ICFO

ICFO NEWS

Community News 47
Winter 2022

Time to Reconnect

Celebrations of science, community, and solidarity

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Mystery ICFOnian
Solution Ed #46

Anne Gstöttner
Relocation, Human Resources and Education Unit

Science Quiz
Answers from p.12

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

ON THE COVER

Time to Reconnect

At long last, we are beginning to enjoy the return to in-person networking and community activities. ICFO Day has historically been an occasion that we all look forward to, however this year there was a special celebratory feeling about the event. The halls meeting rooms and auditorium came alive with activities that allowed us to share our science, our interests and the many things that connect us as ICFOnians. (read more pg 7)

EDITOR'S CORNER

Together Again

Brook Hardwick
Contributing Editor

Technology has allowed us to do so much more, but it is no substitute for personal contact

How many times since February 2020 have we sung the praise of technology, thankful for the fact that even in our isolation, we were connected with family, friends and colleagues? Our new normal includes hybrid events that allow people to connect from all over the world, over various time-zones (see Frontier Schools, pg 9) from home, and at whatever time of day best suits our purpose. We are productive working in remote offices as needed and conducting meetings over Teams and Zoom. The big news now is not that we are grateful to be connected virtually, which without a doubt we are. We are now celebrating the fact that we are together! We have discovered the value of personal contact, the nuances that we were missing when we were online, and just how much we actually enjoy and benefit from the personal interactions that we once took for granted at our institute.

The ICFOnians social program, a valued vehicle for meeting and interacting with ICFOnians across groups and uniting research and administrative units, has begun operating once again. We began with the celebration of la Castanyada, sharing the Catalan tradition of panellets and roasted chestnuts in honor of All Saints Day. ICONs followed with the organization of the International Food Festival, a huge success with thirteen teams participating to share the wealth of cultures that exist in the ICFO community.

ICFO's core activity is research and we have historically valued very highly the opportunity to gather in person to share science and to learn from each other. Professor Hugues de Riedmatten offered a Colloquium to a full Auditorium in December to share the exciting results of work published in *Nature* earlier this year on entangled crystals for quantum repeaters. As the year came to a close, we were able to reinstate our annual ICFO Day Event, presenting labs, research and interests from all areas of the institute, engaging in some friendly competition in the Gymkhana, and celebrating the accomplishments of our fellow ICFOnians.

We cover a wide range of subjects at ICFO, with members of some groups having only a limited understanding of what may be going on in a lab downstairs. But what we have in common is that we are all curious, ambitious, and different. This common bond between ICFOnians helps to ensure that the work we do to generate high impact scientific discoveries is fulfilling both professionally and personally. Those who have a limited time at the institute (which is most of us) will take this with them when they go and fly, as we regularly hear from members of our alumni community.

We close 2021 on a high note, and it is my hope that as our in-person gatherings pick up steam in 2022, we will keep sight of the importance of our personal connections and the ways that they enrich our work and our lives.

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Happenings

ICFO NEWCOMERS

Welcome to ICFO

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

Tim Broekema
Student

Lex Dedding
Student

Maria Paula Ayala
Student

Carlos Ramos
Student

Lara San Martin
Student

Goretti Torres
Student

Alberto De Toni
Student

Maria Torras
Student

Harini Raghavan
Student

Priyanuj Bordoloi
Student

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Anubhav Kumar Srivastava
PhD Trainee

María Hernández
PhD Trainee

Santiago Ortiz
PhD Trainee

Kartika Nimje
PhD Trainee

Jie Meng
PhD Trainee

Susana Plascencia
PhD Trainee

Eloy Piñol
PhD Trainee

Aparna Das
PhD Trainee

Davide Rizzotti
PhD Trainee

Eva María González Ruiz
Visiting PhD

Guillermo Martínez-Denegri
Postdoctoral Research

Mariano Pascale
Postdoctoral Research

Paolo Stornati
Postdoctoral Research

Marcin Plodzien
Postdoctoral Research

Samyobrata Mukherjee
Postdoctoral Research

Hyun-Soo Ra
Postdoctoral Research

Mitradeep Sarkar
Postdoctoral Research

Manuel Gessner
Postdoctoral Research

Piotr Sierant
Postdoctoral Research

Aleksandra Sierant
Postdoctoral Research

Stefano Signorini
Postdoctoral Research

Artur Niezgoda
Postdoctoral Research

Marlin Baral
Postdoctoral Research

Vindhiya Prakash
Postdoctoral Research

Jae Taek Oh
Research Engineer

Ravindra Chhajlany
Visitor

Allan Johnson
Research Fellow

Noemí Muñoz
Health&Safety Coordinator

Luis G. Gerling Sarabia
KTT Project Manager

Lisa Saemisch
Junior Project Manager

Not pictured

Eric Torralba
Student

Álvaro García
Student

Joel Compte
Student

Happenings

ICFO NEWS

Incoming Faculty and Group Leader

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 February 2022, **Dr Nicoletta Liguori will join ICFO as a new faculty member and Group Leader.**

Dr Liguouri, who comes from the LaserLaB of the Vrije Universiteit Amsterdam (NL), will develop a research program aimed at understanding how changes in light, structure and environment regulate the molecular mechanisms of photoactive (bio)molecular systems.

RSEF- BBVA Foundation Awards Ceremony

The **RSEF-BBVA Foundation Physics Awards** recognize the excellence of the best Spanish scientists in this field, with special attention to young researchers. The **award ceremony annually brings together many of the best physicists in Spain**. As the 2020 ceremony was postponed due to COVID-19, the gala held in December 2021 honored the 21 awardees in both 2020 and 2021.

In the category of Young Researcher in Experimental Physics, the 2021 award was given to **ICFO Professor Pelayo García de Arquer**, leader of the CO_2 Mitigation Accelerated by Photons research group at ICFO that is working on the development of nanomaterials that can be used, for example, for the development of clean energies, as well as to capture CO_2 from the atmosphere and transform it into fuels and other products.

