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Community News 59
Winter 2024

ICFONIANS

Our Community

Greater than the sum of its parts

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Mystery ICFOnian

Solution Ed #57

Nicoletta Liguori
Group Leader, Photon Harvesting in Plants and Biomolecules group

Science Quiz

Answers from p.16

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

ON THE COVER

Our Community

On December 13th we celebrated ICFO Day. The entire community took a day to turn off the computer, step out of the lab and learn more about our colleagues and the work they are doing. ICFactor talent show, a poster session, an enormous escape room adventure, lab tours, presentations, awards, and, like a cherry on the top of an ice cream sundae- the Festive Dinner celebration... We look forward to this unique ICFO tradition all year long!
Read all about it on page 12.

EDITOR'S CORNER

A Toast

Brook Hardwick
Contributing Editor

Cheers to ICFO's extended community

As we close out 2024, we propose a New Year's toast to the ambitious, creative, and generous minds that make up our extended ICFO community.

Here's to those who generously offer their time and expertise to advise our institute on its scientific direction. Our Scientific Advisory Board, which gathered in person at ICFO in October—traveling from the US, Australia, and beyond—perfectly embodies these valued collaborators. Long-time ICFO supporter and SAB member Peter Zoller captured this spirit, reflecting, "*I see the Scientific Advisory Board as an opportunity to brainstorm with friends about the future.*" How fortunate we are to have such accomplished and generous friends supporting our mission.

Here's to the ambitious European initiatives working to bridge the gap between research innovation and industrial-scale manufacturing. As we look ahead, we celebrate the growing recognition that the time has come for photonic chips to play a pivotal role in Europe's industrial competitiveness. PIX Europe, led by ICREA Prof. at ICFO Valerio Pruneri, stands at the forefront of this effort, driving forward a vision where cutting-edge photonics technology transitions from the lab to real-world impact. These initiatives remind us that scientific excellence and industrial leadership go hand in hand—building a future where Europe thrives on innovation.

In parallel, we celebrate the diverse partners who amplify ICFO's impact beyond the scientific and industrial spheres—bridging connections with the public, the arts, and broader society to spark dialogue and awareness around pressing global challenges.

One example, *The Solar Share* (p. 10), emerged from an artist residency with DISNOVATION.ORG, supported by the EU's S+T+ARTS program and co-commissioned by HacTe, the Barcelona Hub for Art, Science, and Technology. This project engaged a wide audience with the fundamental science of the PHPB group, fostering new allies for science, art, and the environment.

Here's to the next generation of scientists and technologists, launching new careers to expand knowledge and drive positive change. We celebrate all who participated in the Frontiers Schools, whether as students, lecturers, or organizers. A special round of applause to the ICONS team, who hosted SCOP24 at ICFO in early October, welcoming participants from around the world. This Student Conference of Optics and Photonics showcased not only scientific passion but also leadership—the foundation of future breakthroughs.

And, of course, here's to us—our vibrant, inspiring community of ICFOnians! Whether volunteering for outreach activities, fundraising for La Marató in support of scientific research, or simply going the extra mile to make ICFO stand out as a research center of excellence, we come together in extraordinary ways. From the intrepid entertainers of *ICFactor* to the professionals across many fields who make ICFO an exceptional place to work, we are reminded that our collective achievements are greater than the sum of their parts. ICFO Day serves as a testament to this, celebrating the diverse and talented individuals who make our community so special.

Join me in this toast—to all we have accomplished in 2024 and all the good we will achieve in the years ahead!

Coordinating Editor
Brook Hardwick
Corporate Communications Head

Editorial Committee
Silvia Carrasco
Knowledge & Technology Transfer Director

Brook Hardwick
Corporate Communications Head

Laia Miralles
HR and Education Head

Morgan Mitchell
ICREA Group Leader, Atomic Quantum Optics

Andrea Morales
Alumni, Communications

Giovanna Petrillo
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Happenings

ICFO NEWCOMERS

Welcome to ICFO

Many of us joined ICFO or took a new position at the institute between October and December

Albert Jiménez
Student

Annika Nel
Student

Cristina Penalva
Student

Derik Rochlitzer
Student

Èlia Diéguez
Student

Giorgio Trespedi
Student

Julie El Dik
Student

Juliette Tudoce
Student

Kamil Dutkiewicz
Student

Laura Arzola
Student

Leon Kasperek
Student

Marc Félix
Student

Naia Soler
Student

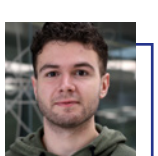
Pablo Graf
Student

Raphael Poloczek
Student

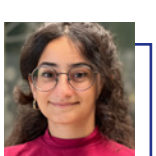
Sara Molló
Student

Wenjing Zhou
Student

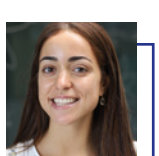
Abraham Nava
PhD Student



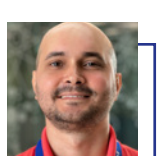
Adrián Sánchez
PhD Student



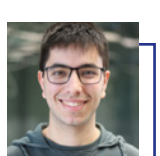
Aya Mneimneh
PhD Student



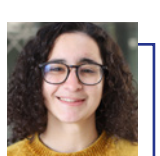
Beatriz Polo
PhD Student



Eduardo Arrufat
PhD Student



Eneko Mateos
PhD Student



Evgenia Klironomou
PhD Student

Giulia Sionis
PhD Student

Jakub Urban
PhD Student

Maribel González
PhD Student

Núria Rego
PhD Student

Sondos Elsehimy
PhD Student

Younes Naceur
PhD Student

Zoe de Bigault
PhD Student

Alessandro Cerioni
Visiting PhD Student

Federico Toffoletti
Visiting PhD Student

Grzegorz Łukasiewicz
Visiting PhD Student

Yuanbin Cheng
Visiting PhD Student

Ashley Hancock
Research Fellow

Ibrahim Akkaya
Postdoctoral Researcher

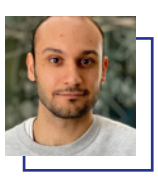
Jaime Díez
Postdoctoral Researcher

K. Soundarapandian
Postdoctoral Researcher

Luciano Pereira
Postdoctoral Researcher

Manuela de Franco
Postdoctoral Researcher

Matteo Pasini
Postdoctoral Researcher



Quentin Redon
Postdoctoral Researcher

Roberto González
Postdoctoral Researcher

Roger Tormo
Postdoctoral Researcher

Sandra Buob
Postdoctoral Researcher

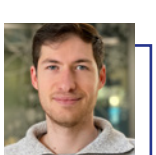
Vaibhav Gupta
Postdoctoral Researcher

Wulyu Jiang
Postdoctoral Researcher

Zoe Velliure-Pellat
Postdoctoral Researcher

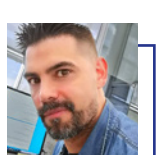
Patricia Juarez
Visiting Scientist

Cristian Boghiu
Visiting Scientist



Armand Estévez
Project Engineer

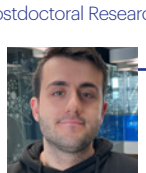
Manú Canals
Project Engineer



Raúl Vázquez
Management

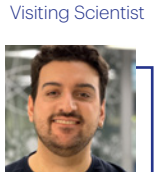
Claudia Mármol
Management

Jenifer Sotillo
Management



Pablo Gónzalez
Management

Sara Gómez
Finance Head



Stefano Pedarra
Outreach

Xènia Rodríguez
KTT

Not pictured

Ainhoa Fraile
Student

Ruth Mora
Student

Daniela Patiño
Postdoctoral Researcher

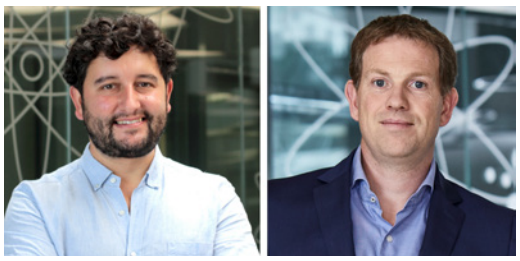
Adrian Ceferino
Visiting Scientist

Javier Fernández
Visiting PhD Student

Happenings

ICFO NEWS

Highly Cited Researchers



Clarivate Web of Science has included two ICFO Group Leaders, **Prof. Dr. F. Pelayo García de Arquer** and **ICREA Prof. Dr. Frank Koppens** in its annual list of Highly Cited Researchers, both in the Cross-Field Category.

