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Spring 2025

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THE LAST WORD

Celebrating Talent

The 10<sup>th</sup> edition of Young **Photonics Congress** 

## **Community News**



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## **Celebrating Talent**

Think back to your first poster session, presenting results to people who shared an interest in science and who were eager to know more about your discoveries. Maybe you can look back and name the people who motivated you to follow your passions, or remember occasions that served as catalysts to your making important decisions about your studies or eventually your career in science. On March 14<sup>th</sup> we celebrated the 10<sup>th</sup> edition of the Young Photonics Congress, an annual event that has touched the lives of over 500 young high school students since its launch in 2015. Which of these students will look back in 20 vears' time and cite this experience as part of the reason they chose a career in science? Read more on pg. 7.

EDITOR'S CORNER .....

# **Evolving for Excellence**

#### What are you prepared to do to ensure the continued success of ICFO?

ICFOnians head into 2025 with a new Executive Leadership Team at the helm—one dedicated to building on ICFO's strong foundation and continuing its path of excellence. The achievements to date are something to be proud of and provide a solid base for what we hope will be an even more exciting and impactful future. In this spirit, this edition focuses on evolution, change, and strategic vision-key to ensuring that ICFO remains well-positioned to meet the challenges and opportunities that lie ahead.

Scientific infrastructures must continually adapt to the ever-changing needs of researchers. When we inaugurated the Nest building in 2012, we added formal and informal meeting areas, laboratories, and highly functional workspaces—critical elements for the growth of our institute. The subsequent addition of the Mir-Puig building provided much-needed offices and lab space to house strategic projects in quantum technologies like the Quíone II quantum computer, as well as initiatives from the ICFO Clean Planet Program. Importantly, it also enabled the development of the unique NM3 infrastructure, which includes a state-of-the-art clean room. This resource helped position ICEO to lead **PIX Europe** the new pilot line for advanced photonic integrated chips, which carries a budget of approximately 400 million euros. Looking ahead, ICFO will soon start the renovation of the IN3 building, ceded to ICFO in 2023, which will house more essential infrastructure to support ground-breaking research.

ICFO's future depends heavily on the next generation of talent building on the foundations we are laying today. Our educational programs

as well as outreach initiatives prioritize the development of scientific thinking and vocations. Through programs like the Young Photonics Congress—which celebrated its 10th anniversary in March–ICFO has been working with teachers and schools across Catalonia to share scientific excitement with high school students.

As we usher in the International Year of Quantum Science and Technology (IYQ), which will be celebrated globally throughout 2025, ICFO is playing an active role in several key events, starting with the IYQ launch in Catalonia. This event brought together key stakeholders from the Generalitat, as well as experts from academia. research, policymaking, and industry-including spin-offs and mid- and large-sized companies that are becoming early adopters of quantum technologies. The gathering underscored the significance of quantum science and technology (QST) and its potential to shape our economy and society.

Also within the IYQ framework, ICFO's Outreach team organized the second edition of Quantum Carla at La Pedrera, convening over 300 students and experts from academia and industry to help shape the future QST workforce. The message is clear: if we are to build scientific capabilities for the future, we must make a strong and sustained investment in talented, scientifically minded young people.

The question, "What are you prepared to change to make things better?" is an important and relevant one, even when things are going well, as is the case at ICFO. To secure ICFO's continued success, we must remain creative, ambitious, and open to new ideas and perspectives-allowing us to grow into the very best versions of our future selves.

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SEVERO OCHOA





**Brook Hardwick** 

Contributing Editor

**ICFO NEWCOMERS** .....

# Welcome to ICFO

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







Luuk Verhees

Student

Marc Camus

Student

María Blasco

Student

**Cristina Sastre** 

PhD Student

Michal Gwizdala

**Gabriel Senno** 

Visiting Scientist

Rosana Torrente

Research Operations

ch Fellow

**Daniel Rodríguez** Studen

**Roman Aseguinolaza** Student

Víctor Izquierdo

Student

Nefeli Stamouli

Student

Lourdes Camblor

PhD Student

Maria Victoria Ale





Student



Júlia González Student



Andrea Navoni PhD Student



Indrajit Mondal



Junmei Chen Postdoctoral Re archer



Adrià Sansa Project Engineer





Mercè Carrasco CFO







Erik Luszczak André Student



Beñat Albizbeaskoetxea Student

Pablo Tikas

Student

**Matthias Pawlik** 

Student

Sadeen Alaa

Student

Zoi Sargianni

PhD Student

Martin Renner

**Donato Farina** 

Visiting Scientist

Nadiuska Cueva

**Research** Operations

tdoctoral Research



Lisa Lando

Student



Felicia lacob Student





Aurora Mugnai





Ekin Opar Visiting Scientist



Ana Aquarod Competitive Funding







Martin Bearzatto Student



Evangelia Mystraki Student



Beáta Plaskurová Student



Guillermo García Student



Alejandra López







Margaret Gitau Visiting Scientist



Carla Miró KTT



**Oscar Michel** 

Student

Tomas Brada

Student

Beñat Berasategui

Student

**Juliette Lignieres** 

Student

Ioannis Draganidis

PhD Student

**Edward Jiang** 

PhD Student

Sam Nerenberg

Visiting Professor

stde



03

Lucía Benito Student



Joan Alegre Student



Ian Paton Student



Jose Castro Student



Tomás Fernández PhD Student



Tommaso Feri Visiting PhD Student



Laura Zarraoa ctoral Re



Nathan E. Lundblad Federico Stramaglia Staff Researcher

#### Not pictured

Aatif Kaisar Khan, Student Albert Grass, Student Laia Salvat, Student Junlin Xiong, Student Yuanzi Xu, Postdoctoral Researcher













**Gabriela Flores** 









# A new leadership structure to serve ICFO

Since its founding in 2002, ICFO has evolved and thrived, driven by its commitment to excellence and adaptability in a dynamic research landscape. ICFO Director Prof. Oriol Romero- Isart, who formally took the reins in September 2024 from Founding Director Lluis Torner, has instigated a new leadership structure to support the next phase of the institute's successful journey and to embrace the challenges and opportunities ahead.