A WICB's 50th Anniversary Favorite Publication

To celebrate the 50th anniversary of the American Society for Cell Biology's **Women in Cell Biology Committee (WICB)**, members of WICB, along with the *Molecular Biology of the Cell (MBoC)* journal's Editorial Board, invited a diverse group of scientists to highlight MBoC papers by women that have had a scientific or personal impact on the authors of the highlight.

Scientist Anikita Jha at the National Heart, Lung and Blood Institute, NIH in Bethesda, MD (USA) highlighted the paper entitled **"Dynamic actin-mediated nano-scale clustering of CD44 regulates its meso-scale organization at the plasma membrane"** by an international team of scientists led by **ICREA Prof at ICFO Prof Maria Garcia-Parajo**. She cited García-Parajo's crucial and impactful work on superresolution imaging for deciphering nano-scale organization.

Narcís Monturiol Plaque

On 4 November, **Ms Gemma Geis, Consellera of Research and Universities of the Government of Catalonia awarded the *Narcís Monturiol* Medals and Plaque** to several members of Catalonia's scientific and technological community in a ceremony that took place in the Auditorium of the Palau de la Generalitat.

ICFO, as a whole, received the institutional plaque for "its outstanding contribution to the development of science and technology in Catalonia". ICFO's director, Lluís Torner, collected the award on behalf of all ICFOnians.

Laselab-Europe AISBL

The General Assembly of Laserlab-Europe AISBL, the international not-for-profit association representing 45 leading laser research infrastructures in 22 European countries, **elected ICREA Professor at ICFO Dr Jens Biegert as its new Executive Director** and appointed new Management Board members.

Prof Biegert is succeeding Claes-Göran Wahlström from the Lund Laser Centre in Sweden, who served as Executive Director since the creation of Laserlab-Europe AISBL in 2018 and who will continue as a member of the Management Board.

Highly Cited Researchers

Clarivate Web of Science annually produces a Highly Cited Researchers list, identifying scientists who produced multiple papers ranking in the top 1% by citations for their field and year of publication and thus demonstrating significant research influence among their peers. Four ICFO Group Leaders have been named Highly Cited Researchers, according to the Highly Cited Researchers 2020 list: **ICREA Professors at ICFO Dr Javier Garcia de Abajo** and **Dr Frank Koppens** and **ICFO Prof Dr Pelayo Garcia de Arquer** were listed in the Cross Field Category recognizing their interdisciplinary work and publication of highly cited papers in several fields. **ICREA Prof Dr Maciej Lewenstien** was recognized in the Physics Category.

Best Global Universities Rankings

***Best Global Universities Rankings*, published by US News**, has published its eighth annual release, comparing universities in over 90 countries by focusing on school's academic research and reputations based on data from Clarivate Analytics.

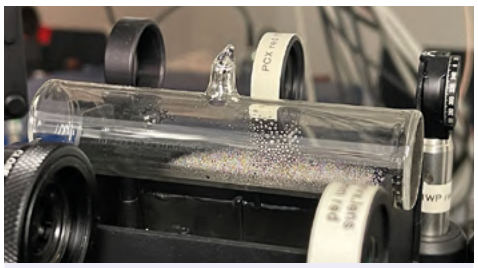
UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

In addition to ranking universities globally, the report analyzes forty-three fields and disciplines based on a battery of indicators linked to research and institutional reputations. The new release places **BarcelonaTech (UPC)**, the university with which ICFO is affiliated and who grants most of ICFO's doctoral degrees, the **2nd best university in the area of Optics in the entire European Union**. Also, in this area, the UPC is ranked 15th in the world as measured by number of highly cited papers that are among the top 1% most cited in the field.

BarcelonaTech (UPC)
The 2nd best University in the area of Optics in the entire European Union

Happenings

LATEST ADVANCES

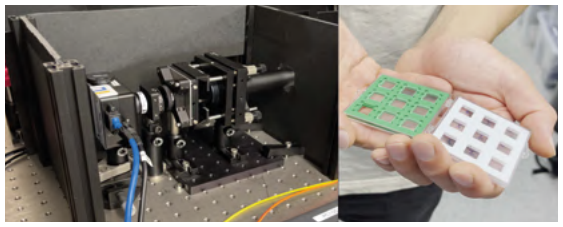


Ultra-precise magnetic field detection using squeezed light

In a recent study published in ***Physical Review Letters***, ICFO researchers Charikleia Troullinou, Ricardo Jiménez-Martínez, Vito Giovanni Lucivero, led by ICREA Prof at ICFO Morgan Mitchell, and in collaboration with Jia Kong from Hangzhou Dianzi University in China, resolve the question as to whether the squeezed light technique used by gravitational wave detectors to improve their sensitivity and to understand more precisely events like the collision of black holes, could also improve magnetometers. The researchers show that **the critical factor is the evasion of measurement back-action**. That is, the light that probes the atoms must only disturb the atoms in ways that do not change their response to the magnetic field. They then **constructed a back-action evading magnetometer, applied squeezed light, and saw that this improved the sensitivity**.

In their experiment, the team built a Bell-Bloom (BB) optically pumped magnetometer (OPM) and used polarization squeezed light to observe the response of a dense, hot cloud of rubidium atoms (87Rb) to a magnetic field.

New quantum microscope enhances sensitivity avoiding photodamage

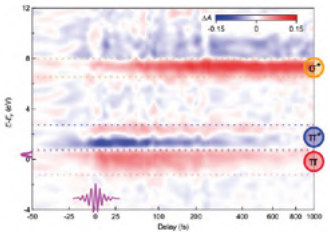


In a recent study published in ***Science Advances***, ICFO researchers Robin Camphausen, Alvaro Cuevas, Luc Duempelmann, Roland Terborg, Ewelina Wajs, led by ICREA Prof at ICFO Valerio Pruneri, in collaboration with researchers from MPD, Politecnico di Milano and Fraunhofer IOF, all partners **of the EU project Q-mic**, report on the capabilities of a **new quantum-enhanced microscope in using very low intensity levels of light to image large areas of samples, with a higher sensitivity and resolution, compared to classical microscopes**.