The Highly Cited Researchers are individuals at universities, research institutes and commercial organizations who have demonstrated significant and broad influence in their field(s) of research. To determine the recently published list of influential researchers, Clarivate surveyed papers produced and cited over an 11-year period from January 2013 to December 2023 that at the end of 2023 **ranked in the top 1% by citations for their Essential Science Indicators** (ESI). Researchers are selected for their exceptional influence and performance in one of more of the 20 fields used in the ESI.

2024 Pioneer Awards

Dr. Sven Bodenstedt, who defended his thesis entitled *"Optically Detected Nuclear Magnetic Resonance Above and Far Below Earth's Magnetic Field"* in 2024 supervised by ICREA Prof. at ICFO Dr. Morgan Mitchell and Dr. Michael Tayler, was awarded one of four Pioneer Awards from the I. CERCA. This recognition is **given annually to a few outstanding thesis's from CERCA centers** that are notable for results with **clear commercial orientation.**

The Jury highlighted his thesis for "the revolutionary concept and the reduction of time and expenses with respect to current magnetic resonance systems, which are costly and difficult to make accessible to the entire population."

The UPC PERTE CHIP Chair

The UPC CHIP Chair for Advanced Architectures and Photonic Systems, driven by the Strategic Project of Microelectronics and Semiconductors (PERTE Chip), promoted by the Ministry for Digital Transformation and the Civil Service, and financed with European Next Generation funds, was launched to respond to the challenges of the semiconductor industry, promoting European competitiveness in this strategic sector. Its mission is **to attract and train new talent, as well as develop innovative technologies that strengthen digital sovereignty in Europe.** The chair is **supported by the Barcelona Supercomputing Center (BSC-CNS)**, and **ICFO**, both with links to the UPC, and 13 leading companies in technology and microelectronics.

The project is part of the PERTE CHIP state plan, which has been allocated more than 3.7 million euros from the Next Generation funds, plus an additional contribution of one million euros from the collaborating companies, who will work together with academic institutions to promote innovations that will contribute to the digital transition.

Italy's Rita Levi Montalcini Award for Young Researchers

The "Rita Levi Montalcini" Program for Young Researchers offers tenure-track research positions designed to support the independent research programs of young scientists in Italy. This year, ICFO Alumni Dr. Vito Giovanni Lucivero and Dr. Emanuele Distante were among 36 recipients of this competitive fellowship.

This prestigious award will allow Dr. Lucivero and Dr. Distante to advance their research in Italy, where they will establish and lead their own research teams.

UPC Special Doctoral Awards 2024

The Extraordinary PhD Awards, given annually by the Technical University of Catalonia· Barcelona Tech (UPC), aim to recognize the best doctoral theses which have obtained "cum laude" in their final PhD defense evaluation. This year, the UPC announced the list of seven awardees in the broad area of "Sciences", which includes the thesis of four ICFO PhD graduates among the list of extraordinary doctoral works for the academic period 2021/2022:

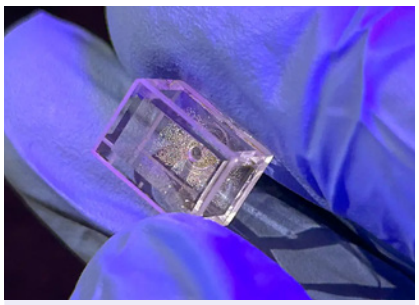
- **Ugaitz Elu Etxano:** *"High-peak-power mid-infrared OPCPAs for extreme nonlinear photonics"*, supervised by ICREA Prof. at ICFO Dr. Jens Biegert.
- **Dario Lago Rivera:** *"Remote distribution of quantum states assisted by multimode quantum memories"*, supervised by ICREA Prof. at ICFO Dr. Hugues de Riedmatten.
- **Anna Maria Dawid Lekowska:** *"Quantum many-body physics with ultracold atoms and molecules: exact dynamics and machine learning"* supervised by Dr. Stefan Wieser and Dr. Verena Ruprecht.

Dr. Vito Giovanni Lucivero defended his PhD thesis in 2016 at ICFO in the Atomic Quantum Optics group. In 2023, he moved to the University of Bari, where he is now working on establishing his own research group.

Dr. Emanuele Distante defended his PhD thesis in 2017 in the Quantum Photonics with Solids and Atoms research group at ICFO. After five years as a postdoc in Munich, Dr. Distante returned to ICFO as a La Caixa Postdoctoral Junior Leader Research Fellow.

Happenings

LATEST ADVANCES



Atomic sensors unveil hidden dynamics of molecular polarization

In Magnetic Resonance Imaging (MRI), hyperpolarization involves preparing a substance outside the body in a state where its magnetization—key to creating MRI images—is near its maximum. This process can boost the signal by thousands of times compared to its natural state.

Once hyperpolarized, the substance is injected into the patient and transported to the target organ or tissue. But before, it is crucial to confirm that the substance is adequately hyperpolarized.

With current techniques, the magnetization of the sample is often reduced during the read-out process; and the time required for measurement can be lengthy, during which the substance's magnetization naturally decays, resulting in a lack of critical data that could otherwise help maximize the efficiency of hyperpolarization. Furthermore, once the sample is hyperpolarized, it could lose its magnetization during transport to the MRI machine, which traditional techniques may fail to detect in time.

Now, a collaboration of ICFO researchers **ICREA Prof. Morgan W. Mitchell** and **Dr. Michael C. D. Tayler** and IBEC has demonstrated the ability of **atomic sensor techniques** (based on optically pumped atomic magnetometers) to non-destructively monitor, measure and optimize the hyperpolarization of some clinically relevant molecules in real-time, overcoming previous limitations. These results, reported in *PNAS*, could enhance and reduce costs of quality controls used in clinical magnetic resonance imaging.

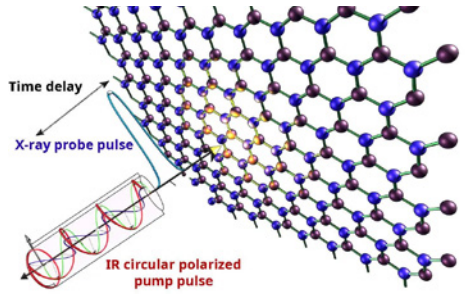
Tracing topological phase transitions with X-ray techniques

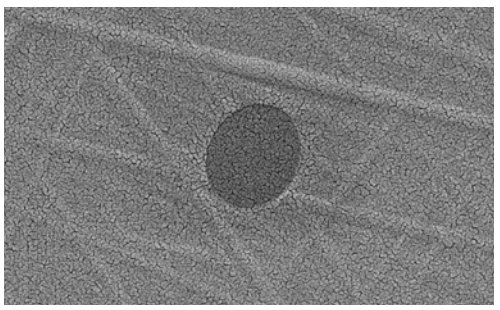
In the quantum world, non-conventional phases of matter, defined by entanglement patterns instead of atomic distribution or mobility, emerge: **the topological phases.** Altering the way particles are entangled, rather than changing their spatial arrangement, leads to a phase transition.

Topological states of matter offer the potential to create exotic materials. Their development and analysis often require femtosecond probes to capture the ultrafast topological phases. But conventional characterization schemes face a drawback: the shorter the probe pulse duration (and, consequently, the closer to capture the material's ultrafast nature), the lower the energy resolution.

