ICFO

ICFONIANS 42

Community News Winter 2020

Espai Roqué

There's a crack in everything, that's how the light gets in

EDITOR'S CORNER

Brook Hardwick
Contributing Editor

Building Community

This ICFOnians newsletter is a community-building tool, highlighting activities taking place at ICFO and/or with the participation of ICFOnians, celebrating achievements, identifying areas for collaboration within and beyond our institute, and promoting common interests.

A strong community is of central importance to who we are and what we do. Reflecting on the past months, I am very proud of all of the opportunities that ICFOnians have taken advantage of to strengthen our community, to extend it beyond traditional borders, and to ensure that the benefits of scientific advances flow from our institute and into our communities and society at large.

ICFO Day is a great example of ICFOnians prioritizing a strong community within our institute. Putting on such a day is an enormous challenge as Rob Sewell and his organizing team will acknowledge, but as we grow in size and scope, the sharing of general trends and institutional directions will help us to stay united and become even more successful.

Our community is also bolstered from beyond its immediate confines by individuals and institutes with very different competencies and perspectives. For example, when Agustí Roqué, renowned sculptor, approached ICFO in 2014 in search of scientific context for an exhibition that would pay tribute to the phenomenon of light, a crucial element in his work, ICFO's KTT team recognized an opportunity for a unique collaboration. The recently inaugurated permanent exhibit in ICFO containing models of Roque's work is a beautiful reminder of the inspirational creativity of members of our extended community.

ICFO has been very fortunate to benefit from scientific philanthropists who have believed in our mission and, through their enablement of our activities, have become valued members of our extended community. The Cellex and Mir-Puig foundations, members of ICFO's board of trustees, have made a permanent mark on everything at ICFO from our facilities to our recruitment of talented scientists. Speaking with Àngel Font from "La Caixa" Foundation in our High Profile interview underscored the vital role that the larger network of philanthropists play in strengthening the scientific ecosystem and its ability to positively influence society.

As members and beneficiaries of the strong community in and around our institute, we all have an interest in building and preserving community ties. In line with this, I was proud to see ICFOnians rally around TV3's Marató in December. Researchers at ICFO have been fortunate to participate in *La Marató* funded projects on many different occasions. Likewise, all of us have friends and family who will have a better chance of finding cures for illnesses thanks to advances in biomedical research that *La Marató* supports. This year's show of solidarity by ICFOnians who contributed to the *Marató*'s fundraising by donating their time, energy and financial resources was heartening. It demonstrated the value that ICFOnians place on our wide and diverse community. It also showed that ICFOnians accept the responsibility of belonging to this extended community, happily investing in its preservation just as we are happy to benefit from its resources.

Mystery ICFOnian
Solution Ed #40

Dr. Pablo Loza-Alvarez
Team Leader and SLN Coordinator

Science Quiz
Answers from p.12 **1**:B **2**:A **3**:A **4**:C

COVER

This work, ***Vúbrido II (I, human)***, is part of a permanent exhibition at ICFO, **Espai Roqué**, which is a memorial to the work of renowned sculptor **Agustí Roqué** (1942-2017). The nine sculptures in the exhibition were conceived by Roqué following an almost two-year period of memorable collaboration with ICFO. The two verses of the title, *There's a crack in everything, that's how the light gets in*, are taken from **Leonard Cohen**'s song, ***Anthem***. They were chosen to refer to the way in which macroscopic matter is affected by light. It is only when a crack exists that light can enter. A window, a slot, an electronic gap. Even a crack in a plan.