This microscope uses interference patterns of entangled photons to reconstruct the image of the sample and reduce the noise level, **increasing the sensitivity of the measurements by more than 25%** when compared to classical measurements. The camera does not register optical intensities nor single photon counts, but actually two-photon coincidences across the entire field of view. By repeating this process of sending in photons, researchers obtain an interference pattern image without the need of a pixel-to-pixel scanning system. Mathematical algorithms allow scientists to reconstruct the image to find more details in the sample itself.

Real-time imaging of the flow of energy inside a material between light, charge carriers and lattice

In a recent study published in ***Physical Review X***, researchers led by ICREA Prof at ICFO Dr Jens Biegert with collaborators from Universität Kassel, Fritz Haber Institute of the Max Planck Society, Universität Göttingen, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie, Max-Planck-Institut für Mikrostrukturphysik, and Institut Néel at Université Grenoble Alpes (CNRS), **developed and applied attosecond soft X-ray absorption fine-structure (XAFS) spectroscopy to reveal the coherent excitation and dephasing of all material sub-systems in graphite. AttoXAFS revealed the complete flow of excitation across the photon-carrier-lattice system** and resolved outstanding questions pertaining to the scattering mechanisms for both carrier type. It likewise settled the role of dephasing via strongly coupled optical phonons.



Study results prove and confirm the usefulness of core-level XANES with attosecond temporal resolution to achieve an unprecedented view on the temporal evolution of the photon-carrier-phonon system with surprising new results even for a seemingly well-studied system like graphite.

Severe COVID-19 patients suffer alterations on their tissue microcirculation

Although COVID-19 is primarily a respiratory syndrome, it has been observed and detected in other organs. To further investigate how the disease could affect microcirculation, a project coordinated by ICREA Prof at ICFO Dr Turgut Durduran, in collaboration with an international team of researchers, put together a clinical study to **monitor the endothelium of COVID-19 patients** that had been admitted to different intensive care units (ICUs) around the world. They did this by **using a non-invasive, portable, wireless, battery-operated near-infrared optical device (NIRS) to observe microvascular health**.

After many months of data gathering and analysis, the researchers have published their preliminary results in the journal ***Critical Care***, where they have provided data for the monitoring of healthy adults versus patients with acute respiratory distress syndrome caused by COVID-19, in six different hospitals across Spain, Mexico and Brazil.

*These findings demonstrate that NIRS could have an important role in **fulfilling an unmet need at the intensive care units**, for patients with COVID-19, ARDS, sepsis and other conditions. Furthermore, it supports the hypothesis that **more advanced forms of NIRS with the latest technologies that are being developed in the EU initiative VASCOVID could have a significant clinical impact**.*

Quantum theory needs complex numbers

A study published in ***Nature*** by ICFO researchers Marc-Olivier Renou and ICREA Prof at ICFO Antonio Acín, in collaboration with researchers from the University of Geneva, the Schaffhausen Institute of Technology, the Vienna University of Technology, and the Institute of Quantum Optics and Quantum Information (IQOQI), has overturned the long held consensus that complex number in quantum theory are merely a convenient tool. **Researchers have shown that if the quantum postulates were phrased in terms of real numbers, instead of complex, then some predictions about quantum networks would necessarily differ. Indeed, the team of researchers came up with a concrete experimental proposal involving three parties connected by two sources of particles where the prediction by standard complex quantum theory cannot be expressed by its real counterpart**. This experiment was realized in collaboration with researchers in China at the Southern University of Science and Technology, and the University of Electronic Science and Technology, and was published in parallel with these findings in ***Physical Review Letters***.

The results are a generalization of Bell's theorem, providing a quantum experiment which cannot be explained by any local physics formalism. The study also shows that combining quantum network concepts with Bell's ideas can lead to outstanding predictions.

Happenings

BUSINESS NEWS

SIXSENSO wins Startup Capital Grant

ACCIÓ grant offers direct aid to emerging technology start-ups to advance in the initial phases of their ventures, develop their product or service and validate the business model to reach their markets

Each year, ACCIÓ, the agency for corporate competitiveness of the Government of Catalunya, launches Startup Capital, a call offering direct aid to emerging technology start-ups in need of financing in order to advance in the initial phases of their ventures, develop their product or service and validate the business model to reach their markets.

In the 2021 call, 138 startups from all over Catalonia applied for the funding. ICFO Spin-off SIXSENSO was one of the twenty-five companies selected for funding from a variety of different sectors for their project, **"Systems for the rapid and on-site detection of pathogens in water"**.

With this grant, SIXSENSO will develop and build up new upgraded versions of their SX-CYT Fluorescence Reader and SX-CON Concentrator devices for in-situ and rapid specific detection of microorganisms in water.

In addition, it will validate these devices with real samples from end-user sites: environmental waters, port and ballast waters and samples from aquaculture facilities.

The project also seeks to carry out a feasibility study and lab benchmarking for the use of the Sixsenso Concentrator in combination with clinical lateral flow devices (LFDs) to enable them for use with water samples for a new ultra-fast test to detect the presence / absence above threshold in just 30 minutes. This validation will enable a complementary technology more appropriate for rapid screening of contaminated sites, helping to open the market to target consumers.

