medical professionals in patient care and clinical data management.



“

**What are some of the things you have gotten out of your stay at ICFO?**

Apart from being able to concentrate on research, I am discovering many things from the (Medical Optics) team and exploring new technologies. I had never worked with the diffused optics modality before. I have discovered diffuse correlation spectroscopy (DCS) and cerebral blood flow (CBF) signal, very useful for patient monitoring in neurology. Outside of work, I have discovered the culture, and the architecture, and I have travelled to Mallorca and also Madrid.

**Tell us the subjects you teach**

We train students with skills that they can use to find work or to be self-employed. I spend a lot of time with hands-on teaching and I also take students to industries so they can learn about job opportunities. ICFOnians would be interested in our farm which is not only for agriculture, but it is an external lab where we apply new technologies, for example to automate the irrigation process using sensors that measure the temperature and the humidity and send orders to pump water to the field.

We also work with solar panels to measure the irradiation, the temperature and the output of the solar panel, and we apply machine-learning techniques to predict their efficiency and eventual defaults and maintenance... There are many interesting things.

**What have you learned here that you will apply in your research?**

What I have learned about the Diffused Optics Modalities, which align perfectly with my research objectives, will help me as a research scientist. I have new vision for research and new projects. Our institution specializes in technical education, including Biomedical Engineering with a focus on biomedical signal and imaging systems. As a lecturer in this field, my stay here will help me to train students effectively, equipping them to become highly qualified engineers in diffuse optical modalities.

**What is it like to be a woman scientist in Cameroon?**

It is not so easy! There are many more men in science- probably 80% vs 20% women. Women in science have to be really organized with their family and work activities or they cannot succeed. You need to give a lot of time to science to be visible in the world. If not, you cannot publish an article. You must prepare your lectures and be there for your students. At home you have an important job to do too and you must be present for your family.

Many women are marginalized in science because they are expected to do the work of the home. There are families in Africa that will not allow women to go to school past secondary school -they want women to be at home cooking, caring for the family. For me, it has always been different because my parents were both teachers. I always performed well in technical and scientific domains and was oriented towards the sciences and technical studies. I faced only small difficulties compared to other women.

### COMMUNITY

# ICFO Alumni Chapter in India

In July, ICFO Ambassador in India Chaitanya Suddapali, now a Reader at the Tata Institute of Fundamental Research (TIFR) in Hyderabad, hosted the first Alumni gathering in India on behalf of ICFO’s Alumni Network



From left to right: G. V. Pavan; Chaitanya Suddapalli; Rajan Jha; Goutam K. Samanta; Joyee Ghosh; Sukeert; and Anuja Padhye

Taking advantage, a natural gathering of ICFOnians and alumni attending the Photonics Conference in Bengaluru, Chaitanya organized an online meeting to launch the Chapter in India, which was followed by a dinner by those present attending the conference.

This first gathering is the starting point for upcoming events and opportunities to strengthen the network in India and to keep common ties with the institution.

# People

## GO & FLY

### Congratulations to 7 New ICFO PhD Graduates

301 ICFOnians have successfully defended their theses

Each of these ICFOnians has played an important role in ICFO's success and reputation as a leading international research institute. Honoring ICFO's tradition, ICFOnians celebrate this important personal, professional and institutional milestone and encourage you to Go & Fly! Remember that wherever you go, you will always be a part of the ICFO community.



295

**David Barcons Ruiz**  
Exploring graphene artificial superlattices and hydrodynamic plasmons

July 11, 2023  
ICREA Prof. Dr. Frank Koppens and Dr. Hanan Herzig Sheinfux



296

**Matteo Scandi**  
Information and thermodynamics

July 13, 2023  
ICREA Prof. Dr. Antonio Acín



297

**Lisa Kobayashi Frisk**  
Application and development of diffuse optical methods for the non-invasive bedside assessment of cerebral hemodynamics in the stroke unit

July 14, 2023  
UPC Prof. Dr. Turgut Durduran



298

**Chiara Mazzingui**  
Cavity-enhanced non-destructive measurements of atomic magnetism

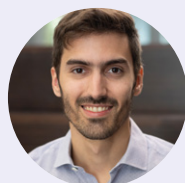
July 26, 2023  
Prof. Dr. Morgan Mitchell