Recently, a team led by Universidad Autónoma de Madrid, together with researchers from ICFO, **Dr. Emilio Pisanty**, **Dr. Alexandre Dauphin** and **ICREA Prof. Dr. Maciej Lewenstein**, and other institutions, presented a numerical experiment that demonstrates the possibility to capture topological phase transitions via an X-ray absorption spectroscopy scheme in *Reports on Progress in Physics Original Research*. **The method employs ultrashort probe pulses that do not suffer from energy resolution reduction.**

This approach could be used to study topological phases and identify topological phase transitions within some materials and will enable further studies of relevant systems for optoelectronics applications, whose investigation had so far been held back by the duration/resolution trade-off.





Researchers develop the first photon pair quantum source based on a silicon core fiber platform

Quantum technologies demand photon sources with exceptional characteristics: high brightness, minimal losses and high scalability. While bulk optics and silicon photonic integrated circuits (PICs) have been the traditional choices when third-order nonlinear parametric effects are used, they often fall short in meeting all these criteria simultaneously. Silicon core fibers, however, are showing great potential as a viable platform for quantum applications, particularly in the realm of quantum communications.

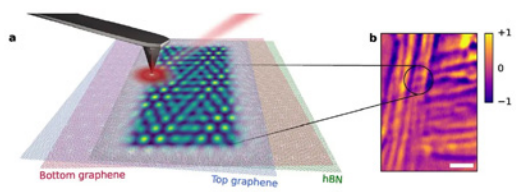
Now, a team of researchers from ICFO, **Davide Rizzotti**, **Stefano Signorini** and **ICREA Prof. Dr. Valerio Pruneri**, and the Royal Institute of Technology from Sweden reports on *APL Photonics* the first demonstration of a photon pair source based on a silicon core fiber. The novel platform offers a unique combination of low propagation losses, low cost, high nonlinearity and compactness, making it a promising candidate for scalable quantum applications.

While further developments are needed to reduce losses and improve the scalability of the platform, these low propagation losses pave the way for effective fiber-based quantum sources in the telecom band and represent a significant step towards realizing the full potential of silicon core fibers in practical quantum applications.

First spatial observation of an entire second-order superlattice in twisted bilayer graphene

These days, the scientific community has started to increase the number of layers that are twisted upon each other. This can lead to an interference effect between the moiré lattices corresponding to different pairs of twisted bilayers. Such 'moiré superlattice of two moiré lattices' have a dramatically increased periodicity, and consequently the so-called second-order superlattice (SOSL) can be spatially observed with optical techniques. However, they can only address a small subsection of the device.

A direct visualization of a whole SOSL was still lacking until, recently, ICFO researchers, **Dr. Niels C. H. Hesp, Sergi Batlle-Porro, Dr. Roshan Krishna Kumar, Dr. Hitesh Agarwal, Dr. David Barcons Ruiz, Dr. Hanan Herzig Sheinfux, Dr. Petr Stepanov,** led by **ICREA Prof. Frank H. L. Koppens,** in collaboration with NIMS and University of Notre Dame, **reported on a new type of experiment that, for the first time, maps the entire SOSL inside a twisted bilayer graphene device,** offering a deeper fundamental understanding and revealing previously hidden features of these structures.

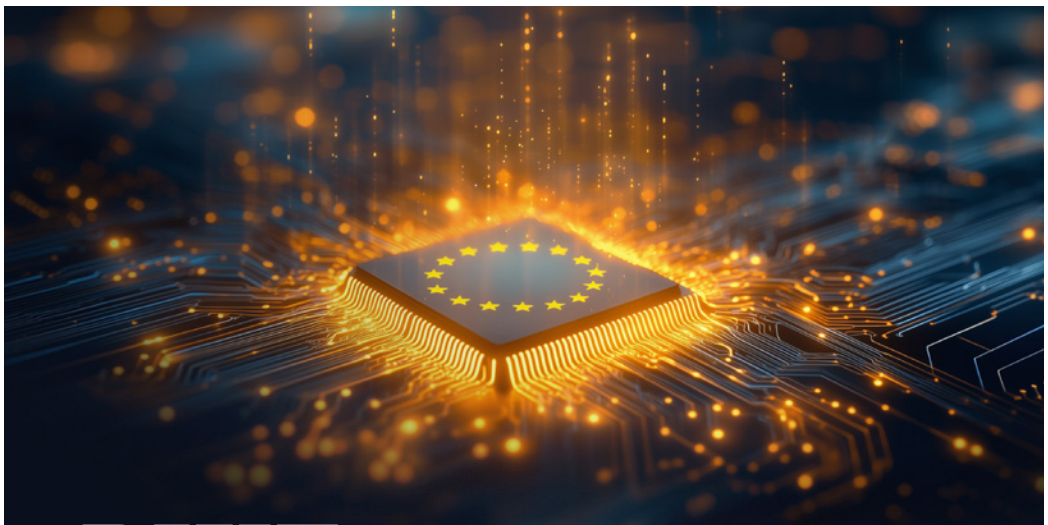


The **SOSL manifests itself when the alignment between the graphene layers coincides exactly with the 'magic angle' of twisted bilayer graphene.** Although researchers don't see any causality, this makes the physics of magic-angle twisted bilayer graphene even richer.

The study, published in *Nature Materials*, shows SOSLs are very sensitive to strain and to the twist angle between layers, and thus they could serve as a 'magnifying glass' to detect deviations of these parameters when engineering bilayer graphene devices.

Happenings

BUSINESS NEWS



PIXEurope

ICFO coordinates a consortium at the continental level to lead the European Pilot Line on Advanced Photonic Integrated Circuits

- The European Commission's Chips Programme confirms the selection of "PIXEurope", the European pilot line of photonic chips, and enters into the financial and technical negotiation phase.
- Coordinated with the support of the Ministry for Digital Transformation and of Civil Service of the Government of Spain, and the Generalitat of Catalonia, PIXEurope will mobilize investments of about 400 million euros to offer unique technological capabilities to industry.

Every year, the needs of the digital society increase significantly, evidenced by the global market for photonic integrated circuits (PICs) production, which is expected to grow by more than **400%** in the **next 10 years**. By the end of the decade, the global photonics market is expected to exceed **1,500 billion euros**, a figure comparable to the entire **annual gross domestic** product of Spain, and of which photonic chips currently represent only a small percentage.

This remarkable growth is spurred by the demand for devices for applications in areas such as telecommunications, AI, image sensing, automotive and mobility, medicine and healthcare, environmental care, renewable energy, defense and security, and a wide range of consumer applications sectors.
The necessary features and specifications for such applications are provided by the combination of microelectronic chips and photonic chips. The former are responsible for information processing by manipulating electrons within circuits based on silicon and its variants, while the latter **uses photons in the visible and infrared spectrum ranges in a wide variety of materials.**

Within the framework of the European Chips Strategy, the so-called **European Chips Act**, the European Commission has announced the creation of **PIXEurope, a new European pilot line for photonic chips that aims to offer cutting-edge technological platforms**, transforming and transferring innovative and disruptive integrated photonics processes and technologies to accelerate their industrial adoption. The **objective is the creation of European-owned/made technology in a sector of capital importance for technological sovereignty,** and therefore for the creation and maintenance of the corresponding jobs in the Union.

The European Commission has selected this programme as its **5th pilot line** and has chosen the **proposal led by ICFO** to coordinate it at continental level. The pilot line consortium also involves participating entities from **Austria, Belgium, Finland, France, Ireland, Italy, Poland, Portugal, the Netherlands and the United Kingdom.** The pilot line is co-financed by the Ministry for Digital Transformation and the Civil Service of the Government of Spain and supported by the Generalitat of Catalonia.