> *"This award will help us advance our product development, significantly increasing its readiness level by validation benchmarks using real samples from relevant environments. It will also contribute to establishing the bases of the industrialization process to bring the devices and its consumables to a commercial phase.*
>
> **Pedro Martinez**
> SIXSENSO's CTO

Quside receives funding from the Catalan Department of Business and Labor

The funds complement additional funding from other private investors and will be used to accelerate growth

The Department of Business and Labor in Catalonia, through AVANÇSA (Empresa de Promoció i Localització Industrial de Catalunya), promotes two projects in growth phase using Avançsa's INNOVA funding lines, with a total investment of €1.5 million. The two companies are **QUSIDE TECHNOLOGIES, S.L., a quantum technology company and ICFO spin-off**, and **THE SOCIAL COIN, SL**, responsible for the CITIBEATS project. Innova lines are a tool for public-private collaboration, which is carried out through participatory loans or equity. It aims to promote high value-added projects, with a global vision and high growth prospects, based on the development of a breakthrough innovation that allows them to compete internationally. These projects are part of the line "Innova Creixement", intended to support the "Catalonia Exponential" initiative, which includes actions to promote the transformation of the business model of Catalan companies in sectors related to Blockchain, Artificial Intelligence, Machine Learning, Internet of Things (IoT), 5G and health. This operation is preceded by those performed with Validated ID, Nexiona Connectocrats, Psico Smart Apps (PSIOUS) and Agroptima.

QUSIDE

Quside, established in 2018 and currently with a team of 24 people, is consolidating its position in the quantum technology sector with projects and agreements with national and international organizations. With the collaboration of AVANÇSA, **Quside plans to launch new random number generation products based on quantum technologies**. This allows them to be more compact and with more advanced features - for cybersecurity and supercomputing.

Catalonia National Research Awards

B. Braun receives award for Public-Private Partnerships in R+I initiatives

The Fundació Catalana per a la Recerca i la Innovació (*Catalan Foundation for Research and Innovation*-**FCRi**), with the support of the Catalan Government, organizes the annual Catalonian National Research Awards. These prestigious awards recognize and reflect different aspects of research efforts, communications and outreach as well as scientific sponsorship and Public-Private-Partnerships in R&I initiatives.

> *"The award that we receive today is by definition a team award and we want to share and dedicate it to the Catalan institutions and universities.*
>
> **Pau Turon**
> VP of Research and Development at B. Braun

B. Braun Surgical SAU, was recognized in this 31st edition of the awards for its **extensive network of collaborations for research on biomaterials and the development of sanitary products** with the UPC, UAB, Hospitals in the Institut Catala de Salut, in particular IGTP Institut Germans Trias i Pujol, and ICFO, among others. These collaborations have produced more than 50 papers published in leading scientific journals, and have generated 8 shared patents resulting from more than 30 collaborative projects.

ICFOnians congratulate all the members of the B. Braun team and look forward to more productive collaborations!

Collaboration

COMMUNITY

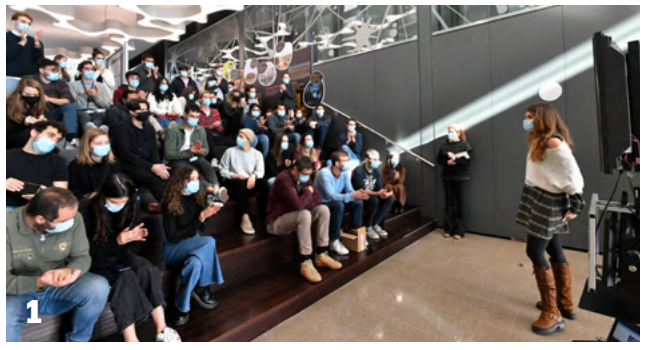
ICFO DAY 2021: We are happy to be back!

The sixth edition of ICFO Day took place on December 17th with an enthusiastic gathering of ICFOnians

This year's edition of ICFO Day, coming at the end of almost two years of online meetings and restrictions, was particularly special as it brought many ICFOnians together for the first times in months to celebrate community with the entire institute. For new ICFOnians who joined us during the pandemic, this was a first chance to witness ICFO in full swing.

This festive reunion of ICFOnians was the best possible way to close the year.

1. Scientific and Flash talks were spread out in the Auditorium, Blue Lecture Room, and NEST Hall, giving ICFOnians plenty of space to share advances in their research and interests. Talks ranged from label free bioparticle detection to twitter tips, and everything in between.
2. Six teams from all labs and units participated in the ICFOlympic Games gymkhana, competing for the gold medal with activities all around ICFO.
3. Research groups opened their labs, giving a glimpse at what goes on behind these closed doors.
4. The sun cooperated to offer outdoor seating for a boxed lunch break.


1


2


3


4

ICFO Awards

After a hectic and enjoyable morning of shared science and interests, ICFOnians met in the Auditorium to celebrate the accomplishments of our colleagues and friends.

In addition to an acknowledgement of the dedication and success of the outgoing ICONS leadership team and the welcoming of the 2022 team, four important awards were presented:

PhD Poster Session and Award

The ICFO Student Poster Session is an opportunity for the exchange of ideas and knowledge among ICFOnians of different groups and areas. The poster presentation took place in the week leading up to the ICFO Day celebration with the winners announced in the awards ceremony.


1


2

1. ICONS Prize for Best Poster

Xinyao Liu: Machine learning for laser-induced electron diffraction imaging of molecular structures. **Group:** Attoscience and Ultrafast Optics led by ICREA Prof Dr Jens Biegert

Shanti Liga: Colloidal synthesis of lead-free Cs2TiBr6-xIx vacancy-ordered perovskite nanocrystals. **Group:** Functional Optoelectronic Nanomaterials led by ICREA Prof Dr Gerasimos Konstantatos

2. ICFO PhD Poster Prize

Xinyao Liu: Machine learning for laser-induced electron diffraction imaging of molecular structures. **Group:** Attoscience and Ultrafast Optics led by ICREA Prof Dr Jens Biegert

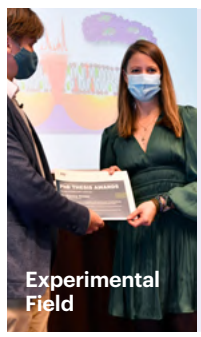
Andrés Díez: Magnetic Josephson junctions and superconducting diodes in magic-angle twisted bilayer graphene. **Group:** Low-Dimensional Quantum Materials led by Prof Dmitri Efetov

ICFO PhD Thesis Awards

This award was created in order to distinguish particularly brilliant PhD theses presented at ICFO. To determine the recipients of the 2020 PhD Thesis award, the PhD Committee launched an in-depth deliberation of the 26 PhD Theses defended at ICFO that year, highlighting and rewarding the extraordinary PhD students whose research progress at the Institute has proven to be highly creative and ambitious.