299

**Mohit Lal Bera**  
Harnessing Quantum Dynamics: Heat Engines, Negative Temperatures, and Dynamical Spectroscopy

July 28, 2023  
ICREA Prof. Dr. Maciej Lewenstein



300

**Pablo R. Fernández Esteberena**  
Preclinical and clinical studies in oncology and endocrinology with diffuse light

September 27, 2023  
ICREA Prof. Dr. Turgut Durduran

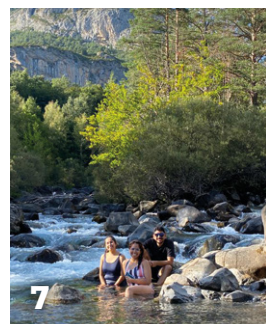
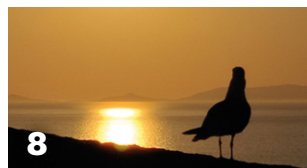
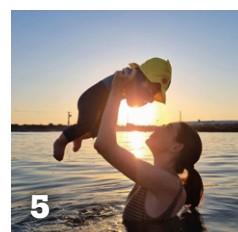
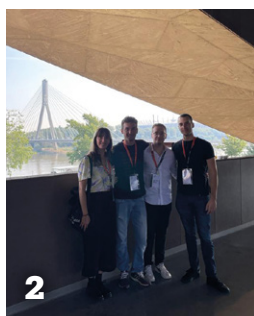


301

**Catarina Ferreira**  
Light absorption and ergodicity in systems that transform light into other forms of energy

September 27, 2023  
UPC Prof. Dr. Jordi Martorell

## COMMUNITY



### Check out some of these ICFOnians' summer adventures!

1. Andrea Morales at train street in Hanoi, Vietnam
2. SLN Team in Warsaw for CRATER Conference
3. Jacqueline Martínez at the Eras Tour Concert in Mexico City
4. Olga Lorente in Panticosa
5. Rut Torner and Joan at Platja la Marquesa
6. PhD students saying goodbye to August in a Korean barbecue
7. Andrés Quiroga, Carolina Fajardo and Jacqueline Martínez at Parque Nacional de Ordesa and Monte Perdido
8. Magda Lara sent a picture from Corsica, Italy
9. Stefano Signorini, Nico Linalés, David Kernan, Elena Nolla and Judith Salvador hiking at Comapedrosa
10. Meteor showers at Visočica mountain in Bosnia and Herzegovina by Faruk Beslija

# Mystery ICFOnian

How much do you know about the people you work with?

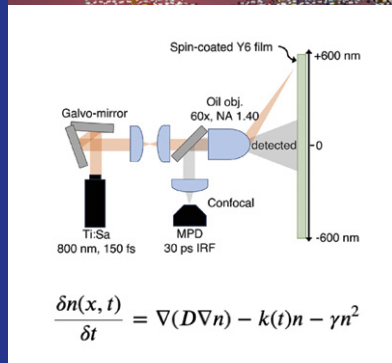
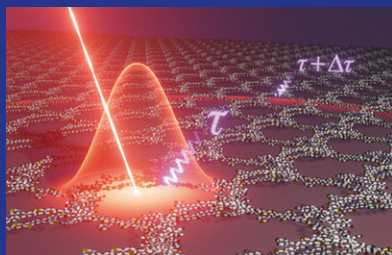
ICFOnians are a fascinating group, with hobbies, interests and talents that may surprise you. Have a look around and see if you can guess who this edition's Mystery ICFOnian is!

Look for the answer in the next edition of ICFOnians.

1. She loves plants and has around 150 at home.
2. She is interested in manual processes and arts and crafts (knitting, sewing, home-made candels...).
3. She has recently started reading manga with her son.
4. If you are craving sugar, you can always find candy in her office.
5. She/her team has done all possible team building activities.

## The Last Word

### SCIENCE QUIZ



ICFO researchers, led by GLs Niek van Hulst and Jordi Martorell, recently published in The Journal of Physical Chemistry Letters the article **“Spatiotemporal Mapping Uncouples Exciton Diffusion from Singlet-Singlet Annihilation in the Electron Acceptor Y6”**. This work used 150 fs pulses to excite excitons in Y6, and then time- and space-resolved photoluminescence to determine how they diffuse.