Within Spain, entities from the autonomous communities of Catalonia, Valencia, Madrid and Galicia are directly participating, and the entire national community in the sector will benefit. These institutions are:

- Institut de Ciències Fotòniques (ICFO) - Coordinator.
- Universitat Politècnica de Valencia (UPV).
- Inst. Microelectrónica Barcelona, IMB-CNM (CSIC).
- Universidad Carlos III Madrid (UC3M).
- Universidade de Vigo (UVigo).

Over the next 10 years and during the operational phase, the pilot line will boost the production capacity and innovation potential of European companies to a new level, allowing them to develop and manufacture prototypes of their products based on photonic chips. It will support research organizations in bridging the gap between the laboratory and the factory exploiting novel scientific results and accelerating the commercialization of this research, in particular by supporting the creation of new start-ups.

In particular, the pilot line will contribute to the design and development of an optimized manufacturing chain, involving end-users and industry partners for the evaluation of production processes to be transferred to industrial scale, with the ultimate aim of creating a unique European PICs ecosystem, with **open access services** to the user, establishing itself as the **first fully integrated open access PICs pilot line in the world.**

PIXEurope is the first Photonic Chip Pilot Line in Europe that unifies diverse materials, processes, and integration techniques that will allow the development and demonstration of devices and systems for all applications where Photonics is a key technology.

Valerio Pruneri
ICREA Prof., ICFO Group Leader and director of the pilot line

I am Delighted to collaborate in PIXEurope, bringing Tyndall's expertise in advanced packaging to help the Pilot Line build the full technology supply chain. Europe needs to scale-up its integrated photonic capabilities and the PIXEurope consortium is set to address this grand challenge.

Peter O'Brien
Head of Packaging at the Tyndall Institute in Ireland

PIXEurope will facilitate the wide adoption of advanced photonic integrated circuits produced using the standardized design kits and foundry processes pioneered in Europe. Advanced photonic chips will offer game changing advances in speed, power-efficiency and precision.

Kevin Williams
Chair of the Photonic Integration group at the Technical University of Eindhoven in the Netherlands

Collaboration

RESEARCH

A Meeting of ICFO's Scientific Advisory Board

Esteemed members of the international scientific community meet at ICFO to provide expert council on the scientific direction of our institute

ICFO's Scientific Advisory Board (SAB) brings together leading scientists from around the world who contribute to the strategy and high-level evaluation procedures accompanying research conducted at ICFO. The SAB is composed of internationally distinguished scientists who advise ICFO's Director and Board of Trustees on key matters concerning the scientific development of the institute.

On October 17-18, the SAB came together at ICFO for a productive meeting where they were briefed on key aspects of the evolution of the center's scientific program and where they were able to interact with members of all research groups to hold technical discussions on key topics of interest. Two days of intense interactions made it possible for SAB members to offer guidance on the strategic scientific direction of the institute.

ICFO's Scientific Advisory Board (SAB) includes:
(L-R bottom row): **Lluis Torner**, **Maria Yzuel** (Universitat Autònoma de Barcelona), **Halina Rubinsztein-Dunlop** (University of Queensland), **Michal Lipson** (Columbia University), **Ignacio Cirac** (Max-Planck Institute of Quantum Optics, CHAIR), **Oriol Romero-Isart.**
(L-R top row): **Alexander Gaeta** (Columbia University), **Rolf Tarrach** (University of Luxembourg), **Donna Strickland** (University of Waterloo, Nobel Laureate), **William D. Phillips** (National Institute of Standards and Technology, Nobel Laureate), **Peter Zoller** (University of Innsbruck).

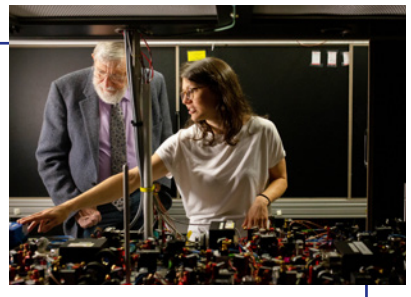
** Not pictured Anna Fontcuberta i Morral (École Polytechnique Fédérale de Lausanne)*

This has been a particularly productive meeting, thanks to the efforts of all the members who were able to make it to ICFO to meet in person and share perspectives. We have all learned a lot and are eager to play some role in the ongoing success of ICFO.

Ignacio Cirac, director of the Max-Planck Institute of Quantum Optics, is the Chair of the SAB

I'm not good at dispending wisdom, what I'm good at is asking questions. Everyone thinks that this is an act of generosity, but it's not, it's a chance for me to see learn about new things.

William D. Phillips



It is interesting to be here to see what the institute is doing and to brainstorm about the best directions it could explore.

Halina Rubinsztein-Dunlop

Humility, determination, and ambition are core values at ICFO. Having the opportunity to carefully listen to our Scientific Advisory Board, given their experience and wisdom, is extremely valuable to us. We are full of enthusiasm and motivation to apply their guidance as we continue ICFO's positive evolution with the highest ambition to pursue disruptive research with a long-term scientific vision during this post-startup phase. We thank them for their important role and contribution to ICFO's future.

ICFO Director, Oriol Romero-Isart

A poster session and lab visits gave research groups the opportunity to share interests and achievements with members of the SAB

Presentation from the ICONS student organization

Collaboration

TRAINING

Frontier Research Schools

ICFO's Frontier Research Schools offer young researchers and students worldwide a first introduction to a thematic research area and a taste of an international research environment. These schools incorporate a dynamic and social learning environment and are offered in partnership with leading international organizations.

This Fall two schools were organized in collaboration with the LaserLab- Europe project.

Frontiers Research School on Advanced data processing methods

October 9-11, 2024

Data analysis and treatment is a key skill for experimental science. Beyond determination of the signal to noise of the detection scheme and applying an error analysis, there exist a plethora of methods to extract meaningful information from the measurement.

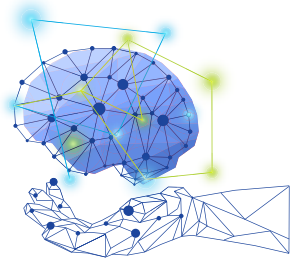
Independent of the physical origin, the statistical significance of data determines which methods produce the most meaningful representation of the physics. Machine learning methods are just one example, others are nonlinear hypersurfaces for singular value decomposition methods.

This 3-day training school introduced various methods, developing an understanding of when to use each method, and providing hands-on practice with examples. These methods are applicable to both spectroscopy and imaging.

The event also included lectures and hands-on tutorials, networking sessions, student talks, and a poster session, offering participants the opportunity to interact and present their own research.

Organizing Committee: Prof. Jens Biegert, Prof. Robert Sewell, Dr. Giovanna Petrillo

Hands-on course on MINDLAB: "Manipulating and Investigating Neural Dynamics for Learning and Ageing in the Brain"



November 12-15, 2024

The core faculty of the ICFO-MINDLAB, organized a successful school to introduce cutting edge technologies to study neuroscience at the molecular, cellular and systems in a **combination of lectures and hands-on experience** leading to group projects.

What is MINDLAB?

MINDLAB is an interdisciplinary creative playground, rooted squarely in academic rigor, comprised of research groups from ICFO and beyond. The program focusses on advancing fundamental knowledge on how the mind emerges from the behavior of individual molecules, neurons and brain networks but also on creating and commercializing transformational future technologies with outstanding potential to positively impact society.

The school aimed to expose participants to the state-of-the-art of photonics-based technologies tailored to monitor a hierarchy of scales in the study of the brain. Its core expert faculty from ICFO was complemented by diverse affiliated adjunct faculty plus clinical and corporate partners, and was supplemented by invited lecturers covering topics related to Horizon 2020 Project, TinyBrains, whose work has led to the development of a tomographic, non-invasive imager of brain function for newborns with severe congenital heart defects.

