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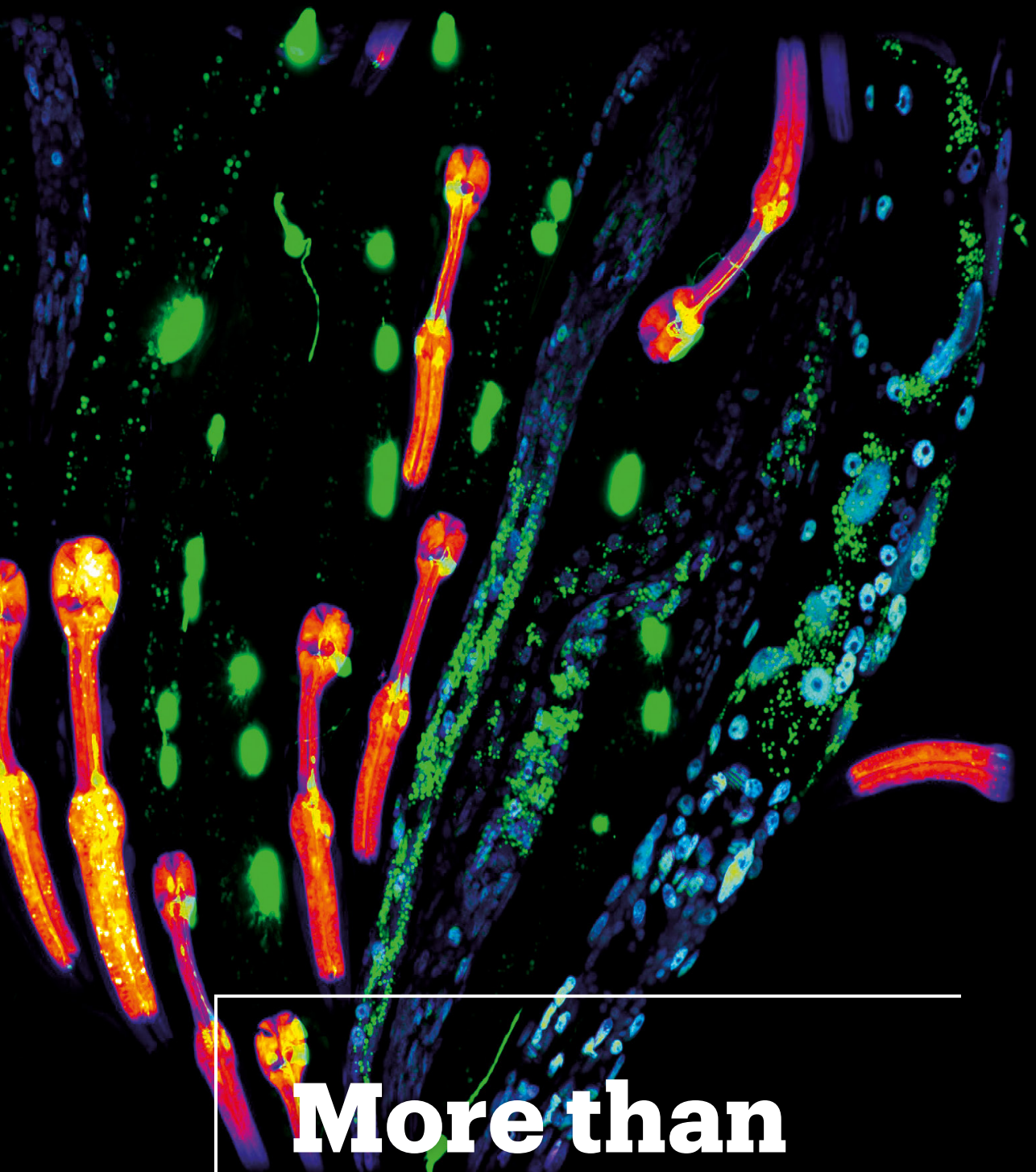
ICFONIANIAMS

Community News
Spring 2023

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More than Meets the Eye

Photonics helps to discover
the secrets of life



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SCIENCE QUIZ

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Solution Ed #51

Javier García de Abajo

ICREA Group Leader,
Nanophotonics Theory

Science Quiz

Answers from p.12

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

ON THE COVER

More than Meets
the Eye

Thanks to the Neurophotonics and Mechanical Systems Biology group for this beautiful image: *The transgenic C. elegans generated by a new established technique called fluorescent landmark interference (FLInt)*: The background strain (blue) ubiquitously expresses tdTomato fluorescent marker in nuclei. The transgenes (shown in red and green) were introduced into tdTomato landmark after cutting gene by CRISPR/Cas9. This fluorescence conversion greatly simplifies the transgenesis process for researchers using *C. elegans* as a model organism. The method is described in Malaiwong et al., 2023 (G3 Genes|Genomes|Genetics).
Read more on pg. 8.

EDITOR'S CORNER

Growth Spurt

Having successfully (some would say spectacularly) completed our first 20 years of life, ICFO has officially left behind its infancy... and continues to grow

I have had some fun applying the metaphor of the "twenty-year-old kid" to our institute today. It is a handy framework for considering the wide range of themes that run through this edition of *ICFOnians*.

The most obvious parallel is our recent growth spurt. Many assumed that we would reach our optimal size with the occupation of the Mir-Puig building, however as our research ambitions have grown, so has our need for space. When the UOC, our former neighbors who until recently occupied the IN3 building adjacent to ICFO CELLEX NEST, transferred their activities to a central Barcelona campus, the Generalitat of Catalunya was able to cede this additional building to ICFO. Once refurbished (and that is a multi-level challenge on its own), it will give us the space to develop strategic national and international projects we currently lead linked to quantum materials and photonic chips, and to develop facilities and services we will need during the next decade.

Not only are we maturing physically, we are proving to have quite a good head on our shoulders. One of the first news highlights we published this year was of the Paul Ehrenfest Best Paper award for Quantum Foundations which was awarded to Toni Acín and Marc-Olivier Renou for their big hit publication "Quantum theory based on real numbers can be experimentally falsified" (not the first time Toni Acín has received this recognition). ICFOnians' proven expertise in research areas that will have an important impact on society motivates members of the national and regional governments to visit ICFO to discuss ongoing areas of mutual interest.

Another indication of our growing level of maturity is our ability for introspection, where we evaluate not only what we are doing well, but what we can do better. Our annual celebration of *ICFOnians for Women in Science Month* is a moment that the ICFO community sets aside each year to celebrate the contributions of women and to promote actions that will facilitate a more equitable and productive scientific enterprise for all. In this context, the Diversity Committee was also able to unveil diversity guidelines for events to ensure that our institute promotes and observes the best practices for sharing science and networking.

It has been exciting to see ICFO's very own Mentoring program take off. The program is powered by members of our alumni network who, having taken and applied the training they received at ICFO, are in a position to give back to the community by sharing their experience with 3rd and 4th year PhD students. Once you reach a certain point in your career it is interesting to be able to reach back and help the next generation take their own steps forward, be it through the mentoring program or through the numerous outreach activities that aim to promote scientific vocations.