With the support of the Board of Trustees, he has established a new Executive Team consisting of:

- **Director:** Prof. Oriol Romero-Isart
- Vice Director of Innovation, Sponsored Research, and Public Engagement (VD ISRPE): Dr. Silvia Carrasco, who to date has led the Knowledge & Technology Transfer team at ICFO
- Vice Director of People, Education and Culture (VD PEC): Dr. Robert Sewell, previously Head of Academic Affairs
- Chief Financial and Compliance Officer (CFO): Mercè Carrasco has recently joined ICFO with over 15 years of management experience in Catalan public research centers
- Chief Infrastructure Officer
   (CIO): Carlos Dengra, who leads
   the Facilities team at ICFO.

This team, together with all ICFOnians and ICFO stakeholders, is excited to serve ICFO and contribute to the fulfilment of the institute's mission to pursue disruptive science and technology and nurture the talents of all ICFOnians, with the purpose of improving the wellbeing of our society and planet.

## Joan Guinovart Cirera (1947-2025)

ICFO morns the loss of Dr. Joan Guinovart Cirera, founding director of the Institute for Research in Biomedicine Barcelona (IRBB), a remarkable leader, scientist and friend.



He is well known for his scientific expertise as well as his key role in the research community, for which he received numerous awards. An influential figure in national research policy, he served in numerous policy-making panels and committees in Catalonia and Spain. He was also a devoted member of ICFO's Board of Trustees since June 2022. We remember Dr. Guinovart with profound gratitude and admiration.

### The 2025 SPIE Society Awards



SPIE's prestigious annual awards honor transformative advancements across a range of professional areas, recognizing technical accomplishments as well as committed service to SPIE and support of its organizational mission.

ICREA Professor at ICFO **Dr. F.** Javier García de Abajo, leader of the Nanophotonics Theory group, was awarded the SPIE Mozi Award, for "seminal contributions to confined optical polaritons, their interaction with free electrons, and applications in nonlinear nanophotonics, optical sensing, and ultrafast processes in condensedmatter systems."

Of special interest to ICFOnians is also the award of the **Gold Medal**, SPIE's highest honor, that was awarded to **ICFO Scientific Advisory Board member Prof. Halina Rubinsztein-Dunlop** for innovations in the transfer of optical angular momentum to matter.

#### New Proof of Concept

In its efforts to help to bridge the gap between research and the earliest stage

of a marketable innovation, the European Research Council awards Proof of Concept (PoC) funding to researchers who have already been awarded an ERC grant. ICFO Prof. F. Pelavo García de Arquer has been awarded his first PoC grant for the project **ARIEL: scaling** sustainable Anodes for efficient water Electrolysis. This is ICFO's 17th PoC since the launch of the grant scheme. The main goal of this project is to demonstrate and validate a scalable process for the synthesis, activation, and implementation of catalysts alternative to iridium for water electrolysis - a critical bottleneck on the path to achieve the global deployment of this technology that is needed to meet carbon emission targets.



## EC's Executive VP for Tech Sovereignty, Security, and Democracy visits ICFO

After visiting the Quantum Flagship stand curated by ICFO at MWC25, **Henna Virkkunen** came to our institute to gather insights on research initiatives and programs.

As a strong advocate for scientific and technological advancement in Europe, Ms. Virkkunen expressed interest in the photonics and quantum technology projects ongoing at the center, such as quantum secure communications (Quantum Secure Network Partnership), quantum internet (Quantum Internet Alliance) and quantum computing and simulation (Pasquans2). She was also interested in ICFO's nano fabrication facilities which will play a pivotal role in the upcoming Photonics Integrated Chips Pilot Line, PIXEurope, coordinated by ICFO.

Her visit underscored the European Commission's commitment to fostering cutting-edge research and innovation, ensuring that Europe remains at the forefront of scientific and technological development.



### La Caixa Foundation Fellowships

Three ICFOnians are among the 100 recipients of doctoral and postdoctoral fellowships from the "la Caixa" Foundation's 2024 calls. 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.

- ICFO PhD student, Harini Raghavan in the Atomic Quantum Optics research group led by ICREA Professor at ICFO Dr. Morgan Mitchell, was awarded an INPhINIT fellowship to pursue a project in atomic sensor development for non-invasive brain imaging.
- Antonio Rubio Abadal, Postdoctoral researcher in the Ultracold Quantum Gases group led by ICREA Professor at ICFO Dr. Leticia Tarruell, was awarded the Junior Leader Postdoctoral Fellowship to pursue the project "Boosting quantum simulation with an optical atomic clock".
- Carmen Rubio-Verdú, leader of the STM on 2D quantum materials research group since Spring 2023, was awarded the Junior Leader
   Postdoctoral Fellowship to pursue work on the microscopic origin of electronic interactions in moiré quantum matter.