Lecturers: Prof. Turgut Durduran (ICFO), Prof. María García-Parajo (ICFO), Prof. Michael Krieg (ICFO), Prof. Nicoletta Liguori (ICFO), Dr. Pablo Loza-Alvarez (ICFO), Prof. Morgan Mitchell (ICFO), Prof. Martin Lauritzen (University of Copenhagen, *TinyBrains talk*), Dr. Jennifer M. Lynch (Children's Hospital of Philadelphia, *TinyBrains talk*), Dr. Giovanna Coceano (SciLifeLab), Prof. Ilias Tachtsidis (University College London), Prof. John Kennis (Vrije Universiteit Amsterdam), Prof. Jordi Soriano (University of Barcelona), Prof. Pau Gorostiza (Institute for Bioengineering of Catalonia), Ute Hochgeschwendter (Central Michigan University).

There was a strong hand-on element to this school, where participants were able to engage in lab sessions focused on the latest photonics technologies. Each lab session allowed participants to work directly with advanced equipment and gain valuable practical skills in the following labs:

- **Super resolution Light microscopy and Nanoscopy,** led by Dr. Pablo Loza-Alvarez.
- **Neurophotonics and Mechanical Systems Biology,** led by Prof. Michael Krieg.
- **Medical Optics,** led by Prof. Turgut Durduran.
- **Photon Harvesting in Plants and Biomolecules,** led by Prof. Nicoletta Liguori.
- **Single Molecules Biophotonics,** led by Prof. Maria García-Parajo.

Organizing Committee: Dr. Pablo Loza-Alvarez, Prof. Turgut Durduran, Prof. Michael Krieg, Dr. Lorenzo Cortese, Prof. Nicoletta Liguori, Prof. Niek van-Hulst, Prof. María García-Parajo, Dr. Ariadna Martínez, Ms Judith Salvador, Dr. Giovanna Petrillo, Dr. Miguel Ángel Moreno.

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement no. 871124, 101138041 and 101017113.

ICFO-TIFRH Frontiers Research School: Hot topics in Quantum and Nanophotonics

October 23-25, 2024

The 2nd edition of this school highlighted the strong and growing collaboration between ICFO and the Tata Institute of Fundamental Research Hyderabad. This event brings together leading experts and young researchers to explore cutting-edge advances in photonics, fostering knowledge exchange, networking, and lasting scientific connections.

Internship opportunities were available for talented students attending the school to spend time at ICFO, supported by SPIE.

Collaboration

TRAINING

SCOP '24

October 2-4, 2024

More than 100 students in Optics and Photonics gathered at ICFO from across Europe for SCOP24 – the Student Conference in Optics and Photonics. The event engaged young scientists in a variety of activities, including invited and contributed talks, a multi-day poster session, and several focused workshops.

Supported by the societies EPS, Optica, and SPIE, the conference successfully fostered a community of peers with diverse backgrounds and a shared enthusiasm for science and common practical goals: acquiring the tools to navigate an early career in research, from innovative laboratory methodologies to best practices for mental well-being. Organized by ICONS (ICFO Organization and Network of Students), the event greatly benefited from the support of many ICFOnians and several student chapters from Catalan, Spanish, and European universities.

Diversity was one of the conference's strengths. At every level, from the organizing committee to the plenary talk schedule, the participation of members from underrepresented communities was encouraged. Additionally, an anti-discrimination support team was available throughout the conference. The event also upheld sustainability principles, with all food provided being vegan.

In total, the conference hosted six keynote speakers: **Prof. Nicoletta Liguori** (ICFO, Barcelona), **Dr. Maja Colautti** (CNR-INO, Florence, Italy), **Dr. Carlos Abellan** (Quside, Barcelona), **Prof. Teri Odom** (Northwestern University, Chicago, US), **Dr. Alba Cervera-Lierta** (BCS, Barcelona), and **Dr. Fernando Guiomar** (University of Aveiro, Portugal). Additionally, 24 students presented their research during the plenary sessions.

SCOP24 also provided participants with opportunities to present scientific posters, visit ICFO laboratories, and engage in informal discussion sessions. Each day, attendees gathered in the cafeteria for "coffee & Q&A" sessions, where they discussed topics such as parenthood in academia, the scientific publishing system, and the ongoing fight for gender equity in science.

The program included a parallel workshop session, where small groups of students participated in hands-on workshops on science-related topics. These included a session organized by the **mental health initiative, a "2Tonnes" workshop** on the climate crisis, and seminars on Python-based techniques for AI and outreach.

SCOP24 organizing committee:
Jessica Angulo Capel, Javier Arrés Chillón, Marta Cagetti, Valentina Gacha, Rebecca Hoffmann, Tomas Lamich, Sidney Palardonio, Alejandra Padilla Camargo, Bianca Turini.

Contributing student chapters:
Hbar Omega (Erlangen, DE).
Optica Students Chapter at University of Aveiro (Aveiro, PT).
USCOPTICA/LUZADA (Santiago de Compostela, ES).
Photonicats (Barcelona, ES).
Optica Mental Health Initiative (Online).

"SCOP24 was a refreshingly broad conference that went beyond research to address the societal and personal challenges in our field—covering topics from environmental impact to mental health and equity in academia. With its broad and inclusive scope, there was something valuable for almost everyone in the optics community.

Arianne Brooks (She/Her)
PhD student, ETH Zurich

SCOP was a fantastic opportunity to connect with talented young researchers worldwide. It is truly inspiring to see science progress in fields other than one's own. Photonics is in great hands.

Gerard De Mas Giménez (He/Him)
PhD student, Universitat Politècnica de Catalunya

* Building Skills and Strengthening Community: Annual PhD Training Days

This **well-established annual event** serves as a solid foundation for **seeding essential skills** and fostering the **ICFO PhD student community.** New PhD students spend time together, engaging in hands-on learning while also enhancing the social aspect of their journey.

Through interactive sessions, discussions, and shared experiences, this event helps lay the groundwork for both **academic and personal growth**—creating connections that last well beyond the training days!

Collaboration

OUTREACH

Photosynthesis: Inspiration for collaborations that bridge science and art

The EU's S+T+ARTS in the City Artists in residency initiative helps bring research in the Photon Harvesting in Plants and Biomolecules group to society through a creative alliance

We were motivated to launch this challenge to inspire conversations between researchers and society, in particular with artist that could help us find ways to not only explain to large audiences the importance of fundamental science, but also to put into much larger context the type of research that we are performing in our group. It has been an amazing experience.

Prof. Dr. Nicoletta Liguori
ICFO

ICFO's **Photon Harvesting in Plants and Biomolecules (PHPB)** group led by Prof. Nicoletta Liguori is part of the institute's **Clean Planet program**, exploiting the underlying physics of light interactions with matter to develop and implement renewable, clean energy technologies that can contribute to the mitigation of climate change. There are many pieces of this puzzle and the PHPB group utilizes experimental and computational tools to explore the regulatory mechanisms governing sunlight harvesting in photosynthetic organisms. They aim to deepen the fundamental understanding of natural photosynthesis in order to potentially uncover strategies to optimize the utilization of solar energy in photosynthetic organisms.

Recognizing an urgent priority for the environment, the group is working to engineer photosynthesis for a more sustainable future, a challenge that led them to participate in the EU's **S+T+ARTS in the CITY initiative** which brings artists into research centers through a residency program with the goal of enhancing art-driven innovation. The 9-month residencies enabled artists, host institutes, and local experts like HacTe (the Barcelona Hub for Art, Science and Technology), to reflect and develop the artwork.

The Challenge

Understanding and engineering photosynthesis for a more sustainable future

How does photosynthesis function at the molecular scale, and can we improve it? Unveiling the processes governing light-harvesting regulation in plants could advance sustainable agriculture. The PHPB group invited artists to support the scientific challenge of making plants even stronger allies in the fight against climate change.