Finally, I would be remiss if I concluded without a mention of ICFOnians' tendency towards FOMO (fear of missing out). I have only listed a small sampling of projects, achievements and activities that have taken place at ICFO over the past couple of months. With so many exciting things to discover and so much inspiration at our fingertips, we are of course tackling the world with the energy and enthusiasm that you would expect of a "kid" our age. This is a spirit that we aim to never outgrow.



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Happenings

ICFO NEWCOMERS

Welcome to ICFO

Many of us joined ICFO or took a new position at the institute between January and March



Eva Jou Ollé
Student



Julia Cikos
Student



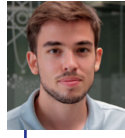
John B. Cardenas
Student



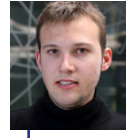
Tomás Levy-Yeyati Franzé
Student



Adrián Sánchez
Student



Teodor Parella Dilmé
Student



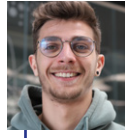
Jakub Urban
Student



Vera Moerbeek
Student



Rachel Rae
Student



Todor Krasimirov
Student



Nick Toledo
Student



Mariana Navarro
Student



David Pascual Solis
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Ashfaq Ahammed
Student



Laia Serradesanferm
Student



Èlia Solé Cardona
Student



Marc Miranda
Student



Laura Carreté
Student



Orlando J. Solorzano
Student



Alejandra Padilla
Student



Yanliu Li
Student



Léo Willig
Student



Alberto Rodriguez-Moldes
PhD Student



Erik Recio Armengol
PhD Student



Sandra Rodrigues
PhD Student



Enric Perez
PhD Student



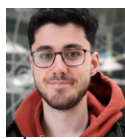
Martina D'Andrea
PhD Student



Anna Steffinlongo
PhD Student



Antonio Sampaoli
PhD Student



Timothy Heighthman
PhD Student



Ranit Ram
PhD Student



Panagiotis Tselifis
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Samira Nooshnab
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Oscar Beltrán
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Luca Cavicchioli
Visiting PhD Student



Andrea Zanoni
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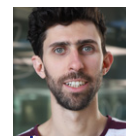
Luca Mariani
Visiting PhD Student



Carmelita Rodà
Postdoctoral Researcher



Pere Mujal
Postdoctoral Researcher



Nicolás Linale
Postdoctoral Researcher



Denitza Denkova
Postdoctoral Researcher



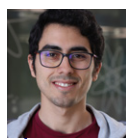
David Jansen
Postdoctoral Researcher



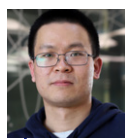
Sarah Hirthe
Postdoctoral Researcher



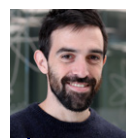
Chunyu Li
Postdoctoral Researcher



Pierpaolo Fontana
Postdoctoral Researcher



Lu Xia
Postdoctoral Researcher



Ignacio Perito
Postdoctoral Researcher



Yongjie Wang
Postdoctoral Researcher



Ranieri Vieira Nery
Postdoctoral Researcher



Blazej Jaworowski
Postdoctoral Researcher



Nima Taghipour
Postdoctoral Researcher



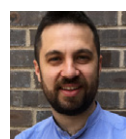
Francesco Andreoli
Postdoctoral Researcher



Yanan Li
Visiting Scientist



Allan Johnson
Visiting Scientist



Gianvito Lucivero
Visiting Scientist



Giulia Piccinini
Research Engineer



Daniel Senciales
Electronics



Albert García Celma
Logistics



Anna Domínguez
Human Resources Staff



Eylem Ozkaramanli
Librarian Substitute



Carmen Rubio
Group Leader

Not pictured

Mariona Bonàs
Student

Antonis Delakouras
Student

Lucas Mascaró
Student

Carlos Gas
Student

Gustavo Balvedi
Student

Judit Donada
Student

Joel Compte
Student

Ilia Lykov
Student

Karen Pérez
Student

Jonas Kuijpers
Student

Yuma Watanabe
PhD Student

Eleanor Munger
Visiting PhD Student

Meritxell Riquelme
Visitor Laser Lab

Victor Torres
Visiting Scientist

Xinyang Liu
Visiting Scientist

Happenings

ICFO NEWS

Paul Ehrenfest Best Paper Award for Quantum Foundations 2022



The *Paul Ehrenfest Best Paper Award for Quantum Foundations*, given by the Institute for Quantum Optics and Quantum Information in Austria, is awarded to the **most significant paper in foundations of quantum physics, theoretical or experimental, published in a peer-review journal** in the five calendar years prior to the prize call.

ICFO researchers Dr. Marc-Olivier Renou and ICREA Prof at ICFO Dr. Antonio Acín, in collaboration with Prof. Nicolas Gisin from the University of Geneva and the Schaffhausen Institute of Technology, Armin Tavakoli from the Vienna University of Technology, and David Trillo, Mirjam Weilenmann, and Thanh P. Le, led by ICFO alumnus Prof. Miguel Navascués, from the Institute of Quantum Optics and Quantum Information (IQOQI) of the Austrian Academy of Sciences in Vienna have been named recipients of the 2022 award for their paper titled **'Quantum theory based on real numbers can be experimentally falsified'**, published in *Nature*.

The researcher group led by Prof. Acín was also the recipient of this award in 2016 and 2018.



New Faculty Member and Group Leader: Carmen Rubio

ICFO's NEST program, supported by Fundació Cellex and Fundació Mir-Puig, allows the institute to offer outstanding opportunities for young scientists aiming to start and lead an independent research group. In Spring 2023 **Prof. Dr. Carmen Rubio Verdú will join ICFO as a new faculty member and Group Leader**.

Prof. Rubio, who comes from the Freie Universität Berlin, will lead a program focused on the study of electronic correlated phases in two dimensional materials.

BIST Ignite Awards



The Barcelona Institute of Science and Technology's Ignite Program promotes the initiation of new collaborations among BIST researchers, facilitating the exchange of knowledge among different scientific fields and exploring new approaches to address complex questions.

Multidisciplinary projects that received "seed" funding in 2022 were eligible to apply for the second phase of funding to begin a second research phase.

Two outstanding multidisciplinary projects have now been awarded grants to continue their work. ICFO participates in one of these projects.

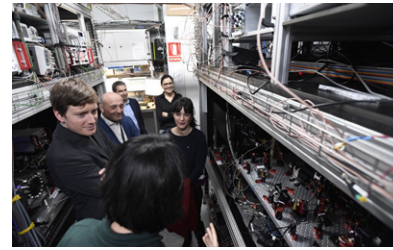
- **TeraFox:** Seeks to develop a more efficient method to control the functional properties of Transition Metal Oxides (TMOs). Led by **Dr. Ekaterina Khestanova (ICFO)** and **Dr. David Pesquera (ICN2)**.
- **EXPLODE-TNBC:** Seeking a targeted therapy for triple-negative breast cancer. Led by **Dr. Sara Sdelci (CRG)** and **Dr. Antoni Riera (IRB)**.