### ICFOnian to lead the Harish-Chandra Research Institute

Congratulations to one of ICFO's pioneers, **Prof. Ujjwal Sen**, who



conducted research here as a Ramon-y-Cajal postdoctoral researcher from 2005 to 2008. Ujjwal has recently been named director of **the Harish-Chandra Research Institute in Prayagraj, Allahabad,** where he started as a Reader in 2009, steadily solidifying his distinguished career.

Congratulations Ujjwal on your enormous achievements to date and on this well-deserved leadership role with which you have been honored.

LATEST ADVANCES



## Innovative Optical Tweezers Technique Discovers Novel Disease Indicators in Aging Animals

ICFO researchers **Dr. Frederic Català-Castro, Santiago Ortiz-Vázquez, Dr. Carmen Martínez-Fernández, Martín Fernández-Campo, Dr. Neus Sanfeliu-Cerdán,** led by **Prof. Dr. Michael Krieg**, along with Dr. Paolo-Antonio Frigeri from Impetux Optics and collaborators from multiple institutes have developed a new method, based on optical tweezers, that allows to measure viscoelasticity of biological materials.

This approach, published in **Nature Nanotechnology**, allows for more versatile, simplified measurements of the rheological properties of cells, tissues, and organelles. Thanks to this technique, called TimSOM, the team has shown, for the first time, how different organelles inside developing stem cells have varying mechanical properties and how age influences the viscoelasticity of tissues inside living animals. In particular, the technique has reported three novel results in the field of mechanobiology. For instance, that viscoelasticity of tissues inside living animals changes with age.

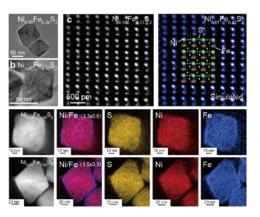
Their approach only requires a single laser, which simplifies the complexity of the set-up and enhances the versatility of the technique. Moreover, as only small sample volumes are required, TimSOM is particularly useful to quantify the rheological properties of precious and rare materials. Thus, it is suited for industrial applications, like the food processing industry, cosmetics or pharmaceutics.

Prof. Krieg is even more excited about the information in fundamental science that could be unlocked: "Which is the energy that a cell requires in order to move? How does the nucleus protect DNA and activate transcription? How does the deformation of a mechanosensitive protein condensate translate into the activation of a neuron? TimSOM will help scientists in the field take a picture of biological mechanics, and luckily that might allow us to finally answer these and many other long-lived questions in rheology."

## Same beginning, different ends: new tailored catalyst activation protocols improve reliability in green hydrogen generation

The predictive design of active catalysts is challenged by their chemical and structural transformation during reaction, which also exacerbate degradation and limit stability. Typically, though, the initial material is not yet fully optimized for catalysis; it is said to be in a precatalyst form. To improve its ability to drive the electrochemical reaction, a so-called activation processes is needed. Conventionally, though, activation processes are overlooked and standard regardless the starting precatalyst material.

Now, a joint effort between the Forschungszentrum Jülich (led by Dr. Meital Shviro, now at NREL), University of Bayreuth, and ICFO researchers, **Dr. Lu Xia, Dr. Kaiwen Wang, Tengyu Chen, Dr. Kaiqi Zhao, Ranit Ram, Dr. Barbara Polesso, Dr. Anku Guha**, led by **Prof. Dr. F. Pelayo García de Arquer**, has shown that the role of tailored activation protocols is, in fact, critical. In a **Nature Materials** article, the team has proposed an activation protocol that offers real-time control over deterioration and has demonstrated that it leads to catalysts with higher durability, stability



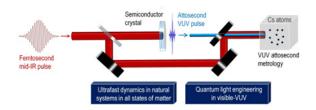
and reproducibility compared to those achieved through traditional protocols. Importantly, this was implemented at industrially relevant conditions. On the other hand, they have shown that inappropriate activation protocols lead to irreversible catalyst degradation, complicating control and reproducibility. Compared to traditional techniques, the combination of theory and experiment enabled higher control over the oxidation process, minimal dissolution of the catalyst and longer-term stability of the material.

The natural next step would be to apply the protocol to other electrochemical reactions and investigate how it impacts them. Another research direction would be to refine the protocol to take into account larger material areas, transport phenomena and other subtleties surrounding water electrolysis. That would allow for extending the strategy to larger-scale electrolyzers, bringing the ultimate goal of device commercialization one step closer.

# Scientists create vacuum-ultraviolet attosecond pulses to track ultrafast processes of natural systems

Electrons in atoms interact with each other and with other particles, changing their motion, energies, and other features at incredibly fast timescales, on the order of attoseconds. Capturing these ultrafast changes demands ultrafast light pulses. The pulse's duration needs to be more or less the same as the effect's; otherwise, it would be like trying to capture a hummingbird's wing motion with a slow, longexposure camera.

XUV light does not provide access to the bound states of the natural systems, so their study has remained out of reach for attoscience. To address this, a source delivering less energetic attosecond pulses (for instance, in the vacuum-ultraviolet spectral range) and new methods to measure their main features (duration, intensity, etc.) are needed.



This has now been done by an international team of researchers from ELI-ALPS, ICFO researchers, **Philipp Stammer, Dr. Javier Rivera-Dean** and **ICREA Prof. Dr. Maciej Lewenstein**, and other institutions. For the first time, the team has demonstrated a method capable of generating and characterizing vacuumultraviolet attosecond light pulses using semiconductor crystals illuminated by strong laser fields. They have also retrieved the pulses' temporal shape and have measured their total duration,

These unprecedented results, published in **Nature Communications**, establish the basis of a novel technique for probing the ultrafast changes that occur in most natural systems in all states of matter, preserving their bound state rather than inducing their ionization.

which was confirmed to be of around 950 attosecond.