Theoretical Field

Daniel González Cuadra, in recognition of the exceptional thesis: *"A cold-atom approach to topological quantum matter across the energy scale"* supervised by Prof Alejandro Bermúdez and tutored by ICREA Prof at ICFO Dr Maciej Lewenstein


Experimental Field

Pamina Winkler, in recognition of the exceptional thesis: *"Novel planar photonic antennas to address the dynamic nanoarchitecture of biological membranes"*, supervised by ICREA Prof Dr María García-Parajo

*

Luciana Vidas and **Renwen Lu**, the winners of the 2019 Thesis Award who were unable to collect their award last year due to the pandemic, joined the award ceremony during this year's ICFO Day. Luciana returned to ICFO to take part in the award ceremony in person, while Renwen connected online from Stanford in California to accept his award.

15 Year Recognition

So much can happen in 15+ years when talented people come together to work towards a common goal. ICFO has become what it is today thanks to the contributions of our gifted and diverse community of ICFOnians.

The following ICFOnians began their work at ICFO in 2005 and 2006:

Oriol Bardés, Jens Biegert, Ferran Camps, Silvia Carrasco, Niek van Hulst, Javier Encomienda, Elena Enrique, Luis Enrique, Anne Gstöttner, Maciej Lewenstein, Olga Lorente, Jordi Martorell, Xavier Menino, Jonas Padonou, Juan Perez Torres, Valerio Pruneri, and Nuria Segú.

Thank you for your 15+ years of dedication and for the mark that you have made on our institute.

Collaboration

COMMUNITY

Optica Diversity and Inclusion Advocacy Recognition

ICFO and Fujitsu Network Communications are honored for efforts to increase diversity and inclusivity in science

Optica (formerly OSA), the society advancing optics and photonics worldwide, announced at the all-virtual 2021 Frontiers in Optics + Laser Science (FiO LS) event that ICFO and Fujitsu Network Communications are the winners of the 2021 Optica Diversity and Inclusion Advocacy Recognition. The recognition honors the steadfast commitment and achievements of Optica members, companies or institutions that proactively work to create a more diverse, equitable and inclusive optics and photonics community.

> *The 2021 honorees demonstrate how significant investments in diversity, equity and inclusion help foster advancements in scientific research and application. We are inspired by their commitment to achieving inclusivity and applaud their embodiment of Optica's core values.*
>
> **Elizabeth Rogan**
> Optica CEO

> *Diversity and inclusivity are absolutely core ICFOnian values, and we cultivate them as one of our most important assets. We very much admire Optica's programs and global reach, thus we are extremely honored by this recognition.*
>
> **Lluis Torner**
> ICFO Director

ICFO was cited **"for their deliberate and intentional work to integrate equitable, transparent and inclusive policies and programs throughout their institution's hiring, mentoring and technical programming"**.

As a truly international research center, focused on optical and photonics sciences and its applications, ICFO strives to create and implement policies, programs and projects in its HR, education, innovation and outreach branches. Collectively, these policies and activities attract, empower and promote diversity as essential to enhancing innovation, creativity and excellence. Efforts include gender diversity activities such as the mentoring program for female researchers with young children, career development tools and participation in Optica's governance and programs such as the International Optica Network of Students (IONS) featuring equality and gender sessions and a LGBTQIA+ program. Efforts go beyond the institute with participation in efforts including the Science by Women Program of the Women for Africa Foundation (FMxA) to promote African women's leadership in scientific research and technology transfer.

Focus: Mental Health

Building on a year-long agenda that aims to promote diversity and inclusion at ICFO by improving awareness of themes that effect members of our extended community, in October ICFOnians focused on mental health.

Through a variety of discussions, we attempted to dispel misconceptions about psychiatric diseases, highlight mental health issues prevalent in academic careers, and to look outside the box at ways of managing stress in highly competitive situations.

Program

October 15
Launch of Focus: Mental Health

Introduction: Laia Miralles, Human Resources Head and Chair of the ICFO Diversity and Equity Committee

La Marató 2021 - Mental Health: Launch of ICFO community fund-raising initiative: Marina Cunquera & Andrea Morales, volunteers

Invited Talk- "Intro to Mental Health Literacy" created by Dragonfly Mental Health: Dr Senaida Hernández, ICFO PhD graduate, currently postdoc at the Universidad Politécnica de Madrid, and volunteer in the international academic mental health NGO, Dragonfly Mental Health

October 21, 23, 24
ICFO Resilience & Well-being Program

November 9
Invited Talk- "The Philosophy of Alpinism": Jordi Tosas, Mountaineer

October – December
Marató de TV3 at ICFO: ICFOnians raised runds for the 2021 campaign and highlighted specific mental health issues to increase awareness

Perspectives from the mountain: a conversation with Jordi Tosas

What can scientists working in frontier research learn about stress management and healthy decisions from an elite athlete who puts it all on the line in his quest to reach the top?

How do you manage frustration when an ascent doesn't go the way you imagined?

Framing it as a disappointment or frustration evokes feelings that block future attempts at success. It is better to consider the path up the mountain as one of discovery to find and explore new peaks or walls, and on the psychological front, to break down the performance barriers at the very far frontier of what is possible. The objective is so uncertain that any small change in a single variable could cause me to miss the mark. I can set myself a more controlled or less committed objective, but if I accept to play at this level, I must accept "failure" and "error" as an integral part of my game. They are part of the training and help to draw the map of possibilities that shapes evolving strategies. Every mistake is new knowledge.