New ERC Advanced Grant

The European Research Council (ERC) announced the awarding of 218 Advanced Grants to outstanding research leaders across Europe, including **ICREA Prof. at ICFO Dr. Morgan Mitchell**, leader of the Atomic Quantum Optics group. This new grant for the project **Field-SEER: Field Sensors with Exceptional Energy Resolution** will run from 2023-2028 and will allow the group to develop magnetic sensors with combined spatial, temporal, and field resolution beyond what is possible with existing sensing approaches.



The ERC Advanced Grant funding is amongst the most prestigious and competitive EU funding schemes, providing researchers with the opportunity to pursue ambitious, curiosity-driven projects that could lead to major scientific breakthroughs. They are awarded to established, leading researchers with a proven track-record of significant research achievements over the past decade.



Members of the Generalitat de Catalonia visit ICFO

The **Secretary General of the Department of Business and Labor, Oriol Sagrera** and the **Secretary of Digital Policies, Georgina Tost** of the Generalitat de Catalonia visited ICFO to learn about the institute's expertise specifically related to quantum secure technologies. They received an overview of some of the exciting programs underway at the institute and discussed ongoing areas of mutual interests. They were presented programs associated with **"Quantica – Mediterranean Valley of Science and Quantum Technologies"**, including the laboratory that hosts **QUIONE** in which ICFOrians led by ICREA Prof. at ICFO Dr. Leticia Tarruell are working to configure a quantum simulator that will facilitate the understanding of the behavior of materials and their properties. They also discussed successful technology transfer activities in the area of quantum technologies with KTT team members and the CEOs of ICFO spin-off companies Quside Technologies and LuxQuanta.



"La Nit" focuses on Climate Change

The 2023 *Night of Telecommunications and IT (La Nit de les Telecomunicacions i la Informàtica)*, an important annual occasion for the Information and Communication Technology sector had a special focus on climate change in which they addressed themes ranging from the digital carbon footprint, to how technology can become the best tool for curbing the impact of climate change and moving towards the sustainability of the planet. As part of this special focus, they awarded a special recognition for impactful work to **ICFO, for its Clean Planet program**, and to **the Earth Sciences department of the Barcelona Supercomputing Center**, both initiatives that are leading in this field.

"la Caixa" Foundation Fellowships

Two ICFOrians are among the 105 recipients of doctoral and postdoctoral fellowship from the "la Caixa" Foundation in their most recent calls.

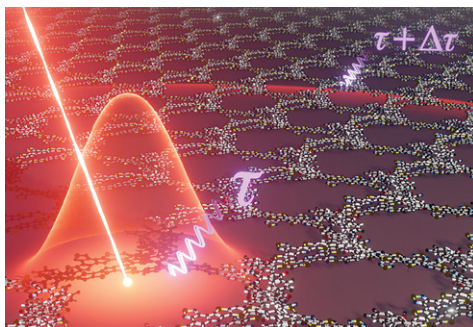
- **Goretti Torres Pérez**, PhD student in the *Functional Optoelectronic Nanomaterials* research group led by ICREA Prof. at ICFO Dr. Gerasimos Konstantatos, receive INPhINIT Fellowship.
- **Prof. Dr. Nicoletta Liguori**, leader of the new *Photon Harvesting in Plants and Biomolecules* research group at ICFO, received the Postdoctoral Junior Leader Fellowship.



The **doctoral INPhINIT and postdoctoral Junior Leader fellowships** pursue the twofold aim of supporting young talents to carry out their research in Spain or Portugal and attracting international researchers to these countries. The calls offer competitive salaries and cross-disciplinary training. Doctoral fellowships offer complementary training to strengthen such areas as scientific communication, the researcher's emotional wellbeing, leadership, and opportunities for funding. The postdoctoral fellowships promote the independent scientific degree program as an option for a professional future, and fosters innovation and leadership.

Happenings

LATEST ADVANCES

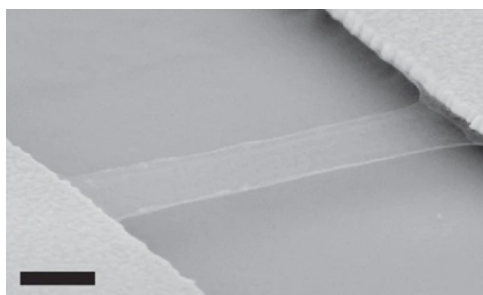


Novel nanotube device for quantum transport and mechanics

Carbon nanotubes are widely used to study several quantum phenomena thanks to their exceptional mechanical, electrical and optical properties that might be used for processing quantum information. Now, Roger Tormo-Queralt, Dr. Christoffer Moller, Dr. Stefan Forstner, Gernot Gruber, Dr. Chandan Samanta, Marta Cagetti, Jennifer Sánchez-Naranjo and Núria Urgell-Ollé from the Quantum NanoElectronics and NanoMechanics group led by **Prof. Dr. Adrian Bachtold** in collaboration with researchers from the Center for Nanoscale Materials, have developed a method to fabricate carbon nanotube devices with a large number of gate electrodes, demonstrating the high quality through quantum transport measurements. The study has been published in **Nano Letters**.

The new layout created by the researchers offers two main advantages. First, the devices can stand the high temperatures of the chemical vapor deposition, up to 1000°C, without major issues. Second, the final design offers excellent quantum transport characteristics.

This method could help build a new generation of high-quality quantum devices in ultraclean environments, which will allow the development of nanotubes without surface contamination, potentially useful in applications related to the development of double-quantum dots, spin qubits, and mechanical qubits.



How not to overestimate exciton diffusion

In Organic Photovoltaics (OPVs), understanding the spatial dynamics of nanoscale exciton transport beyond the temporal decay is essential for further improvements in the morphology of the devices. Nowadays, OPVs reach power conversion efficiencies of over 19%, which could be increased up to 25% in cells designed with materials exhibiting optimized characteristics. The non-fullerene electron acceptor Y6 is among the most promising materials utilized today for OPVs, exhibiting a high exciton diffusion coefficient, a key-parameter for the optimization of OPVs. However, the exciton diffusion competes with fast singlet-singlet annihilation (SSA) and the OPV diffusion is often overestimated as the two are hard to disentangle.

ICFO researchers **Giulia Lo Gerfo Morganti**, Dr. Luca Bolzonello and **ICREA Prof. at ICFO Dr. Niek van Hulst**, in collaboration with Francisco Bernal-Texca and **UPC Prof. at ICFO Dr. Jordi Martorell**, working within ICFO's **Clean Planet Program**, have developed a method able to decouple the exciton diffusion coefficient from SSA. This way they correctly determined the diffusion coefficient in a Y6 film to be $D = 0.017 \pm 0.003 \text{ cm}^2/\text{s}$, which gives a Y6 film diffusion length of $L = 35 \text{ nm}$. This new tool enables a direct and artefact-free determination of diffusion coefficients, which researchers expect to be pivotal for further studies on exciton dynamics in energy materials.