BUSINESS NEWS

# **Quantum technologies make waves at MWC25**

10 companies and 3 European initiatives showcased products and services currently on the market, demonstrating that 'quantum' is now tangible technology

Mobile World Congress 2025 (MWC25) welcomed more then 109K visitors this year and witnessed a remarkable level of interest from attendees and industry leaders alike to the Quantum Flagship stand. Curated by ICFO, the stand was designed to highlight the latest advancements in quantum computing, cryptography, and communication and attracted a high volume of visitors, underscoring the growing relevance of quantum technologies in the telecommunications sector and beyond. Industry professionals, investors, and technology enthusiasts engaged with exhibitors, delving into the products and services on display, all perceived as a strong market interest for quantum adoption.



The growing interest in quantum technologies especially among industry leaders and policymakers—was clearly reflected in the visit of **Henna Virkkunen**, Executive Vice-President for Tech Sovereignty, Security, and Democracy at the European Commission. Her presence at the stand signaled strong EU support for the development and deployment of quantum technologies across Europe. It also highlighted the European Commission's commitment to driving cutting-edge research and innovation, with the goal of keeping Europe at the forefront of global scientific and technological progress.

Quantum Communications companies shared the latest technology advances for Quantum Random Number Generator (QRNGs) devices, QKD devices, quantum cryptography systems, key management software, quantum memories and repeaters, quantum space, among others, with some exciting new product releases.

- LuxQuanta (ICFO spin-off company)
- \*\* launched 2nd-gen NOVA LQ® QKD system
- Qoolnet
- QUBO
- Quside (ICFO spin-off company)
   \*\* launched Onyx<sup>™</sup> Series, the latest Reliable
   (50-100 Mb/s) QRNG to date
- Welinq
- ThinkQuantum

**Quantum computing companies** provided software and hardware solutions for quantum computing and simulation to a varied ranged of possible applications:

- IQM
- Qilimanjaro
- Qcentroid \*\* launched their QuantumOps platform
- Delft Circuits

#### **Quantum Technologies Showcase**

In additional to a quantum computer mock-up on display, there was an exhibition area displaying real tangible technologies manufactured by these companies as well as a full set of quantum computer chips, microchips, and photonic chips, giving visitors a palpable understanding of how they work, how they can be integrated into current systems, and how these advancements can transform a wide range of industries.

# Presentations of ongoing research and European projects

The stand's stage offered exhibitors ad Quantum Flagship researchers the opportunity to gain visibility for ongoing initiatives. QSNP, coordinated by ICFO, QIA- The Quantum Internet Alliance and Pasquans (in both ICFO has an active role), held panel discussion to present the latest advances in technology development. EuroQCI Spain presented the current status of the deployment of quantum communications networks in Madrid and Barcelona and the future extension of the network at a national level and to neighboring countries. ACCIÓ – the Agency for Business Competitiveness, invited ICFO to their stand to present the new PhotonChip initiative and its integration into the much bigger scheme of the new pilot line PIXEurope.

The stand also welcomed high-level visitors including European Commission officials and representatives from governments in Spain, Catalonia, Hong Kong, and Korea—an important indicator of strong global and institutional interest.

#### **Europe's position towards Quantum**

The Quantum Europe stand at MWC25 is just a small sample of the technology that is being developed within the Flagship, but a clear indicator of how Europe is seeking to drive quantum technologies into the market and industry and position itself as a leader in the Quantum Field.



# **QSENSATO**

# The 12<sup>th</sup> spin-off venture based on ICFO IP

ICFO is proud to announce the launch of **QSENSATO, the 12<sup>th</sup>** 



deep tech venture based on ICFO IP, generated through collaborative research conducted between the Atomic Quantum Optics group led by ICREA Professor at ICFO Dr. Morgan Mitchell and the section of the CNR-IFN led by Dr. Roberto Osellame in Milan.

The company is focused on developing and commercializing integrated vapor cells and atomic sensors for quantum sensing and metrology applications. By leveraging patented femtosecond laser-written vapor cells (LWVCs) and integrating them with photonic structures, QSENSATO aims to deliver unparalleled precision and size reduction in its products for industries requiring enhanced robustness and durability, such as space, defense, remote sensing, and automotive as well as in biomedical and lab-on-chip applications.

QSENSATO, headquartered in Bari, Italy, was officially constituted in May 2024 by co-founders **Dr. Vito Giovanni Lucivero**, CEO & Founder, **Dr Annalisa Volpe**, Head of processing and microfluidics & Co-founder, and **Dr. Domenico Tulli**, Tech advisor & Co-founder. The company will exploit the technology of LWVCs thanks to an exclusive patent, licensed by ICFO, CNR and PoliMi.



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Thanks to the unique combination of exquisite sensitivity and miniaturization, quantum sensors are poised to replace conventional sensors in several strategic industries, from medical diagnostics and lab-on-chip applications to space communications and environmental monitoring

> Vito Giovanni Lucivero QSENSATO CEO

The startup is already showing signs of a strong start. It received second prize at the Start Cup Puglia 2024, a Jury mention from Studio Torta (IP) at the final of Talentis GI Startup Program in Capri, including an interview for Forbes Italia, and was among the finalists of the National Innovation Prize (PNI) at the University of Tor Vergata (Rome) in December 2024.