Artists from DISNOVATION.ORG responded to the challenge by creating "THE SOLAR SHARE: An Edible Solar Currency". This project challenges prevailing economic models with insights from sunlight-harvesting organisms, crucial to the metabolism of life on Earth. Staged as a one-square-meter microalgae bioreactor, the artwork foregrounds human energy dependence on photosynthesis and proposes harvested edible microalgae as a ra Artists from DISNOVATION. ORGdical economic unit: The Solar Share. This unit is the biomass produced on one square meter of the Earth's surface that day. This edible algae unit is a photosynthetic proof of work that can be consumed, exchanged, or stored as a currency. The Solar Share is an invitation to experience first-hand a transformative economic model that reintegrates human metabolism and energy needs with the actual new energy entering the Earth system as photosynthesis. The Solar Share provocatively re-centers Earth's metabolism in economics, redefining sustainability within planetary limits.

The Solar Share was produced with the support of the S+T+ARTS program of the European Union, and co-commissioned by HacTe. It was inspired by the conversations held with the Photon Harvesting in Plants and Biomolecules research group (ICFO) during the research phase of the project.

* Sharing the *Solar Share* with Society

At the ***Open Forum on Arts Science and Technology*** at the **Sònar +D festival** in Barcelona in June 2024, Prof. Liguori and Dr. Michal Gwizdala, a postdoc in the PHPB group, joined Nicolas Maigret from the artistic collective DISNOVATION.ORG to discuss their collaboration. Soon after, the artwork was showcased for the first time at ARS Electronica Festival in Linz , Austria.

Finally, in late October, an organizing committee from ICFO, Vrije Universiteit Amsterdam, and HacTe, expanded the discussion at ***Photosynthesis at the interface of Arts, Sciences and Society***, an interdisciplinary discussion examining the dynamic intersection between science and the arts, with a focus on photosynthesis for societal impact. The event aptly took place at the beautiful, modernist *Hivernacle* in Barcelona's Parc de la Ciutadella. By bringing together researchers and artists, the dialogue examined both scientific and creative approaches to understanding and harnessing this vital biological process, from the microscopic mechanisms of photosynthesis to large-scale applications such as regenerative life support systems for human space missions.

The event featured the participation of ICFO **Prof. Nicoletta Liguori**, and **Nicolas Maigret** from the artistic collective DISNOVATION.ORG, and added further perspectives from **Prof. Francesc Gòdia Casablancas**, director of the Melissa Pilot Plant project and UAB professor as well as **Raoul Frese**, physicist at the Vrije Universiteit Amsterdam and Head of the Hybrid Forms Lab, who offered an array of examples of inspired artistic collaborations where they were able to communicate aspects of their scientific programs. Artist and environmentalist **Paula Bruna** described projects in which she was able to palpably humanize science through her art. **Irma Vilà i Òdena**, professor at the Universitat Oberta de Catalunya whose work is rooted in science and engineering and who is also actively involved in creative practice and cultural research, and in hybrid research projects spanning science, culture and curating, moderated this event.

The event was funded by the European Commission, with the support of the Department of Culture of the Generalitat de Catalunya. The event also received support from the Ajuntament de Barcelona.

Collaboration

OUTREACH

Medical Photonics for the Classroom

ICFO launches a new platform with resources for high school students

The "Medical Photonics for the Classroom" platform has been designed and developed by the Outreach team in close collaboration with the Medical Optics group and was partially funded by **Fundació Catalana per a la Recerca i la Innovació (Oró Grant 2023).** This innovative online resource is designed to provide secondary school teachers with tools and materials to introduce students to the fascinating world of medical photonics. The platform is divided into several sections, each focusing on different aspects of medical photonics. These include introductory materials on the basics of photonics, detailed explanations of various medical technologies, and engaging flash talks and research projects. Additionally, the platform contains a series of educational videos and hands-on activities to do in classrooms that cover topics such as light and living matter, tomography, pseudoscience, and the detection of biological tissues.

As part of the program, the outreach team offers training sessions for teachers to facilitate and expand the use of the platform. To officially launch this platform, ICFO hosted a training session event for high school educators, kicking off with an introduction to ICFO and the field of photonics.

After that, attendees enjoyed an insightful talk on medical photonics given by **ICREA Prof. at ICFO Dr. Turgut Durduran, leader of the Medical Optics group**, emphasizing the non-invasive and precise diagnostic techniques that utilize light. The main highlight of the evening was the presentation of the new educational platform given by Dr. Lucía Castillo García from ICFO's Outreach team. The event concluded with an engaging hands-on workshop, where educators had the opportunity to explore the various activities and materials available on the platform. This interactive session provided valuable insights into how these resources can be effectively integrated into the classroom to inspire the next generation of scientists. Teacher's in attendance were pleased with the platform, with one sharing, *"The resources ... are well-designed to target the level of students that I work with and the content is focused on engaging experimental activities."*

The launch of this platform marks a significant step forward in bringing ICFO's research into the classrooms, providing teachers with the support they need to bring cutting-edge scientific knowledge to their students. As per experience gained in introducing the *ICFO Maciej Lewenstein Quantum school for Teachers* into classrooms, the outreach team anticipates future training and workshop for both teachers and students to solidify implementation of the platform.

More info at
www.outreach.icfo.eu

CARLA Camp

December 12, 2024

The fifth edition of the CARLA Camp – the Photonics Career Symposium, hosted by ICFO on the 12th of December was enthusiastically received by participants. **17 speakers** from diverse backgrounds shared experiences with **nearly 150 students and early-stage researchers**, offering them the chance to discover the exciting career opportunities within the ecosystem of photonics and learn about some of the trends in photonics, including personalized medicine, AI and photonics, and photonics chips.

Photonics in 5 minutes!

November 8, 2024

ICFO celebrated **Science Week** coordinated by the *Fundació Catalana per la Recerca i la Innovació* (FCRI) on November 8th with a **Photonics in 5 Minutes** activity, which enabled high school students to immerse themselves in the world of photonics through short talks given by four ICFOnians, with extra time for Q&A about their work and daily lives as researchers. A total of 540 students registered for the event to learn about research in areas like photosynthesis, super-resolution microscopy as well as miniaturization of magnetic sensors.

Thank you ICFO Outreach Volunteers

The following ICFOnians participated in outreach activities (October – December 2024) sharing their enthusiasm for science with new audiences: Dr. Alastair Cunningham, Dr. Alina Hirschmann, Alisa Tanaka, Antonio Sampaoli, Dr. Ariadna Martinez, Dr. Barbara Polesso, Prof. Dr. Carmen Rubio Verdú, Dr. Clara Vilches i Caubet, Diana Méndez Ávalos, Eric Calatayud Gómez, Georgina Tresanchez, Jacqueline Martínez García, María Hernández Ruiz, Dr. María Marsal, Dr. Markus Teller, Martina Berglund Solé, Mirko Fornasier, Dr. Mariona Dalmases, Paula Alonso, Rajashree Haldankar, Dr. Rajesh Bera, Prof. Dr. Robert Sewell, Dr. Romain Veyron, Santiago Tabares, Dr. Stefan Forstner, Prof. Dr. Turgut Durduran, Dr. Viktoriia Holovanova.

Become an Outreach Volunteer
outreach@icfo.eu

Collaboration

COMMUNITY

ICFO Day 2024

A celebration of talent, creativity and community

ICFO Day 2024, **the annual celebration organized by ICFOnians for ICFOnians,** took place on Friday, December 13, 2024. This unique and highly anticipated event featured a variety of activities, bringing together all areas of the institute to celebrate colleagues' achievements and showcase the year's highlights.

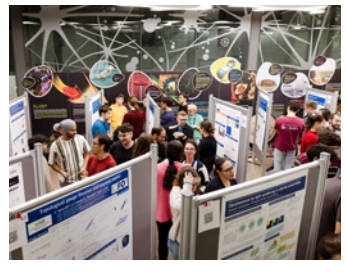
The festivities kicked off on the afternoon of December 12 with the **Posters Session,** where researchers gathered to discuss posters displayed in the Nest hall throughout the week. Following this, ICFOnians filled every corner of the NEST Hall to watch and applaud their creative and talented colleagues who performed in the third edition of **ICFactor** (also known as *ICFO's Got Talent!*). Performances included dancing, singing, poetry recitation, group hypnosis, monologues, and acroyoga, with a record number of participants.