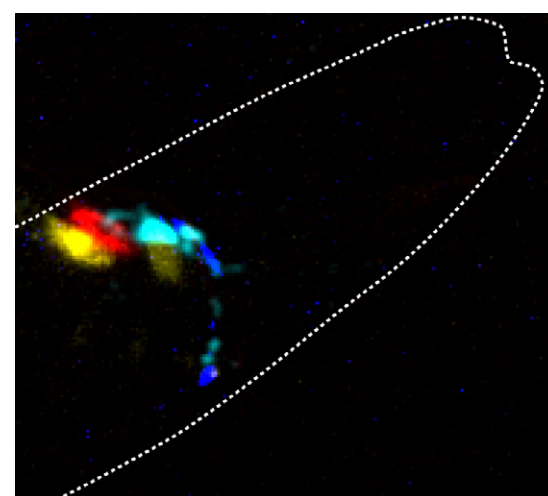
This study was published in **The Journal of Physical Chemistry Letters**, with an illustration from the study featured on the edition's cover.

Using photons as neurotransmitters to control the activity of neurons

Scientists seek to control connections between neurons in order to better understand and treat neurological disorders, rewire or repair the malfunctions of damaged neural circuits, improve learning capabilities or expand behaviors. The use of photons is a relatively new technique that involves genetically modifying neurons to express light-sensitive proteins, ion channels, pumps or specific enzymes in the target cells. It allows researchers to precisely control the activity of concrete populations of neurons with higher precision, nonetheless, challenges exist including the non-invasive delivery of a sufficient flux of photons to the target synapses.

Researchers in the Neurophotonics and Mechanical Systems Biology group led by **Prof. Michael Krieg** together with collaborators in the Medical Optics and Optoelectronics research groups, have published a study in **Nature Methods** that demonstrates a system to overcome these challenges. **The system that they developed and tested in the roundworm *Caenorhabditis elegans* is named PhAST -short for Photons as synaptic transmitters, using luciferase enzymes to send photons, instead of chemicals, as transmitters between neurons.**

To test if photons could codify and transmit the activity state between two neurons, the team genetically modified the roundworms to have faulty neurotransmitters, and then engineered light-emitting enzymes luciferases and selected ion channels that were sensitive to light, following the information flow with a device they developed that delivered mechanical stresses to the animal's nose while measuring, at the same time, the calcium activity in the sensory neurons.



To be able to see the photons and study bioluminescence, the team used a specially designed and simplified fluorescence microscope, assisted by machine learning. They succeeded in using photons to transmit neuronal states in several experiments, establishing a new transmission between two unconnected cells, and restoring neuronal communication in a defective circuit. They also suppressed the animals' response to a painful stimulus, changed their response to an olfactory stimulus from attractive to aversive behavior and studied the calcium dynamics during egg-laying. These results demonstrate that photons can indeed act as neurotransmitters and allow communication between neurons and that the PhAST system allows the synthetic modification of animal behavior.

Happenings

BUSINESS NEWS

European Quantum Space at Mobile World Congress in Barcelona

ICFO curated space for the Quantum Flagship, showcasing innovation and the most recent developments in Quantum Technologies being driven forward by Europe

An annual occurrence in Barcelona, the GSMA's Mobile World Congress (MWC) is the world's largest and most influential event for the mobile technology ecosystem. This year's Congress (Feb 27th - March 2nd) attracted more than 88,500 attendees from 202 countries across the globe. ICFO curated the European Quantum Flagship's 100m² stand where Flagship partners and other EU Quantum initiatives showed their most mature technology and disruptive innovations, connected with the global audience, and pressed forward to enable the integration of these technologies in the market.

Interest is increasing for quantum technologies, as illustrated by the curiosity demonstrated by visitors who wanted to know more about the efforts of the European Commission to advance Europe's academic and industrial capabilities in this area, and also, importantly, how to incorporate quantum technologies in their fields.

The European Quantum Space gathered European quantum companies and initiatives, all showcasing their products and services within the stand.

Companies

- Q-bird
- IDQ Europe
- Terra Quantum
- LuxQuanta
- Quside
- QMWare
- Qilimanjaro
- Qnami

Initiatives

- Quantum Valley Lower Saxony (QVLS)
- Quantum Internet Alliance (QIA)
- QSNP
- PASQUANS2 (two initiatives that will be starting in spring of 2023)



Exhibitors in the European Quantum Space MWC 2023

Within the European Quantum Space, companies and initiatives announced their newest products and milestones and connected with an audience in a series of Quantum Coffee Talks, expanding possibilities to create potential synergies and business opportunities.

A number of high-profile guests visited the space, starting with the European Commissioner of Internal Market, Thierry Breton who was interested in learning about the quantum ecosystem in Europe through the different companies and initiatives present in the booth.

Following the Commissioner's visit, the stand also received visits from members of the Catalan government, notably the President of the Generalitat de Catalonia, Pere Aragonès, and the Minister of Business and Labor of the Generalitat, Roger Torrent, as well as Montserrat Ballarín, Councilor of Commerce and Markets from the Barcelona City Hall. In addition, Jaume Martorell, the Government commissioner for the PERTE (Strategic Projects for the Recovery and Economic Transformation) for Microelectronics and Superconductors in Spain, also visited the space given the strategic importance of quantum technologies in those fields.



Proof of Concept Grant

ERC Funding to develop a Terahertz graphene receiver for wireless communications

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 ERC grantees to bridge the gap between the results of their pioneering research and the early phases of its commercialization, 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.



ICREA Prof. at ICFO Dr. Frank Koppens,

leader of the *Quantum Nano-Optoelectronics research group*, has been awarded his fourth PoC to date, the thirteenth award of this kind for ICFO in the past ten years, for the project titled **TERACOMM**. This project aims to develop a terahertz graphene receiver for wireless communications.

LuxQuanta launches first product system

ICFO deep-tech spin-off presents NOVA LQ™ based on Continuous Variable Quantum Key Distribution (CV-QKD) technology

LuxQuanta, a deep-tech company that spun-out of ICFO in 2021 with the mission of delivering an unprecedented way of securing communications and data, now presents its **first product system, NOVA LQ™, which is based on Continuous Variable Quantum Key Distribution (CV-QKD) technology.**



LUXQUANTA



LuxQuanta NOVA LQ™

This type of QKD uses properties of quantum states of light, such as the amplitude and phase, to generate and deliver ultra-secure shared keys between remote network nodes. Quantum Key Distribution leverages the unique properties of Quantum Physics to provide an unbreakable defense against quantum computers and malicious hackers. Any attempt of interception will inevitably introduce noise into these quantum states, allowing the technology to detect the intruder. NOVA LQ™ uses coherent detection techniques and fully mature components developed for the telecommunications industry. With its high secret key rate performance and reliability, NOVA LQ™ stands out as an excellent solution for secure communication, compatible with conventional telecommunication technologies and capable of being integrated into existing optical fiber links without the need for dedicated optical fibers.

The company's mission is to integrate innovative and secure quantum products and systems into conventional communication infrastructures. Its team, composed of engineers and physicists with decades of multidisciplinary experience in Quantum Technologies, Optical Telecommunications, FPGA programming, microelectronics and software development, is constantly on the look-out for scientific collaborations with other companies and research institutes to spur the development of a quantum cryptography ecosystem in Europe and the deployment of an ultra-safe European Quantum Network.