# ICFO's Young Photonics Congress turns 10 years old!

Young Photonics Congress celebrates its 10<sup>th</sup> edition with more than 1250 participants since its creation



On March 14<sup>th</sup>, ICFO opened its doors to host the 10<sup>th</sup> edition of the Young Photonics Congress, a scientific congress created for and made possible by high school students, allowing them to share their photonics projects. It has become a landmark event and a meeting point for young generations. Since its inception, the congress has brought together more than 1250 participants, including high school students, teachers, educators, general public, as well as early-stage researchers and experienced scientists, to exchange ideas, knowledge and explore the power of photonics.

Many secondary school students, with high hopes of becoming up and coming scientists, arrived to the event eager to experience what it means to participate in a scientific conference for the first time, and live it at its full potential, from registering and getting their accreditation badges, checking that their posters were correctly placed to greeting colleagues and crowding the auditorium to take part in the plenary sessions offered by photonic experts.

The event was led by Dr. Lucía Castillo García, member of the Outreach team at ICFO. The event opening was offered by the director of ICFO, Dr. Oriol Romero-Isart, who transmitted inspiring words to the young participants: "Young people define the future of our society. Things are as they are now because someone has decided them before. So, you can change and improve them."



During the first sessions of the morning, the attendees had the opportunity to learn about the scientific research carried out at ICFO, in particular those shared by Dr. Luis Trigo-Vidarte from the Optoelectronics group, Dr. María Marsal from the Super Resolution Light Microscopy and Nanoscopy Lab and predoctoral student Miguel Dosil from the Functional Optoelectronic Nanomaterials group. In addition, before the poster session, the audience also enjoyed a scientific stand-up talk show given by Oriol Marimon a chemist from Big Van Ciencia, who aimed at engaging with the audience on scientific concepts and explaining them through the use of comedy.



Following this, it was time for the poster session, the core session of the event, dedicated exclusively to encouraging students to network and share scientific insights. The session commenced with motivating words from Dr. Silvia Carrasco, Vice Director of Innovation, Sponsored Research, and Public Engagement. She cheered all those present to continue pursuing their dreams and invited two students to blow out the candles of a cake in honor of the YPC's 10th anniversary. Then, it was the moment for the students to show and tell what they had been investigating and working on within their projects. They shared their results and experiences with all the other students present in the congress as well as the researchers from ICFO. A total of 25 projects were presented by 60 authors, covering very diverse topics, including experiments that delved into the field of portable X-ray devices, wave translators, solar filters and their effectiveness, among others.

To close the event, participants gathered in the Auditorium to receive a diploma recognizing their work. Dr. Lydia Sanmartí-Vila, Head of Outreach at ICFO, delivered a closing speech summarizing the ten editions in pictures and highlighting the contributions of all participants and the particular importance of the support of the teachers.

With a decade of success, the Young Photonics Congress remains committed to inspiring and supporting the next generation of researchers, ensuring and awaking scientific vocations among the youngest and aiming to bring them closer to the world of photonics research. Its continuous success demonstrates the importance of fostering interest in science from an early age and offering spaces where students can share their projects and experiences with the scientific community.



This congress gives students the

opportunity to be inspired by new projects by talking to scientists and just being in a scientific institution. They get to see themselves as future scientists.

Lucía Castillo García Outreach team at ICFC

The YPC is precisely the experience of living a scientific congress as if they were real scientists, which they truly are, because they have done a research project, in this case in photonics.

Federica Beduini Teacher and ICFO Alumn

The congress is awesome- we see it in the student's happy faces! It's a good chance for them to connect with people who have done the same type of project in different fields, and to talk to teachers, the researchers at the center, all the people... Young people need these types of events.

Miguel Dosil ICFO PhD studen

YPC simulates a real science conference. It's great that the ICFO scientific community comes to ask our students "difficult" questions and let them sweat a little bit!

Francesc Closa St. Peters School Teache

It really is a very nice opportunity for the students, giving them ideas about doing research work, and ideas about what they can study later.

**Sonia Tarancón** Col·legi Santo Angel Teacher

It is a place where you can exchange information and experiences with scientists. And, above all, you learn a lot, because even though you have done the research, you will always find a scientist who will broaden the horizons of your knowledge. You also have a great time with other students who are also interested in the same areas as you.

**Comment from a student presenter** 

OUTREACH

# Quantum CARLA Symposium

A full house with over 300 students and experts gathered to shape the future workforce of quantum science and technology!



The Quantum CARLA: the Quantum Careers Symposium 2025, hosted by ICFO on March 28th at La Pedrera, was a dynamic gathering of students, early-career researchers, and quantum experts.

This hybrid event, celebrating the International Year of Quantum Science and Technology, brought together over 300 participants both in person and online to explore career opportunities, cutting-edge science, and the rapidly evolving landscape of quantum technology.

#### What the speakers said:

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The Quantum CARLA symposium offered a great opportunity to share concepts and views with our young professionals, the future of our industry. I enjoyed all the discussions I had with my panelist colleagues, and with the students. Great venue!

The Quantum Careers Symposium has been a great opportunity to explain our activities to many talented and motivated students. This strongly encourages us to keep on generating innovation in the field of quantum sensing. With 17 prominent speakers and a wide array of discussions, the event provided attendees with valuable insights into the vast career paths within the quantum field. Feedback was positive, with the symposium receiving an overall rating of 4.5 out of 5!