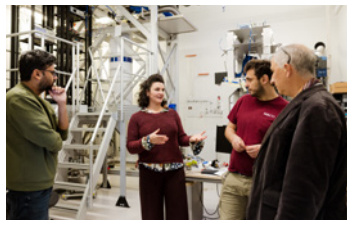
The celebration resumed early on Friday, December 13th with a community breakfast to energize everyone for a full day of activities. The first half of the day took place in ICFO's Castelldefels facilities. The **informal morning program focused on networking and community interactions.**

Around 80 ICFOnians participated in the **'Salvation' escape room,** an activity that fostered collaboration by bringing together colleagues from different areas of the institute to work together to solve an "environmental crisis". Later, volunteers **opened labs** to fellow ICFOnians, presenting the work and focus of their groups to other researchers and members of administrative units.

The second half of the day's events took place at the **World Trade Center in central Barcelona.** There, the entire ICFO community gathered in an auditorium to celebrate scientific and personal achievements within ICFO and beyond.

Prof. Roel Baets, emeritus professor at Ghent University, was invited to offer a **Keynote talk** on ***'Silicon Photonics: trends, opportunities and challenges'***, a highly relevant area of activity to many in our field and a strategic area for international investment by governments around the world. Additionally, Professors Michael Krieg and Maciej Lewenstein offered engaging presentations on the science and significance of the **2024 Nobel Prizes in Medicine and Physics,** respectively. Dr. Clara Vilches, a longtime advocate for sustainable research practices in research, enthusiastically shared the news of the launch of a **new Sustainability Committee at ICFO.**





Collaboration

COMMUNITY

Following a warm **address by Prof. Dr. Oriol Romero-Isart** who experienced ICFO Day for the first time as ICFO's director, the program highlighted individual achievements with the following recognitions:

Postdoc Mentoring Award

Dr. Aleksandra Sierant, Research Fellow at Atomic Quantum Optics research group. *"Aleksandra has an extraordinary ability to provide exactly the right kind of support when it's needed. She notices things others miss, whether they're scientific challenges, personal struggles, or emotional hurdles".*

Dr. Christoffer Moller, Research Fellow at Quantum NanoElectronics and NanoMechanics research group. *"Chris is not only quick to help solve problems directly but also guides you in a way that encourages learning and growth, empowering you to tackle challenges independently".*

Dr. Clara Vilches, Staff Researcher at SLN and Medical Optics research groups. *"Clara met with all her mentees regularly, described to them the methods utilized which were outside their areas of education, helping physicists and engineers learn experimental biology methods".*

Dr. Daniel Urrego, Postdoctoral researcher at Quantum Engineering of Light research group. *"Daniel's mentorship isn't just about the technical side of research; he genuinely cares about the people he works with. He creates a positive, supportive environment and goes out of his way to help others grow".*

Dr. Viktoriia Holovanova, Postdoctoral researcher at CO_2 Mitigation research group. *"She has a unique ability to break down complex concepts into manageable steps, empowering her mentees to build confidence in their problem-solving skills".*

Poster Prizes

Posters that had been on display in the Nest Hall all week were evaluated in two categories:

PhD Committee's Poster Prize winners

Giacomo Franceschetto, from the Quantum Information Theory group led by ICREA Prof. Dr. Antonio Acín, for the poster *"Harnessing quantum back-action for time-series processing".*

Valentina Gacha, from the Organic Nanostructured Photovoltaics research group led by Prof. Dr. Jordi Martorell, for the poster *"Advancing photoelectrochemical water splitting and CO_2 reduction: Material's engineering and light management to enhance $BiVO_4$ photoanode performance".*

ICONS Popular Prize for Best Poster: Sponsored by ICONS, this award was chosen by popular vote

Ibtissam Ghailan Tribak, from the Medical Optics research group led by ICREA Prof. Dr. Turgut Durduran, for the poster *"A new multimodal neuro-monitoring approach to study neuronal mechanisms in young infants".*

2023 Thesis Prizes

Outstanding theses from the 2023 cohort of PhD graduates were recognized in three fields:

Experimental Field

Dr. Ipsita Das, in the research group led by Prof. Dmitri Efetov: *"Investigation of the Interaction Driven Quantum Phases in Magic-Angle Twisted Bilayer Graphene".*

Dr. Craig Chisholm in the research group led by ICREA Prof. at ICFO Dr. Leticia Tarruell: *"Raman Dressed Bose-Einstein Condensates with Tunable Interactions: Topological Gauge Theories and Supersolids".*

Theoretical Field

Dr. Valerio Di Gulio in the research group led by ICREA Prof. at ICFO Dr. Javier García de Abajo: *"Nanophotonics with charged particles".*

Industrial Field

Dr. Yongjie Wang in the research group led by ICREA Prof. at ICFO Dr. Gerasimos Konstantatos: *"Eco-friendly solar cells with cation-engineered $AgBiS_2$ nanocrystals".*

15-year ICFOnians award

Eight ICFOnians were honored for 15 years of contributions to the institute

David Artigas: Staff Scientist, UPC Prof. and Head of ICFO Academic Liaisons.

Turgut Durduran: ICREA Prof. at ICFO and leader of the Medical Optics research group.

Jose María Beato: Mechanical Workshop.

Daniel Mitrani: Electronics Workshop.

Johann Osmond: NanoCharacterization Facility.

Gerasimos Konstantatos: ICREA Prof. at ICFO and leader of the Functional Optoelectronic Nanomaterials.

Rob Sewell: Staff Scientist, Head of Academic Affairs and International Relations.

Frank Koppens: ICREA Prof. at ICFO and leader of the Quantum Nano-Optoelectronics research group.

The evening concluded with everyone's favorite part of the day- the festive cocktail dinner (and dancing!) where we relaxed and celebrated in the company of our friends and colleagues.

The organization and celebration of ICFO Day involves many people who work and volunteer their time to make this great celebration happen every year. A heartfelt thanks to everyone who contributed to the success of this special event!

Graduating Class of 2024

All 2024 PhD graduates were recognized for the important achievements culminating in the presentation of their doctoral theses. Read more on page 14.

LA MARATÓ 2024: ICFOnians amb la Marató activities

This year marked the fifth edition of the ICFOnians for la Marató activities organized to raise money to promote scientific research and raise social awareness of diseases. It all started in 2019 with a group of ICFOnians volunteering to organize a program of activities to support this famous telethon in Catalonia.

Five editions later, more and more ICFOnians volunteer their time to organize and attend these activities: yoga classes, a football tournament, bake sales, the photo contest, a Social run, a self-defence session, and a seminar about 'Air Quality and Health'.

This year's fundraising efforts will be dedicated to respiratory diseases, a group of diseases that affect a large part of the population and have a great impact on quality of life and life expectancy.

Thank you to all volunteers and ICFOnians for your efforts. Together we helped to raise €1970.