Collaboration

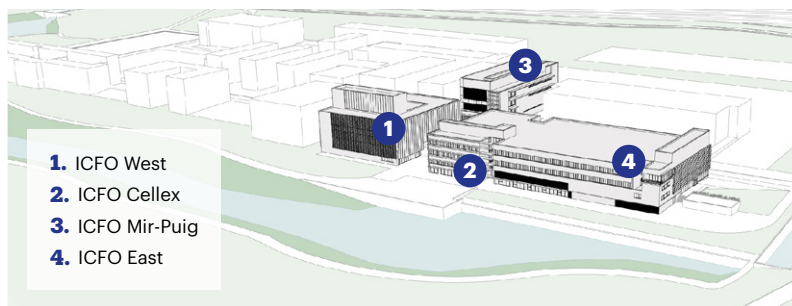
FACILITIES

IN3 Building to Provide New Facilities for ICFO

As the UOC moves its activities to Barcelona, their former building stands to alleviate ICFO's pressing need for space to develop strategic national and international projects

In an event that took place at the new campus of the Universitat Oberta de Catalunya (UOC) in the historic Can Jaumandreu building in central Barcelona, the Conseller for Research and Universities of the Generalitat of Catalonia, Joaquim Nadal; the deputy mayor of Culture, Education, Science and Community of the Barcelona City Council, Jordi Martí; the director of ICFO, Lluís Torner, and the rector of the UOC, Josep A. Planell formally celebrated an agreement that promotes and facilitates knowledge and research in Catalonia.

On one hand, the ceremony celebrated the consolidation of the UOC campus in Barcelona, and on the other hand, the expansion of ICFO's facilities in the Mediterranean Technology Park in Castelldefels. The Generalitat de Catalunya has formally ceded the IN3 building, adjacent to the ICFO CELLEX NEST and facing ICFO's the new Mir-Puig facilities, to our institute and in doing so, aims to alleviate the institute's pressing need for space to develop strategic national and international projects it currently leads linked to quantum materials and photonic chips.



Specifically, the new building is expected to house research programs associated to "Quantica - Mediterranean Valley of Science and Quantum Technologies", "QPICS" about photonic chips, a Nanocharacterization Facility and TWIST - a unique international program in collaboration with researchers from the Massachusetts Institute of Technology (MIT, USA), the Max-Planck Society (Germany), and the Weizmann Institute (Israel), among other facilities and services the Institute will need during the next decade.

“

Refurbishing the new building will take a while and will require serious funding - that we still do not have. However, we happily accept the challenge to raise it because the new facilities will be crucial to our central mission, namely offering increasingly better training through world class research opportunities to our talented PhD students and post-doctoral researchers.

Lluís Torner
ICFO Director

COMMUNITY

Diversity Focus: ICFOrians for Women in Science

ICFOrians celebrate the 6th edition of this initiative in support of the positive future for women in science that we all hope to be part of



ICFO's institution-wide tradition of celebrating the **International Day of Women and Girls in Science** began in 2016, the same year that the UN declared the International Day. In 2018, we extended the celebration all the way to March 8th, **International Women's Day**, in order to dedicate an entire month to related discussions and activities.

While there is a concentration of events that take place during this month, ICFO's commitment to supporting and increasing diversity in all its forms is a year-round activity.

Diversity, along with respect for others and scientific rigor, is one of ICFO's core values which is why it is important that every day we work to create an inclusive environment where all staff and students can thrive and fully participate. By providing support and access to opportunities as well as increasing the visibility of positive female role-models in science, we aim to encourage even more girls in the next generation to pursue careers in STEM, and more women to become leaders in their fields.



(L-R) Professors María García-Parajo, Georgia Papadakis, Nicoletta Liguori, and Leticia Tarruell

2023 Agenda

Wikimarathon

ICFOrians joined a number of other research institutions in Catalonia in an online Wikimarathon organized by the Barcelona Biomedical Research Park (PRBB), strengthening the presence of women scientists in the Wikipedia.

Focus on the Future

In honor of the International Day of Women and Girls in Science, ICFOrians participated in two separate Outreach activities aimed to give girls and young women positive women role-models in science. (*learn more on pg 9 in the Outreach section of this newsletter*)

Meet the Scientist

After offering a Quantum Seminar in the framework of ICFO's Light Seminar Series, Dr. Emilia Witkowska from the Institute of Physics, Polish Academy of Sciences in Warsaw met informally with ICFOrians to discuss her career as a scientist and her interests.

Panel Discussion: Starting a Research Group- the experience of women GLs at ICFO

Chaired by ICREA Prof. Dr. María García-Parajo, panelists Prof. Dr. Nicoletta Liguori, Prof. Dr. Georgia Papadakis, and ICREA Prof. Dr. Leticia Tarruell discussed their personal experiences starting and leading research groups at ICFO.

Workshop: Women's Self Defense:

ICFO PhD Student Julia Bergmann, also a licensed instructor for women's self-defense instruction, offered a free workshop to ICFOrians on the theoretical and practical aspects of women's self-defense.

Collaboration

TRAINING

ICFO Mentoring program

Alumni share their knowledge and experience with students to enhance their careers

Mentoring is a vital element for professional development, and mentoring programs can play a crucial role in supporting and advancing careers in science, both for students and early-career researchers. With this in mind, ICFO has launched a new mentoring program with alumni serving as mentors to help students achieve their professional and personal goals.



The program aims to team up **3rd or 4th year PhD students** with alumni working in professional environments inside and outside academia to help introduce them to the full range of possibilities after the PhD and give advice about **career development or career transition**.

PhD students will benefit from mentors' experience in navigating their own career paths beyond ICFO, and from their support in identifying career options and mapping their next professional step. The program represents an investment in the success of PhD students, providing them with unique insights and perspectives from alumni who have firsthand experience with the challenges and opportunities that arise after completing a PhD.

Moreover, the program will help the students expand their professional network and make valuable contacts in the field, while creating a strong sense of community and support among the students and alumni.

Prof. Dr. Robert Sewell, head of Academic Affairs, has long awaited the opportunity to add this program to ICFO's offering for PhD students.

“

The Mentoring initiative comes down to maximizing the impact of scientific training, while providing personal and professional support for ICFO PhD students. Having access to both formal and informal networks for guidance during the transition period at the end of the PhD can be key to helping students navigate into careers where they can get the most out of their PhD training.

Prof. Dr. Robert Sewell
Head of Academic Affairs

Andrea Morales, coordinator of ICFO's Alumni Network, testifies to the warm reception the program has received from ICFOrians who are already applying training they received at the institute in diverse careers around the world.

“

We found that alumni were very quick to sign up to collaborate as mentors. In fact, most commented that they would have appreciated an Alumni mentor to demystify the 'what next' question when they were finishing their PhD.