# What the participants said:

Yes, I would recommend Quantum CARLA because it provides valuable insights into quantum science and technology. The sessions were informative, and the opportunity to interact with experts was beneficial.

The event is overall super nice! I will attend next year!

It was wonderful opportunity to get to know about Quantum Technology from both the academic and industrial perspective.



#### Thank you ICFO Outreach Volunteers

The following ICFOnians participated in outreach activities (January – March 2025) sharing their enthusiasm for science with new audiences:

Become an Outreach Volunteer outreach@icfo.eu Dr. Alastair Cunningham Dr. Aleksandra Sierant Alisa Tanaka Dr. Antonio Acín Dr. Barbara Polesso Bertran Soria Dr. Carmelita Roda Carolina Fajardo Dr. Clara Vilches Diana Méndez

Dr. Ekaterina Khestanova

Giacomo Franceschetto

Ignacio Pérez Jacqueline Martínez Dr. Joana Ibáñez Dr. Johann Osmond Julia Bergmann Juliette Tudoce Dr. Laura Zarraoa Prof. Dr. Leticia Tarruell Dr. Luis Guillermo Gerling Dr. Luis Trigo

Prof. Dr. María García-Parajo

Ibtissam Ghailan

María Hernández Dr. María Marsal María Recasens Dr. Marina Cunquero Marta Cagetti Dr. Matteo Pasini Miguel Dosil Mirko Fornasier Prof. Dr. Oriol Romero-Isart Paula Alonso Dr. Pere Mujal Dr. Raja Yehia Rebecca Hoffmann Dr. Rob Sewell Dr. Roberto González Dr. Romain Veyron Santiago Tabares Dr. Silvia Carrasco Dr. Stefan Forstner Tomás Fernández Valentina Gacha Prof. Dr. Valerio Pruneri Zoi Sargianni



# **Exploring the Frontiers of Quantum: 2025 Spring School**

#### 📛 March 24- 27, 2025

This year's Spring School provided students with a hands-on introduction to the software and hardware tools essential for both theoretical and experimental work in quantum science and technology. The program covered key applications in quantum computing and simulation, communications, and sensing.

The theme of quantum science and technology was especially timely, as **2025 has been marked as the Year of Quantum**, reflecting the growing global focus on quantum computing and the increasing demand for education and training in this field. A strong grasp of both theoretical foundations and practical tools is essential for students aiming to shape the future of quantum innovation.

In addition to technical sessions, the school **featured a career development workshop** led by the **Knowledge and Technology Transfer team**, as well as a **networking workshop** designed to strengthen students' professional connections and soft skills.

Following the Spring School, the **360 Quantum CARLA Careers Symposium** took place on Friday, March 28<sup>th</sup> at the iconic *La Pedrera* in Barcelona, offering students a unique opportunity to connect with professionals and explore career pathways in quantum technologies.



Exploring the Frontiers of Quantum: 2025 Spring School

The Spring School was organized as part of the **Master in Quantum Science** and **Technology Barcelona**, within the framework of the **DigiQ (Digitally Enhanced Quantum Technology Master)** project and the **Catalonia Quantum Academy (CQA).** 



Master in Quantum Science and Technology Barcelona







# New Board for ICONS

Congratulations to the new ICONS leaders and many thanks to the outgoing team for all your efforts to enrich the experience of PhD students at ICFO



#### New board for ICONS

The ICFO Organization and Network of Students (ICONS), is an organization that promotes educational activities for students, boosting their career opportunities by drawing them closer to the photonics community.



Likewise, the network endeavors to intensify the interaction and collaboration of its members within ICFO by organizing social events like Social Friday and, the annual International Food Festival. In more recent years it has spearheaded the organization of the PRIDE celebration at the institute.

Each year since its creation in 2004, the general assembly of the ICFO Organization and Network of Students (ICONS) appoints a new board of officers by an open vote.

 This year the new leaders are Bianca Turini (President),
 Alejandra Padilla (Vice-President), Rebecca Hoffmann (Treasurer), Roxana Wedowski (Secretary), Valentina Gacha (Communication Officer) and Alberto Rodríguez-Moldes Sebastian (Diversity and Inclusion Officer).

They take over from the outgoing leadership team who organized many initiatives aimed at helping fellow ICFOnians get the most out of their time at the institute, most notably the successful Student Conference in Optics and Photonics (SCOP '24) which took place at ICFO in October 2024.

Congratulations to the new ICONS leaders and many thanks to the outgoing team for all your efforts to enrich the experience of PhD students at ICFO.

COMMUNITY



# ICFOnians for Women in Science Month

A month of concentrated activities focusing on gender diversity in science

The Diversity and Inclusion Committee organizes activities throughout the year to stimulate conversations and gain visibility for important issues that have been identified in our community for their importance and for their potential for improvement and growth. The historical disparity in the representation between women and men in our field of science, most notable when comparing positions of leadership, motivated the committee to initiate the annual celebration of ICFOnians Women in Science Month (WiS) at ICFO in 2018.

This month long initiative begins on **February 11<sup>th</sup>**, **International Day of Women and Girls in Science** and extends all the way to **March 8<sup>th</sup>**,

#### **International Women's Day,** during which time ICFOnians organize a range of discussions and activities aimed at supporting women in and around science and helping to ensure a positive future for women in science that we all hope to be part of. It is an important part of the institute's Diversity and Inclusion program.