What helps you control pressure in your ascents, bearing in mind that in mountaineering, success is of vital importance.

The mind is my greatest ally and enemy. I use it to evaluate how different thoughts and energies affect me. Above all

it gives me tools to feel my presence and channel emotional energies. The most important tool I have for this is meditation. Through mediation you can be aware of the great complexity of the system of the mind.

In an ascent, how do you know when to stop and go back, or when you can take even more risk?

In fact, you never know. The fine line that you must not cross is ephemeral and mutant. Going beyond the known is a pilgrimage to the world of creation. Going back is always an option; surrender in order to rebuild the project, from another perspective, with other knowledge acquired along the way, with other travel companions. The paradigm shift always implies stopping walking in one direction to continue walking in another.

Collaboration

TRAINING

ICFO Schools on the Frontiers Schools

The goal of the annual schools that ICFO organizes in partnership with leading international organizations is to offer talented young researchers and students worldwide a first introduction to a thematic research area and a taste of an international research environment

This year, in spite of the dynamic health situation worldwide, ICFO organized a total of three International Frontier Schools. The first, which took place in July in partnership with the Weizmann School, focused on "New Approaches to Atom-Light Interactions". The Fall schools followed the new online model as well, facilitating the participation of students who may otherwise not have been able to attend in a "normal year" and making it possible for the school to have a truly global reach. The first of the Fall schools was organized in collaboration with the **University of Toronto (CA) and Stanford University (USA)**. The second school was organized with **Universidad Nacional de Mexico (MX) and the Universidad de los Andes (CO)**.

While the online format helped to facilitate the participation of students who otherwise would not have been able to travel, the SPIE@ICFO Chair for Diversity in the Photonic Sciences allowed ICFO to offer research fellowships to selected students who participated in the schools to pursue a research stay at the institute with preference given to students from developing countries.

ICFO-U of T- PTL- STANFORD International Schools on the Frontiers of Light: PHOTONS FOR GREEN ENERGY

October 25-27 (online) Toronto, Barcelona & San Francisco

www.frontiers.icfo.eu/icfo-uoft-ptl-stanford

Solar and thermal photons, emitted by the sun and other hot radiative bodies, respectively, can be captured and transformed into useful electricity via photovoltaic and thermophotovoltaic technologies. They can also be used to drive chemical reactions such as the transformation of CO_2 into value-added hydrocarbons, thus offering a route towards carbon neutrality, or to store electricity into batteries.

This 3-day online school brought together leading experts and young researchers in the fields of nanophotonics, catalysis, thermophotovoltaics, solar photovoltaics, hot electrons, and light-driven CO_2 reduction, to cover the most recent advances in these areas, and address what is possible with next-generation energy technologies, based on our knowledge about light and its interaction with materials.

- **+330** registered attendees
- Participants connected from **29** countries
- **+130** attendees per seminar
- **12** hours of online sessions

ICFO-UNAM-UNIANDES International Schools on the Frontiers of Light: QUANTUM CHALLENGES

November 8-11 (online) Barcelona, México & Bogotá

www.frontiers.icfo.eu/icfo-unam-uniandes

Researchers world-wide are working to understand and harness the power of quantum phenomena in order to usher in revolutionary new quantum technologies and applications.

This 4-day online school introduced exciting new developments, opportunities and open challenges across all fields of quantum science and technology, covering the main pillars of quantum computing, quantum communications, quantum simulation and quantum sensing.

- **+380** registered attendees
- Participants connected from **20** countries
- **+350** attendees connected in highest attended seminar
- **20** hours of online sessions

BIST Science to Business Course

October 4-15th, 2021

Developing entrepreneurship and innovation skills among the members of the BIST community

BIST Barcelona Institute of Science and Technology

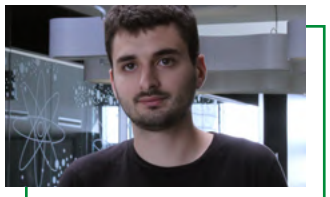
The From Science to Business course (FS2B), created in 2008 through a partnership between ICFO and ESADE Business School, has long been at the heart of ICFO's Plus+ training and development program. A BIST operated training program since 2016, the FS2B course expanded to incorporates researchers from the seven different CERCA research centers that comprise BIST. This year, the intensive program offered four days of intense classroom experience and time for groups to work on projects.

With its strong emphasis on entrepreneurship, FS2B is aimed at BIST researchers including senior researchers, postdoctoral fellows and last year doctoral students. It focuses on helping professionals in academia get acquainted with the business world, increasing their understanding of how companies work and create value in a competitive environment. BIST scientists become familiar with the new venture creation process and the role that science and technology plays in it.

Anika Froelian

PhD Student in the Quantum Optics research group

"I am planning a career change and the FS2B workshop allowed me to get in touch with the business world. I learned about the strategic choice for innovation, the journey from a business idea to the market entry and had the opportunity to work with a future founder on a real project.



Unai Ortiz

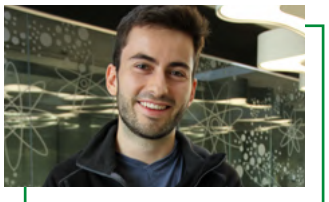
PhD Student I the Molecular Nanophotonics group

"It was very inspiring to learn how you can directly turn your research into a positive impact for the society- not just by applying our developed knowledge but also by creating high-quality jobs.

Hitesh Agarwa

PhD Student in the Quantum Nano-Optoelectronics group

"The FS2B course provided me with exactly the necessary ingredients I have been missing. It was a perfect blend of theory and practical exercises to get us acquainted with the business world and plan our next steps.



Javier Argüello

PhD Student in the Theoretical Quantum-Nano Photonics group

"Over these intensive two weeks, the course helped demystify the process of creating a company, learning from the expertise of people who have already walked this path, and getting hands-on experience on the construction of a real-life case.