Andrea Morales
Coordinator of ICFO's Alumni network

This pilot initiative has been launched in the framework of **ICFO's Enlighten PhD fellowship program**, a Marie Skłodowska-Curie-COFUND action under the European Union's Horizon 2020 research and innovation program. An initial group of five alumni and five current students have been matched as mentor/ mentees. They will meet a minimum of three times over the next six months, virtually or in person.

Spring School on Open-Source Tools for Quantum Computing & Simulation

ICFO hosted the first event of the DigiQ project in collaboration with IBM Quantum

The growing attention towards Quantum Computing and Quantum Simulations in academia and industry has prompted the prioritization of education and training for more students in this field. The theory behind and also the tools needed to solve computational problems is extremely important for students that want to work in this field.

On March 29-31, ICFO hosted a 3-day Spring School covering theory and tools to build the core knowledge needed for starting a career in **Quantum Computing & Simulations**. The program included a 2-day hands-on workshop led by researchers from ICFO and IBM Quantum that aimed at introducing students and researchers to several open-source tools, and their use in cutting-edge research.



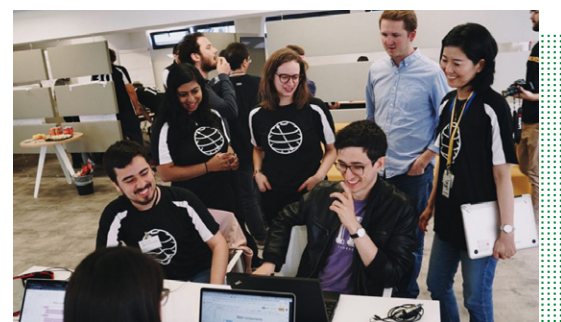
The workshop was followed by a 1-day symposium with researchers from ICFO, IBM Quantum and invited speakers from the wider research community sharing their latest research results.

IBM researchers offered an *Introduction to Quantum Computing using Qiskit* as well as specialized lectures on *Superconducting Qubits, Dynamic Circuits & error mitigation, and Quantum Optimization*. ICFO PhD students and postdocs offered topical lectures on Quantum simulation with cold atoms, Tensor networks, and Quantum machine learning.

Highlights from the symposium included a keynote address from **Dario Gil, IBM Senior Vice President and Director of Research**, and talks from leading researchers from IBM, ICFO, CERN, EPFL, BSC, Harvard LMU and Trento.

“ **The school gave students a fantastic opportunity to mix with both local and international peers.**

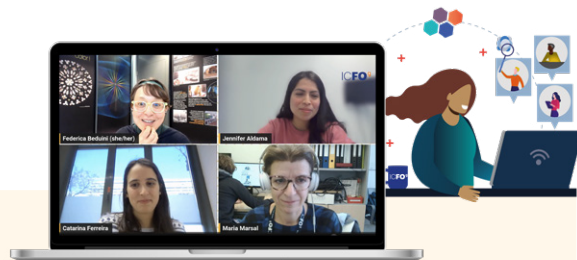
72 students attended the school, selected from over 180 applicants. Students from 14 countries were represented, from across Europe and as far afield as Iran and India, including 42 master's students, 10 undergraduates and PhD students and researchers. Symposium talks were broadcast online to over 140 participants from 39 countries across 6 continents!



The school was the very first event organized in the context of the **DigiQ - Digitally Enhanced Quantum Technology Master**, a new European initiative financed through the European Commission's Digital Europe Programme, and was followed by a 2-day **hackathon** organized by IBM Quantum, the Quantum Barcelona Community, & ICFO in Barcelona over the weekend of 1-2 April, the first such event to be hosted in Barcelona.

Collaboration

OUTREACH



Focus on the Future: Photonics in 5 Min & 100tifiques

A special edition of the “Photonics in 5 minutes!” online event was held on February 10th in the framework of **ICFOrians for Women in Science Month** to celebrate the **International Day of Women and Girls in Science**. For the occasion, the panel was chosen to give visibility to the role of women in STEM. The event, directed to secondary school students from 14-18 years old, drew the interest of more than 40 different schools across Spain, resulting in over 1750 registered participants. The session took place in YouTube Live where, following an enthusiastic introduction by Dr. Federica Beduini, three ICFOrians each gave an inspiring 5-minute flash talk on how photonics is important for their research and society in general.

THE SPEAKERS HAD VERY DIFFERENT TAKES ON THE TOPIC:

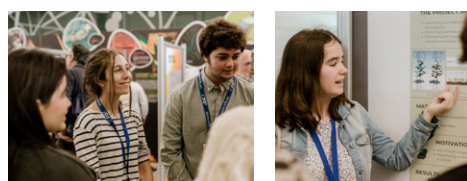
- Dr. Maria Marsal focused on advanced microscopy techniques of biological interest.
- Catarina Gonçalves Ferreira on nanostructures with applications for clean energy generation.
- Jennifer Aldama-Guardia on applied systems for quantum cryptography.

After the presentations, the students were able to ask their questions about the science as well as the life of a researcher, engaging the speakers in a fun and enriching roundtable.

Also, in what is now an annual tradition, several female researchers and scientists at ICFO participated in the **100tifiques** program by the Catalan Foundation for Research and Innovation (FCRI) and the Barcelona Institute of Science and Technology (BIST). This program brings together women in scientific careers around Catalonia in order to inspire hundreds of girls and boys by breaking gender stereotypes in science and research. In this 2023 edition, 6 ICFOrians participated, bringing the research and work of ICFO closer to students from different schools around Catalonia.

A warm round of applause to other ICFOrians who participated in outreach activities during these months: Dr. Yatzil Avalos, Enes Aybar, Dr. Javier Argüello, Eduardo Beattie, Mariona Bonàs, Marina Cunqueiro, Dr. Denitza Denkova, Leo Feldmann, Dr. Stefan Forstner, Joana Fraxanet, Valentina Gacha, Dr. Samuele Grandi, Rajashree Haldankar, Jonathan Hänni, María Hernández, Tomáš Lamich, Giulia Lo Gerfo, Dr. Vasily Makhalov, Dr. Katerina Nikolaidou, Dilan Pérez, Dr. Carles Ros, Dr. Antonio Rubio, Antonio Sampaoli, Neus Sanfeliu, Dr. Marta Sans, Dr. Markus Teller, Roger Tormo, Dr. Luis Trigo, Dr. Claudia Valdés, Dr. Clara Vilches, Dr. Marta Zanoletti, Laura Zarraoa.

Young Photonics Congress



On March 17, around 120 people took part in the 8th edition of the Young Photonics Congress, a scientific conference where the spotlight is on photonics-related projects developed by high school students

All the participants gathered in the ICFO Auditorium for a plenary session with an introduction to photonics and ICFO, followed by flash talks by ICFOrians Arturo Villegas, Dr. Ariane Stucki and Blanca Belsa, who talked about their work in photonics, touching different topics such as the design of light sources to improve microscopy at the nanoscale, using lasers and fluorescence to detect microbes in water to improve the safety of bathing areas, and photochemical techniques to capture carbon from the atmosphere.