Recognizing that there are women working in many fields, directly and indirectly involved in science and each playing a role in facilitating frontier research advances, this year's WiS month agenda purposely aimed at representing a wide range of voices and perspectives of women working in STEM related fields.



We invited members of scientific communities beyond ICFO to bring their expertise to lively discussions about the gender dynamics behind the collaborations that are so important to sharing and advancing science. We also met to discuss books and documentaries that reviewed ways in which gender biases in science have very real downstream effect on society.

Women scientists at ICFO volunteered to participate in outreach events for schools, including the annual *Científiques* event organized by Fundació Catalana per a la Recerca i la Innovació and BIST as well as a special edition of ICFO's own *Photonics in 5 Minutes* event,

all sharing their excitement for photonics research with students. Women role models in science were the common denominators behind these outreach events, as they are in our annual *Women in Science we Admire* campaign, with posters of amazing women scientists nominated by ICFOnians on display in the NEST Hall throughout the month.



More info 2025 Program

# **2025** The International Year of Quantum Science and Technology

Inaugurating a worldwide initiative aiming to raise awareness of the transformative potential of QSTs to address critical global challenges



Quantum Science and Technology

2025 is the International Year of Quantum Science and Technology (IYQ) as proclaimed by the United Nations. This year-long, worldwide initiative, coinciding with the 100th anniversary of the birth of modern quantum mechanics, aims to **celebrate the contributions** of quantum science to **technological progress, raise global awareness** of its importance to sustainable development in the 21<sup>st</sup> century, and ensure that all nations have **access to quantum education and opportunities.** 

On February 4<sup>th</sup>, 2025, UNESCO, and associated partners, celebrated the official opening of the IYQ in Paris. On February 21<sup>st</sup>, within this same framework, the Department of Research and Universities of the Generalitat de Catalunya organized an event at the **Palau de la Generalitat** in Barcelona that aimed at promoting collaboration between research, industry and society by showcasing the academic and industrial advancements that have been made so far in the field both in Catalonia and in Spain.



Salvador Illa, President of the Generalitat de Catalunya It highlighted initiatives being deployed in the region as well as the start-ups and spin-offs, having emerged in the recent years, that now run at full speed to bring quantum technologies to market.

Underscoring the Generalitat's commitment to Quantum Science and Technologies (QSTs) for the future of Catalonia, the event began with opening words from the President of the Generalitat de Catalunya, **Salvador Illa**, followed by the Minister of Research and Universities of the Generalitat de Catalunya, **Nuria Montserrat**. Both emphasized

the important impact QSTs are having in transforming our society in areas ranging from computing and communications, to information security and the discovery of new materials, and celebrated Catalonia's strong quantum research and industry ecosystem.

The event brought together experts from the academic and research fields, as well as policymakers, spin-offs and mid and large-size companies that are becoming the early adopters of this technology. As a key player in the Quantum ecosystem in Catalonia and a leader of a number of high profile collaborative initiatives on the European stage, ICFO was highly visible at the event contributing expert talks, overviews of major international initiatives being

led by the institute, and also represented by CEO's of deep-tech companies that spun-out of ICFO to commercialize promising quantum technologies.

As **Lydia Sanmartí-Vila**, Head of Outreach at ICFO, implied in her comprehensive overview of exciting initiatives and events planned for 2025 that concluded the event, the IYQ will pave the way for a transformative year in quantum science.



Lydia Sanmartí-Vila, Head of Outreach at ICFO

## People

IN MEMORIAM



# In memory of Emmanuel Ofosu

Visiting MSc student, Solid-State Physics, Kwame Nkrumah University of Science and Technology, Ghana

It is with deep sadness that we remember Emmanuel, a kind friend and bright young scientist.

## GO & FLY

## Congratulations to 5 New ICFO PhD Graduates

347 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.



Saurabh Ishwar Borkar Nanocavities and Molecules: Polaritons and their Dynamic Interactions

Harch 21, 2025 ICREA Prof. Dr. Niek van Hulst



Stephy Vincent Solution Processed Colloidal Quantum Dot-Based Short Wave Infrared Light Emitters

January 23, 2025 ICREA Prof. Dr. Gerasimos Konstantatos



**Eduardo Beattie Eizaguirre** Single rare earth ions for quantum computing nodes

Harch 26, 2025 ICREA Prof. Dr. Hugues de Riedmatten



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Laura Zarraoa Sardón Photon counting with a single neutral atom: quantum efficiency, dark counts, and background rejection

February 27, 2025 ICREA Prof. Dr. Morgan Mitchell and Dr. Romain Veyron



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Guillem Müller Rigat Certifying quantum resources in many-body systems from accessible observables

Harch 27, 2025 ICREA Prof. Dr. Maciej Lewenstein

## COMMUNITY



# ICFO Calçotada

🗄 February 14, 2025

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?

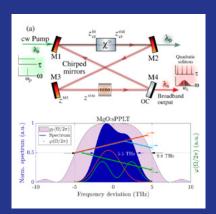
ICFOnians are a fascinating group, with hobbies, interests and talents that may surprise you. Have a look around and see if you can guess who this edition's Mystery ICFOnian is!

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

- **1.** As a proud Valenciano, every year he goes to Las Fallas.
- 2. He plays bass guitar in an indie band.
- **3.** He is a chess and "speedrunning" enthusiast.
- 4. He backs F.C. Barcelona's arch rival Real Madrid C.F.