People

GO & FLY

Congratulations to 11 New ICFO PhD Graduates

342 ICFOnians have successfully defended their theses at ICFO

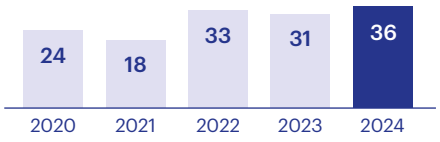
Each of these ICFOnians has played an important role in ICFO's success and reputation as a leading international research institute. Honoring ICFO's tradition, ICFOnians celebrate this important personal, professional and institutional milestone and encourage you to Go & Fly! Remember that wherever you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


2024 PhD graduates at ICFO Day

ICFO PhD Graduates in numbers


36 PhD Graduates in **2024**

Theses defended in the last 5 years



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Jessica Angulo

Imaging and Analytical Tools to Study the Spatiotemporal Dynamics of Protein Export

October 14, 2024
ICREA Prof. Dr. María García-Parajo & Dr. Felix Campelo Aubarell

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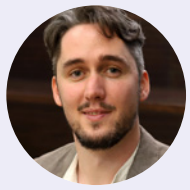

Lukas Dominik Lau

Integrin dynamics and mechanobiology in leukocytes - A multiscale tracking study

October 22, 2024
ICREA Prof. Dr. María García-Parajo

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Hung-Wei Sun

X-ray absorption fine structure with attosecond soft X-ray pulses for condensed matter physics

November 11, 2024
ICREA Prof. Dr. Jens Biegert

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Daniel Goncalves

Novel approaches for quantum technologies with atoms and photons in free space

November 15, 2024
ICREA Prof. Dr. Darrick Chang

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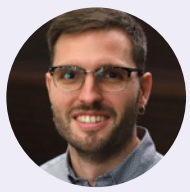

Roger Tormo

A non-linear carbon nanotube mechanical resonator near the quantum ground state of motion

November 18, 2024
ICFO Prof. Adrian Bachtold and Dr. Christoffer Moller

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Sandra Buob

Quantum-gas microscopy of strontium Bose- and Fermi-Hubbard systems

November 22, 2024
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Marina Cenni

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November 25, 2024
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Krystian Nowakowski

Graphene-based Moiré superlattices under opto-electronic spotlight: Bloch oscillations, single photon detection, and polarization-resolved photocurrents

December 11, 2024
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Lorenzo Orsini

A Topological Nanophotonics platform based on hyperbolic phonon-polaritons

December 19, 2024
ICREA Prof. Dr. Frank Koppens

People

COMMUNITY


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So much has taken place at ICFO in the past months

1.- 6. **International Food Festival**

Activities to raise money for La Marató

7. Fun Run participants
8. Football Tournament
9. Bake sale

10.- 13. **Sustainability at ICFO- our recycled holiday trees**

Mystery ICFOnian

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

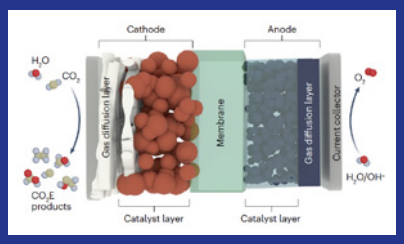
ICFOnians are a fascinating group, with hobbies, interests and talents that may surprise you. Have a look around and see if you can guess who this edition's Mystery ICFOnian is!

Look for the answer in the next edition of *ICFOnians*.

1. She loves musicals, and she invested a full month learning Hamilton rap songs by heart.
2. She takes pride in knowing a large number of ICFOnians by name.
3. She hasn't missed a single ICFOnians book club or bake sale.
4. She is a big supporter of her neighborhood football team, UESA, and never misses a game!

The Last Word

SCIENCE QUIZ



The group of F. Pelayo García de Arquer, together with researchers in Barcelona, Australia and Canada, assess the challenges of global-scale conversion of CO_2 to valuable carbon-based materials in Belsa et al.

"Materials challenges on the path to gigatonne CO_2 electrolysis"

Nature Materials,
June 2024.

1. The image shows a membrane electrode assembly (MEA). If the membrane passes anions, should the electrolytes on left and right be

A) acidic?

B) basic?

C) either?

D) neither?

2. In this context, what is the Nernst overpotential?

A) the voltage required to convert CO_2 and H_2O into reaction products

B) the extra voltage necessary due to inefficiencies

C) The ΔG in $\Delta G = \Delta H - T\,\Delta S$

D) An unpublished work by Oscar Wilde

3. How much CO_2 is now produced by human activity in one year?

A) about 40 kt (kilo-tonne)

B) about 40 Mt

C) about 40 Gt

4. The world's reserves of Copper | Silver | Platinum | Titanium are (in Mt)?

A) 870 | 0.5 | 0.07 | 700

B) 870 | 700 | 0.5 | 0.07

C) 700 | 0.5 | 0.07 | 870

D) 870 | 0.07 | 0.5 | 700

Answers on pg. 2

HIGH PROFILE

Roel Baets

Emeritus Professor, Ghent University and imec

"As a tax payer, I want to see Europe's competitiveness strengthened. I believe that the five pilot lines should make sure that the technologies they develop will eventually be transferred to a manufacturing setting, preferably in Europe.

As a pioneer of silicon photonics, what drew you into this field?

In the '80s and '90's I was mostly focused on integrated photonic devices and circuits made of III-V semiconductors, and in the late '90's my team began exploring the potential of high index contrast in waveguide based devices. We realized that this would require nanometer-accurate fabrication precision, which at that time was very hard to do in III-V semiconductors. Since silicon technology was much more advanced in its patterning capability, and furthermore I was affiliated with imec in addition to Ghent University at the time, there was an obvious opportunity to use silicon as a model system to explore high index contrast photonic devices. In those early years, conventional wisdom had it that "silicon does not have exciting optical properties", but starting in the early 2000s, we and others demonstrated a variety of optical components with excellent properties on the basis of the process and tool set of a CMOS foundry, in particular deep-UV optical lithography. That caught the world's attention and now, 20 years later, the field has matured to the point that high speed silicon photonics transceivers are manufactured by the millions each year and have found their way into the data centers of this world.

Of those evolving today, what applications of PICs do you personally find most exciting?

The most widespread application today is indeed to provide high bandwidth interconnect for distances from meters to kilometers in data centers by means of pluggable transceivers. The next big thing will likely be shorter-distance interconnect solutions with even higher bandwidth and bandwidth density with electrooptic conversion very close to the electronic processors and to memory. This will serve advanced computer engines, amongst others for AI.

There is a myriad of other application areas in a wide range of markets, most related to sensing functionalities. I estimate that 100 - 200 companies around the world are in the process of developing non-transceiver products in which an integrated photonic chip – silicon or other - forms the heart of the system. A dozen or so of these companies already have a product in the market, even if the volumes are still very modest. I have a soft spot for any product that contributes to the quality of life of people or the quality of "life" of high value critical infrastructure. Some of these applications hold the promise of growing to large market volume, but I believe we should also cherish applications that have a substantial societal value (and associated economic value), even if their market volume will remain moderate.

What is your opinion on the CHIPS JU Pilot lines, especially on PixEurope that ICFO is coordinating?

The pilot line is a non-industrial fabrication facility where new process flows are being researched and developed for semiconductor devices and circuits, aiming at TRL-levels of 6 or 7, but not all the way to 8 or 9, which is needed for manufacturing of industrial products. The pilot lines can support the development and prototyping of new products for fabless companies, but not commit to the actual chip manufacturing for products in the market. As a tax payer, I want to see Europe's competitiveness strengthened. I believe that the five pilot lines should make sure that the technologies they develop will eventually be transferred to a manufacturing setting, preferably in Europe. Solid scenarios for such a transfer should be an essential deliverable of each such project. The pilot lines should not wait till the end of the project to develop a plan. The work should start from day 1.

You are a scientist that has worked with both private and public sectors. What competencies have you had to develop that allow you to bridge the interests of such a wide range of stakeholders?

I believe the most important competency for both sectors is to be entrepreneurial. This requires being able to figure out what you would like to achieve; sizing up the boundary conditions under which you are operating; convincing others with a good plan to get approval or funding for this endeavor; and finally execute and harvest. Repeat that cycle over and over again. Each successful cycle gives a lot of personal satisfaction and makes you better for the next. A less successful cycle gives a lot less satisfaction but also makes you better for the next one.

Likewise, nihil sine labore. You need the skill (or is it the gift?) of being able to work hard- something not all people do successfully. My recommendation is that you make sure you can fall back on good family and/or friends for quality time outside hard work. Speaking for myself, my wife, my children, and now my grandchildren, have helped and continue to help a lot for that matter.

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