After that, all moved to the NEST Hall where 31 high school students presented their research projects in a lively poster session. Many ICFOrians joined the event, interacting with the students and chatting about a variety of topics that reflected the diversity of the research in photonics. A sample of poster topics included quantum physics, spectroscopy, solar cells and remote sensing.

One year more, the Young Photonics Congress brought together high school students and ICFO researchers to inspire the new generation of scientists.

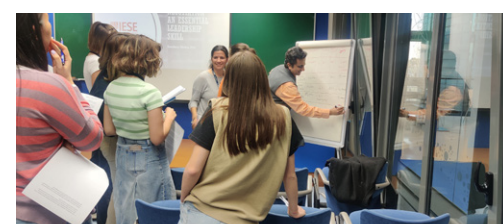
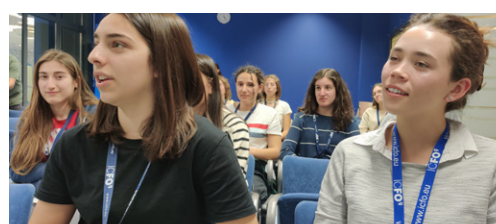
Be an ICFOnian for a Day

On March 14th ICFO hosted the second *Be an ICFOnian for a Day* event, a program designed for women (cis and trans women, genderqueer, and non-binary) pursuing undergraduate STEM studies

The program comprises four half-day/full-day events aiming to introduce participants to the realities of life as a scientist at ICFO, inspire them to pursue careers in STEM, encourage networking among participants and ICFOrians, and provide insights on future career opportunities.

Twenty women were able to attend the interactive panel discussion led by prominent ICFO women group leaders: Professors Dr. María García-Parajo, Dr. Georgia Papadakis, Dr. Leticia Tarruell, and Dr. Nicoletta Liguori about building successful STEM careers. (*learn more on pg. 7*). The panel discussion presented an excellent opportunity for participants to learn from the experiences of successful women in the field, ask questions, gain invaluable advice, and develop a better understanding of their own career goals and the steps they need to take to achieve them. After the session, participants were also able to network with ICFOrians.

To round out the day's program, participants were given the unique opportunity to attend an interactive training session on negotiation skills offered by Dr. Kandarp Mehta, Senior Lecturer of Entrepreneurship and Negotiation at IESE Business School.



Collaboration

ALUMNI NETWORK

Continued Collaborations: ICFOnians benefit from the strong network of alumni...

... at home

Machine Learning and Microscopy... and Coffee



It is a very happy "homecoming" for the Alumni network when ICFOnians come back to share their areas of expertise with current ICFOnians. Last February, Alumni Giovanni Volpe and Carlo Manzo hosted a course on 'Machine Learning for Microscopy' with the support of ICFO's Academic Affairs unit.

In this course, 12 ICFOnians were introduced to basic dense neural networks and backpropagation to progressively move toward deep learning using the standard neural network packages such as TensorFlow/Keras and PyTorch. Giovanni and Carlo described several advanced deep-learning architectures for different tasks, with applications to real case studies.

In addition to the course, they participated in an *ICFO Alumni Coffee* session where they introduced their **start-up IFLAI AB**, a company focused on developing AI software for microscopy. The collaboration that led to the creation of IFLAI was not created during either of their times at ICFO, rather developed many years later. Nonetheless, it is a great example of the ICFO network in action and the possibilities for continued collaborations.

ICFOnians gathered to learn from their careers experience, and more specifically about the opportunities that Machine Learning can offer to their research.



Prof. Giovanni Volpe

Full Professor at the Physics Department of the University of Gothenburg University, where he leads the Soft Matter Lab. He was a PhD student at ICFO in the Optical Tweezers research group. Giovanni is an Alumni Representative at ICFO.



Prof. Carlo Manzo

Associate Professor at the Universitat de Vic (UVic-UCC), where he leads the Quantitative Bioimaging lab. He was a Research Fellow at the Single Molecule Biophotonics group, where he continues his collaborations as a Visiting Scientist.

FPGA Lectures for Scientists

The aim of this course, hosted by Academic Affairs, is to provide simple, functional and open-source examples, which incrementally incorporate new FPGA programming concepts. Targeting PhD students, post-doctoral researchers and engineers with interest in high-speed digital electronics and who could benefit from custom signal generation and acquisition logic, the course was very hands-on, making it possible for participants, upon completion, to create their own FPGA designs that interface with digital and analog IOs.



Dr. Pau Gómez

PhD graduate in the Atomic Quantum Optics group and now an R&D Engineer at ICFO spin-off LuxQuanta, came back to ICFO to offer a second edition of 'FPGA Lectures for Scientists' to our community of students.

... and abroad

Photonics West San Francisco

Scientific meetings around the world are a great opportunity for members of our large and extensive community to share their work, plant seeds for new collaboration and strengthen existing ties. As ICFOnians leave ICFO to pursue their careers around the world, scientific conferences are an important meeting place and chance to reinforce connections between ICFOnians, making possible both social and professional networking.

This January, ICFOnians met at the **Photonics West Conference** in San Francisco. Prof. Robert Sewell, on behalf of ICFO Alumni Network, hosted a dinner that gathered a group made of different generations of ICFOnians!

In the most recent years, the pandemic narrowed the spaces and opportunities to meet and gather together outside ICFO, but this 2023 the Alumni Network aims to make the most of the conferences calendar and organize gatherings that will hopefully settle a yearly tradition for ICFOnians to meet at Photonics West SFO and CLEO Munich.



From left to right: Bárbara Buades, Tobias Steinle, Morgan Mitchell, Carsten Schuck, Zhipei Sun, Eric Puma, Robert Sewell, Ivan Nikitskiy, Martin Leahy, Giovanni Volpe, Jens Biegert, Seth Cousin, Michael Geiselmann, Alejandra Valencia, Luis Salazar and Martin Hendrych

A VIP tour of the Stanford Photonics Research Center

Last year, ICFO alumnus **Dr. Armand Niederberger** was appointed Executive Director of the **Stanford Photonics Research Center (SPRC)**. During his participation last year in the panel discussion at the **Beyond ICFO 2022** event at ICFO, he gave insights into what a day looks like in the life of an Executive Director of a Research Center.

Armand generously offered to share his new alma mater with the ICFO community visiting the Bay Area, an offer that current ICFOnians and members of the Alumni Network eagerly accepted, receiving a guided tour through Stanford and SPRC's labs.



ICFO is working to make it a tradition for member of the Alumni Network to connect with members of the greater ICFO Community, and wherever possible, facilitate the continued sharing of perspectives, ideas, knowledge, business opportunities and of course friendship.

People

GO & FLY

Congratulations to 8 New ICFO PhD Graduates

283 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.