#### **The Last Word**

SCIENCE QUIZ



Researchers at ICFO and TIFM Hyderabad, led by ICFO GL Majid Ebrahim-Zadeh, recently proposed a new way to generate frequency combs using  $\chi^{(2)}$  nonlinear optical effects in **"Quadratic frequency comb based on phase-modulated cw-driven optical parametric oscillator with intracavity dispersion control"** *Physical Review Research*, 2 May 2025.

#### 1. Which of these has not (yet) benefitted from frequency combs?

A) GPS / GNSS systems
B) Spectroscopy
C) High-field physics
D) MW and THz generation

# 2. In 2005, what prize was given for frequency combs?

A) Wolf prize
B) Vidal Sassoon prize
C) Nobel prize
D) Max Born Award

# 3. How are frequency combs typically made?

**A)** Passively mode-locked lasers **B)** Actively mode-locked lasers **C)**  $\chi^{(2)}$  effects in ring resonators **D)** All of the above

#### 4. How are OPO dynamics modelled?

- A) Non-abelian gauge theories
- B) Coupled wave equations
- **C)** Fermi-Hubbard models

# 5. What is a good way to simulate the model from 4)?

- A) Monte-Carlo integration
- B) Metropolis-Hastings algorithm.
- **C)** Split-step Fourier method
- **D)** Fox-trot differentiation



# Philippe Grangier

Director of Research at CNRS, working at the Laboratoire Charles Fabry at the Institut d'Optique Graduate School in Palaiseau, France. Coordinator of QUCATS, the Coordination and Support Action of the Quantum Flagship

#### What does QUCATS involve and what led you to coordinate this large initiative at this point in your career?

The role of QUCATS is to support the growth, robustness and strategic coherence of the European research and innovation ecosystem for quantum technologies. It promotes outreach, cooperation, exploitation, stabilization through standardization and benchmarks, and quantum technology-oriented workforce education and training. QUCATS also assists the European Commission in advancing its quantum technology ambitions, protecting strategic assets, interests, and security, and progressing toward strategic autonomy. In some sense, QUCATS stands between the European Commission (the funding party) and the Research and Innovation projects (the funded party), in order to put oil in the cranks and run the engine faster. Since the mid '90's I have been a participant or coordinator of many European collaborative research projects. One of the successful projects I coordinated was SCALA- Scalable Quantum Computing with Light and Atoms ('05-'09, FP6), where ICFO and many other leading European teams were partners, contributing to a nice quantum science and technology adventure. Overall, I know guite well the European ecosystem, and this is probably why I was asked to coordinate QUCATS, a project on logistics rather than on actual research and innovation . I'm happy to do this at this stage of my career, but I would not recommend this job to a young researcher who still needs to publish many high impact scientific papers to establish their career. On the other hand, everybody is welcome to help QUCATS with their specific expertise, by answering the surveys and questionnaires that pop up quite often!

#### How has your pioneering work in quantum optics and quantum information influenced your strategic vision and leadership within the Quantum Flagship initiative?

It's been a long story with many steps: I started in 1980 as a master student working on Bell's inequalities under the supervision of Alain Aspect: there was the famous Bennett-Brassard protocol on quantum cryptography (BB84) in 1984; the even more famous Shor's algorithm in 1994; around 2000 the first European program on quantum technologies (Quantum Information Processing and Communications-QIPC). From the start I was involved in many projects using guantum optics techniques that I developed during the '90's for QIPC applications. A big change occurred around 2014, when the huge US companies like Google and IBM launched large internal programs on quantum computing. This triggered European reactions starting with the Quantum Manifesto in 2016, then the development of the "quantum ecosystem" with many start-ups in Europe, mixing different cultures and professional interests

It is clear that the language of strong self-promotionsometimes drifting towards excessive hype- used by

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In some sense, QUCATS stands between the European Commission (the funding party) and the Research and Innovation projects (the funded party), in order to put oil in the cranks and run the engine faster.

companies to attract investors is rather remote from the neutral language used in scientific publications. In QUCATS our job is to promote impactful European innovation, but always keeping high scientific standards. This is a necessity to sustain progress in the field, also from the technology point of view.

# How have the priorities of the Flagship shifted since its launch in 2018?

The answer depends on who you ask. Generally, the current shift and pressure is towards applications, but there is an agreement, even from companies, that basic research is still needed and should not be forgotten. A well-known example are quantum error-correcting codes (QECC), which involve a subtle mix of fundamental questions and device-dependent solutions. A meaningful picture may be a "pipeline" with a continuous increase in TRL.

Looking at the funding issues, there are many quantum start-ups in Europe that need increasing investment as they develop to compete with non-European powerhouses like the US. Such issues are central in the ongoing discussions for setting up the next European Multiannual Financial Framework (MFF), deciding the key policy and budgetary challenges that will shape the EU's long-term budget.

#### What recommendations would you give to ICFOnians who are interested in having a positive impact on the Quantum Science Community?

Get connected to other teams across Europe with similar interests to yours. These connections had a major role in my own career, and I think that now all young people know how important this collective enterprise is. PhD students may doubt between working in academia or industry? This is a matter of personal choice, but maybe try both?

If you decide to leave research but want to stay close to science, you may choose a career in research support roles, managing projects, doing outreach, working with industries... To ensure that Quantum science moves forward, we need all these people because they understand the science and know the researchers. This role is different from research but also very important.

This edition and back-issues of ICFOnians are available at www.icfo.eu/newsroom/newsletter Please send questions, comments and suggestions to communications@icfo.eu