1. In organic solar cells, Y6 is a...

- A) Non-bofillene electron acceptor
- B) Non-gaudiene electron acceptor
- C) Non-fosterene electron acceptor
- D) Non-fullerene electron acceptor

2. The cover art (see fancy image) seems to show a ray of light hitting some molecules. Which of these best describes the spatial shape of a focused 150 fs pulse?

- A) A peanut
- B) A pancake
- C) A potato

3. The diffusion equation above, describing the evolution of the exciton density  $n$ , is nonlinear. What might be responsible for the term  $\gamma n^2$ ?

- A) Singlet-singlet annihilation
- B) The Oppenheimer effect
- C) The Southern Reach

4. Why is high-efficiency photoluminescence detection important for measuring exciton diffusion in organic solar cells?

- A) Allows studies at 1 Sun fluence
- B) Allows time- and space-resolved diffusion measurements
- C) Both of the above

Answers on pg. 2

### HIGH PROFILE

## Jaime Martorell

### Special Commissioner of PERTE CHIP within the Spanish Plan for Recovery, Transformation and Resilience

**For those who are not familiar with Spain's PERTE CHIP, can you give a short synopsis of what it is so that we might understand the enormous investment of funds and energy that is going into the initiative?**

The Spanish Strategic Project for Microelectronics and Semiconductors –known as PERTE Chip- is very ambitious and aims to position Spain as a main player in the design and manufacture of microchips. It contemplates a very large investment – EUR 12.25 billion euros to be executed through different organizations and instruments- for two fundamental reasons: the first one is that the PERTE Chip contemplates the development, construction and financing of one, two or three manufacturing facilities in the semiconductor field. Obviously, that goal requires a very large investment; the budget is EUR 9.3 billion.

The Strategic Project is also large in funding because it contemplates not only the implementation of manufacturing facilities, but also takes advantage of this opportunity to develop the entire ecosystem around the microelectronic field in Spain. It implies scientific investments, the development and design of new products and the development of those markets and those industries that intensively use those chips for their products and therefore are the traction that generates the demand for the product. It is a great opportunity for Spain to make a qualitative and quantitative leap in the microelectronic industry.

**Why are you optimistic about Spain's ability to build/strengthen a competitive semiconductor industry?**

I am truly optimistic about Spain's ability to build a competitive semiconductor industry because of its strengths and the project itself. The foundation for that development is already established through different technological areas where Spain is very competitive and excels throughout the territory. I refer to scientific research and development centers such as the BSC in Barcelona, other research facilities both in photonics and in quantum computing such as ICFO and other major Spanish centers that are already leading in Europe with their research.

We also have leading companies that stand at the forefront of technology and benefit from those products, such as technology companies, telecommunications, aerospace and defence companies etc. that drive the demand as well.

In this regard, I would like to mention that Spain is the second largest automotive manufacturer in Europe and the first manufacturer of industrial vehicles in Europe.



“

*I am truly optimistic about Spain's ability to build a competitive semiconductor industry because of its strengths and the project itself*

Therefore, there is a large domestic demand for these technologies as well. We need to focus production and investments on serving those markets where we have a leadership position, both in Spain and across Europe.

**You have been at the head of important international technologies companies in the microelectronics and telecommunications sectors. What new challenges are you facing in your governance of the PERTE Chip?**

Certainly, managing technology companies, in microchips or otherwise, requires certain skills that are common to Government and public service. But the environment itself, the ability to move things fast, to comply with all the legal requirements and the centralization of decisions, many times lengthens the process and requires political consensus to move forward. However, I remain optimistic that we will achieve our goals and will be successful in executing the PERTE Chip. This very important strategic project is a clear Government commitment, with President Pedro Sánchez and First Vice president Nadia Calviño's leadership at the forefront.

**Do you have a message or advice to offer the many ICFOrians who are conducting basic and applied research with potential implication for microelectronics, photonic chips, etc.**

I definitely have a message for those ICFOrians that are working day in and day out in some very advanced projects: I am a fan of ICFO. It is probably the research center that I have visited the most so far, and I keep going back and learning so much. So, I just want to have some words of encouragement: keep up the excellent work, you're doing a great job, and you're at the forefront of technology. And that is where everybody wants to be.

### Follow us

@ICFOrians

This edition and back-issues of ICFOrians are available at [www.icfo.eu/newsroom/newsletter](http://www.icfo.eu/newsroom/newsletter)

Please send questions, comments and suggestions to [communications@icfo.eu](mailto:communications@icfo.eu)