Collaboration

SOLIDARITY

ICFOnians for La Marató de TV3

Activities and workshops for La Marató de TV3 organized by ICFOnians raised funds that will go to increase public awareness and boost research on Mental Health

La Marató de TV is a unique project promoted annually by Televisió de Catalunya and the Fundació La Marató de TV3 which, since 1992, has enabled Catalans to show their solidarity, raise funds to promote scientific research of excellence and raise social awareness of diseases. In addition to the telethon broadcast by TV3, individuals and institutions throughout Catalonia launch fundraising initiatives for the cause.

> *"Awareness-raising and research in mental health are always essential, but after more than a year of pandemic, we are convinced that this Marató is now more necessary than ever and that is what we are told by the experts, who have observed the great impact of the pandemic in this area of health, especially in young people*
>
> **Núria Llorach**
> Vice-President of the Catalan Media Corporation and of the Board of Fundació La Marató de TV3

ICFOnians joined the cause by launching a number of activities which raised over €2300, contributing to the €9 million+ funds that have been raised so far for La Marató. More than 140 ICFOnians came together to participate in la Marató activities.

Congratulations to the entire ICFO Community for the success of all these fundraising activities. Special thanks to all the organizers who made it all possible and to ICFO Spin-offs LuxQuanta and Sixsenso for sponsoring the material for the run!

OUTREACH

Sonar

On October 28, ICFO participated in the AI and Music S+T+ARTS Festival, a special edition of Sónar, at Barcelona's CCCB Teatre Stage

ICFO's presented "Interpreting Quantum Randomness" to a full house, seeking to produce unique sound events from the true randomness of quantum physical systems. The work is based on the conception that if music is mathematics, then it holds to reason that by applying advanced mathematical theory to the structure of music itself, hitherto undiscovered sounds will emerge.

Interpreting Quantum Randomness

Developed by Dr Reiko Yamada and ICREA Prof at ICFO Dr Maciej Lewenstein, the resulting show presented some of the results of their research at ICFO in which a series of radically new timbres and frequencies are created by applying the principles of quantum theory to music, an aesthetic approximation of the level of quantum randomness that exists in the natural world. The performance, introduced by Prof Lewenstein, was prepared and performed by Ángel Faraldo, Andres Lewin Richter Osiander, Ilona Schneider, Barbara Held, Artur Majewski, Vasco Trilla and Dr Reiko Yamada, who used different instruments and materials to create the unique sounds and frequencies.

Second edition of the CARLA Camp

The second edition of the CARLA camp hosted by ICFO took place from November 29th through December 1st

Close to 200 people, including attendees and speakers from across the globe, participated in the event packed with talks, panel discussions, networking sessions and career development workshops to introduce STEM graduates, PhD students and early-stage researchers to the myriad of multidisciplinary careers in photonics.

Due to safety restrictions, the camp was once again held in a virtual format, with the exception of students from the Master in Photonics and Europhotonics programs who visited ICFO on Day 2 of the camp for additional dedicated group activities and in-person networking with ICFOnians.

The program ran over the three afternoons and involved 27 international speakers. The first day was dedicated to introducing the photonics landscape and some of the largest European initiatives in the photonics ecosystem. The second day focused on innovation and entrepreneurship, and also included a session dedicated to students and researchers at the beginning of their career in photonics. The third and last day revolved around the photonics community at large and the camp ended with a virtual networking session.

The profile of the attendees was diverse in terms of gender, career stage, and cultural backgrounds. They came from 23 countries in 5 continents and were affiliated with 40+ institutions.

Participants reported that the camp had a positive tangible impact, significantly increasing their knowledge of the options available for a career in photonics (76% responses) and their overall interest towards photonics careers (72% responses). 82% of the attendees also confirmed that the event expanded their network in photonics.

> *I met people of different backgrounds involved in Photonics that have helped motivate me to continue studying photonics and related topics.*
>
> *I now feel more strongly oriented in my photonics career path.*
>
> *I have benefited from meeting some interesting profiles that I had not considered before. Also, I benefited from the in-person networking on the second day at ICFO.*
>
> **Carla Camp Participants**

Given the success of both CARLA editions organized by ICFO, plans are already underway for a spin-off of the CARLA project with a one-day event in April focused on quantum careers!

+INFO
www.carlahub.eu

People

GO & FLY

Congratulations to 7 New ICFO PhD Graduates

242 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.

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Samyobrata Mukherjee

Bound States in the Continuum in Planar Anisotropic Structures

October 5, 2021
Prof Dr David Artigas and Prof Dr Lluis Torner

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Niels Caspar Herman Hesp

Exploring Twisted Bilayer Graphene with Nano-Optics

October 20, 2021
ICREA Prof Dr Frank Koppens

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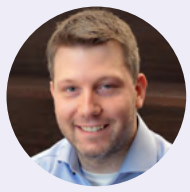

Jonas Fischer

Transcranial Diffuse Optical Measurements of Pulsatility Derived Parameters for Neuromonitoring Applications

October 26, 2021
ICREA Prof Dr Turgut Durduran and Dr Udo M. Weigel

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Rafaël Sibilo

Interactions and Optical Properties of Microorganisms on Surfaces

November 12, 2021
ICREA Prof Dr Valerio Pruneri

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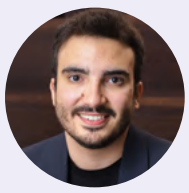

David Moreno Mencía

The Application of Broadband Ultrafast Spectroscopy to Reveal Structural, Magnetic and Electronic Dynamics in Quantum Materials

November 22, 2021
Prof Dr Simon Wall

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Carlotta Ciancico

Integration and Electrical Manipulation of Single-Photon Sources in 2-Dimensional Devices

December 9, 2021
ICREA Prof Dr Frank Koppens and Dr Antoine Reserbat-Plantey

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Vindhiya Prakash

Narrowband Photon Pairs for Atoms: High Resolution Spectral Engineering and Characterisation

December 16, 2021
ICREA Prof Dr Morgan Mitchell

COMMUNITY

1. ICFO Food Festival

2. Castanyada

Fundraising activities for la Marató:

3. Hiking at Siurana

4. Henna workshop

5. Origami workshop

6. Kokedamas workshop

Mystery ICFOnian

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

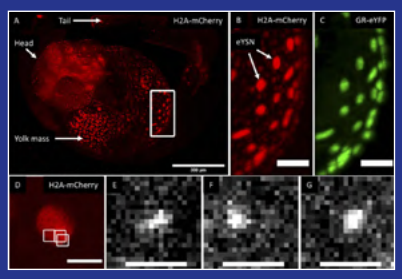
ICFOnians are a fascinating group, with hobbies, interests and talents that may surprise you. Have a look around and see if you can guess who this edition's Mystery ICFOnian is!