 <p>276</p> <p>Dr. Hitesh Agarwal <i>Graphene based optical interconnects and IR photodetector</i></p> <p>📅 January 23, 2023 ICREA Prof. Dr. Frank Koppens</p>	 <p>277</p> <p>Dr. YongJie Wang <i>Eco-Friendly Solar Cells with Cation-Engineered AgBIS2 Nanocrystal</i></p> <p>📅 February 23, 2023 ICREA Prof. Dr. Gerasimos Konstantatos</p>	 <p>278</p> <p>Dr. Stefano Severino <i>Attosecond soft X-ray absorption revealing the ultrafast non-adiabatic dynamics of furan</i></p> <p>📅 March 13, 2023 ICREA Prof. Dr. Jens Biegert</p>	 <p>279</p> <p>Dr. Nima Taghipour <i>Solution-Processed Quantum Dot Infrared Laser</i></p> <p>📅 March 21, 2023 ICREA Prof. Dr. Gerasimos Konstantatos</p>
 <p>280</p> <p>Dr. Shanti Liga <i>Environmentally-friendly perovskite nanocrystals based on titanium and tin</i></p> <p>📅 March 22, 2023 ICREA Prof. Dr. Gerasimos Konstantatos</p>	 <p>281</p> <p>Dr. Francesco Andreoli <i>Multiple light scattering in atomic media: from metasurfaces to the ultimate refractive index</i></p> <p>📅 March 23, 2023 ICREA Prof. Dr. Darrick Chang</p>	 <p>282</p> <p>Dr. Stefano Duranti <i>Towards efficient quantum repeater nodes based on solid-state quantum memorie</i></p> <p>📅 March 24, 2023 ICREA Prof. Dr. Hugues de Riedmatten</p>	 <p>283</p> <p>Dr. Mariia Kramarenko <i>Fluorescence quantum yield and the open circuit voltage in perovskite solar cells</i></p> <p>📅 March 24, 2023 UPC Prof. Dr. Jordi Martorell</p>

COMMUNITY



ICFO Calçotada

📅 February 10, 2023

This Catalan tradition is one of the most anticipated social events on the ICFOnians calendar, bringing together great food, music, and company.

(Insider's Secret: If you've never been a "Calçotada Chef", you are missing half the fun!)

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 has a picture of her cat on her desk
2. She saw Britney Spears live in Las Vegas
3. She is a certified Professional Wine & Beer Taster
4. She really likes Dungeon and Dragons

The Last Word

HIGH PROFILE

Pep Canadell

CSIRO Chief Research Scientist, and Executive Director of the Global Carbon Project

Where was the seed planted for your passion for the environment and more specifically, climate change's effect on the environment?

Since very early in my childhood I was interested in the environment, running home from school to make it in time to watch a wildlife documentary series. My interest was narrowed down when I started a bachelor's in biology at the Universitat Autònoma de Barcelona, where I quickly become interested in fire ecology in the Mediterranean and around the world, including California and Australia, which perhaps not coincidentally, are the places I have spent the last 33 years of my professional life. I wanted to work on a piece of science that could address an environmental issue of our times. Little did I know that I was going to end up working on the biggest of all environmental problems facing humanity this century: climate change.

How did you come to lead the Global Carbon Project?

Halfway through my PhD thesis work I left for California and spent a few years at San Diego State University where I quickly learned about a new emerging science of climate change. There was a sense that something big and attention worthy was brewing. At this time the Intergovernmental Panel on Climate Change (IPCC) had just been established and the UN Framework Convention on Climate Change was about to be launched with 196 countries agreeing that something had to be done about the emerging issue of human-induced climate change.

The entire global scientific community had to be organized to develop a coordinated research agenda to support the many IPCC assessment cycles that



“

Scientists must also continue to explore areas that are not yet on policy maker's radars in order to bring to the surface the big questions that are waiting for us around the corner

would follow and provide the answers that the UN convention needed to motivate countries into climate action. After a few years doing research at UC Berkeley on the impacts of high atmospheric CO₂ on terrestrial ecosystems, I moved to Stanford University to lead a component of the Global Change and Terrestrial Ecosystems project, a predecessor of the Global Carbon Project that I now direct. I saw that individualistic science was unfit to solve the big global environmental problems we were trying to address and that this was an opportunity to work towards shared and coordinated scientific goals that could make the outcomes of the effort bigger than the contributing parts and individuals.

What transversal skills have you developed that have been most useful in engaging with global policy makers?

The most important are communication skills to translate complex science into a language that can engage policy makers in conversations. Insisting on technical vocabulary can often prevent real communication and may even obscure the relevance or alignment between science and policy needs. The second skill is the ability to listen to policy makers to really hear what they need. This goes hand in hand with learning how policy making works and is developed. I have found that developing policy relevant science requires establishing trust and developing an agreed process by which co-design and co-production guides the science and its uptake. Scientists may ask questions they think are policy relevant, and even get some questions right, but we need engagement with policymakers to ensure uptake and impact of that science into the local, national or global policy world. Of course, scientists must also continue to explore areas that are not yet on policy maker's radars in order to bring to the surface the big questions that are waiting for us around the corner.

Where do you think that ICFOrians who want to contribute to the mitigation to the climate crisis can apply their scientific skills to have the greatest impact?

I see the role of the upcoming generations and ICFOrians as working to resolve how we will move from a fossil fuel-based economy towards one of clean and renewable energies, including how we can best harvest the power of the sun and wind, how information science and robotics will support a more efficient and less wasteful society, how we can make our food system cleaner with a lower impact on the environment and climate. We will need to adapt to unavoidable effects of climate change including a more aggressive climate of heatwaves, drought and floods. Interestingly, the new society and economy we need to create is one that we all want anyway because it is cleaner, more efficient, more independent energetically, more just, and smarter about the way we use energy and resources.

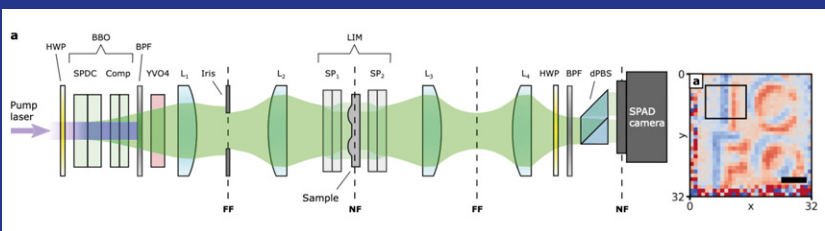
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Please send questions, comments and suggestions to communications@icfo.eu

SCIENCE QUIZ



Researchers from the ICFO Optoelectronics group, in collaboration with four institutions in Germany, recently published "Fast quantum-enhanced imaging with visible-wavelength entangled photons" in *Optics Express*. They showed how "NOON" states can be generated at 532 nm, used for wide-field imaging with sensitivity beyond the shot noise limit, and efficiently detected with a SPAD image sensor array.

1. What is a "NOON" state?

- A) The condition of wondering when lunch will be
- B) A small Schrödinger cat
- C) A N-photon entangled state

2. Of the 18 optical elements shown (excluding sample and iris) how many are crystals?

- A) Eleven
- B) Twelve
- C) Thirteen

3. In the image, SP is a Savart plate. What is a Savart plate?

- A) Two thin walk-off crystals glued together
- B) A metasurface polarizer
- C) A product of Villeroy & Boch

4. The optical system contains two 4f imaging systems. Is the image inverted?

- A) Yes, vertically
- B) Yes, horizontally
- C) Both A) and B)