Look for the answer in the next edition of ICFOnians.

1. He was once a "roadie" for a punk band
2. He led a rafting trip down the Grand Canyon
3. He has done photonics in prison
4. He has a collection of fossils in his office
5. Fidel Castro Jr. once invited him to visit Cuba

The Last Word

SCIENCE QUIZ



Using light-sheet fluorescence microscopy, ICFOnians recently showed that it is possible to image an entire organism (A, a zebrafish embryo), and see not just the cell nuclei (B and C), but also individual protein molecules (E-G).

In a second publication in the same issue, they report that an oscillating wave of microtubule assembly and disassembly is experienced by the entire embryo, in synchrony with cell division.

"Light-sheet fluorescence microscopy for the in vivo study of microtubule dynamics in the zebrafish embryo"
M. Bernardello, M. Marsal, E. J. Gualda, P. Loza-Alvarez
Biomed. Opt. Express 12, 6237 (2021)

"Analysis of intracellular protein dynamics in living zebrafish embryos using light-sheet fluorescence single-molecule microscopy"
M. Bernardello, R. J. Gora, P. Van Hage, G. Castro-Olvera, E. J. Gualda, M. J. M. Schaaf, P. Loza-Alvarez
Biomed. Opt. Express 12, 6205 (2021)

1. When was the last Science Quiz about zebrafish ?

A) Summer 2021

B) Summer 2019

C) Spring 2021

2. What is a light-sheet?

A) A gaussian beam

B) A plasma membrane

C) A fluorescent protein

3. How big is a zebrafish embryo?

A) About 1 mm

B) About 100 μm

C) About 10 μm

4. Which of the following is not a fluorescent marker?

A) mCherry

B) mMango

C) mBanana

D) mApple

E) mBlueberry

F) mGrape

HIGH PROFILE

Connie Chang-Hasnain

2021 Optica President

> *"My advice to our ICFOnian community is to dream big; think bold; be humble; and work hard. Optica will be there along the way to support your professional goals and ambitions*

You are a pioneer of vertical cavity surface-emitting lasers. What inspired you to work in this field?

I was drawn and fascinated by the fields of heterojunction semiconductor electronics and laser physics when I was an undergraduate student. And I was very fortunate to have the opportunity to choose a topic in semiconductor lasers as my doctoral thesis. And with VCSELs, it was love on the first sight! I was particularly inspired by the myriad of potential ways that semiconductor photonics could address global challenges. One major application area is optical communications, which has made an extraordinary impact particularly over the past year, enabling billions of people to continue to work, communicate, learn, attend conferences and conduct important meetings from home or any other safe place.

What new technology/ies currently being developed do you find most exciting/ interesting/ inspirational?

Recently, interest has turned towards thinner, lighter, integratable devices known as metasurfaces. They are subwavelength nanostructured interfaces, capable of controlling optical waves. A large variety of components has been reported, including lenses, resonators, beam-benders, holograms, quarter-wave plates, half-wave plates, vortex plates, carpet cloaks, concentrators, polarizers, thin absorbers, or sensors. Despite exciting findings, achieving simultaneously high efficiencies and large bandwidths has remained a challenge. Currently, I am finding this research to be interesting for next generation devices requiring a smaller footprint.

Throughout your successful career, you have also made significant investments in the optics and photonics community through leadership of professional organizations like Optica, chairing top -tier conferences, editing topical journals... How has this impacted your career?

I joined Optica while in graduate school and have been a member for over thirty years. It has become my professional "home" and I have had the opportunity to meet and collaborate with colleagues from around the world. Optica has helped me at many points during my career. As a young researcher, I appreciated the opportunity to discuss my work with peers around the world and to be exposed to cutting-edge research in the field of optics and photonics. Through volunteer opportunities such as serving as an elected Director at Large on the Board of Directors, I was able to further refine my leadership skills and professional network.

As President, I've had the opportunity to speak at all of the Optica meetings and conferences and to lead the Board of Directors during this historic year.

Despite the challenges of 2021, the society continued to serve 432,000 professionals across 181 countries. Our members are doing such impactful research. I believe we are only at the beginning of what we can do in the optical sciences. Optica and its members will continue to be at the forefront of advancing the science of light.

ICFO is proud to have recently been honored with Optica's Diversity and Inclusion Advocacy recognition. Can you tell us why Optica places such emphasis on the importance of diversity and inclusion?

At Optica, we work to unite a diverse, worldwide community of students, scientists, and engineers. Diversity is essential to scientific advancement by fostering innovation and creativity. Our commitment to inclusivity drives us to provide an environment in which all people feel valued and respected and have access to the same opportunities. The Society has invested in a suite of programs that will foster an inclusive, equitable and diverse optics community. We were honored to highlight the work ICFO has done to implement policies, programs and projects that promote the diversity essential to enhancing innovation and excellence. I look forward to working with the ICFO community to continue to advance and celebrate diversity and inclusion in optics and across all STEM fields.

Do you have any specific advice that you would give to ICFOnians, especially those who are now only just beginning their careers in science?

My advice to our ICFOnian community is to dream big; think bold; be humble; and work hard. Optica will be there along the way to support your professional goals and ambitions.

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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