INDEX

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HAPPENINGS

BUSINESS NEWS
Corporate Liaison Program 2019

p. 6

ICFO NEWCOMERS

Welcome to ICFO

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

Giulia De Rosi
Visiting Scientist

Pascal Wintermeyer
Student

Daniel Tiemann
Research Engineer

Christoffer Moller
Postdoc

Joana Fraxanet
PhD Student

Lorenzo Orsini
PhD Student

Daniel Goncalves Romeu
PhD Student

Alexander Demuth
Student

Stephy Vincent
PhD Student

Tamás Kriváchy
Visiting PhD Student

Vito Giovanni Lucivero
Postdoc

Marco Pagliazzi
PostDoc

Joana Alves
Visiting PhD Student

Vasiliy Makhalov
PostDoc

Fadil Iyikanat
Postdoc

Ramón Ramos
Postdoc

Javier Arrés Chillón
Research Engineer

Miskeen Khan
Visiting PhD Student

Miguel Ángel García
Visiting Scientist

Shahaf Asban
Postdoc

Anna Dawid-Lekowska
PhD Student

Guillem Guigó
Student

Veronika Parfentyeva
Student

Radoslaw Gora
Visiting PhD Student

Barbara Andrade
Student

Saeed Ghasemi
PostDoc

David Cirauqui
PhD Student

Morgan Chabanon
Postdoc

Elettra Neri
Postdoc

Kamran Akbari
Postdoc

Jaime Díez Mérida
PhD Student

Marta Sans Valls
Project Management

Enes Aybar
PhD Student

Utso Bhattacharya
Postdoc

Claudia Valdés
Postdoc

Deng Pang
Postdoc

Neus Sanfeliu
PhD Student

Ignacio López Grande
Postdoc

Christian Hensel
Student

Gyanendra Kumar
Postdoc

Parmeshwar Prasad
Postdoc

Ediz Herkert
PhD Student

Alfredo Ongaro
Postdoc

Piotr Sierant
Visiting Scientist

Aleksandra Sierant
Visiting PhD Student

Amir Rahmani
Student

Francisco Bernal
PhD Student

HAPPENINGS

ICFO NEWS

Paul Ehrenfest Best Paper Award

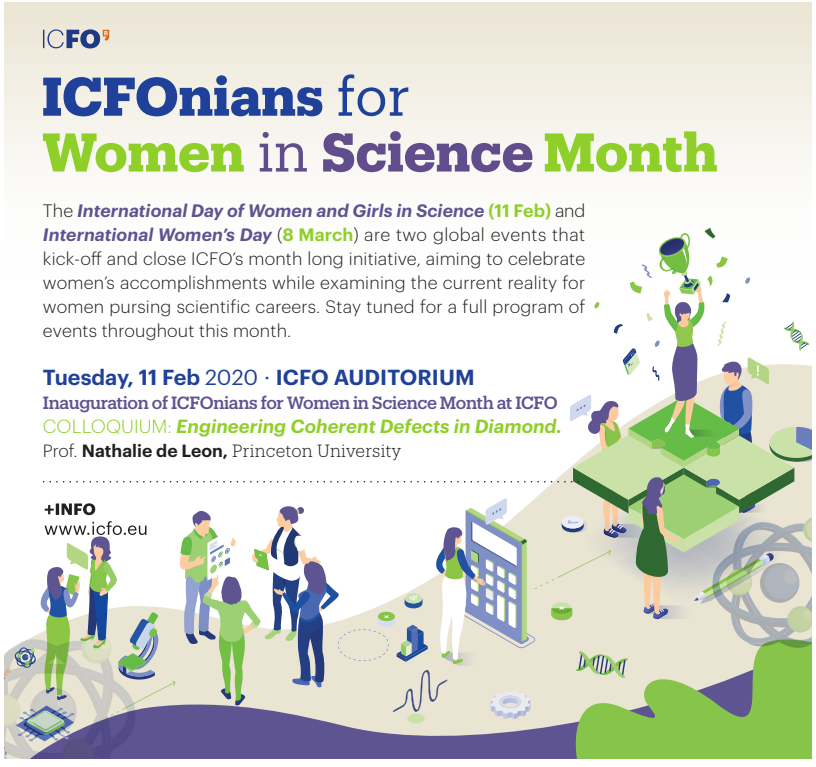
The Paul Ehrenfest Best Paper Award for Quantum Foundations, given annually by the Institute for Quantum Optics and Quantum Information in Austria, is awarded to the most significant paper in foundations of quantum physics, theoretical or experimental, published in a peer-review journal in the five calendar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

Researchers **Miguel Navascués, Yelena Guryanova, Matty J. Hoban and ICREA Prof. at ICFO Antonio Acín have been named recipients of the 2018 award** for their paper titled *Almost Quantum Correlations*, published in *Nature Communications*. The 2018 selection committee has awarded the prize "for the theoretical discovery of a natural set of stronger-than-quantum correlations, which challenges correlations-based approaches to characterizing quantum theory and hints at potential beyond-quantum physics."

The researcher group led by Prof. Acín was also the recipient of this award in 2016, making this the second time that the group has been recognized for the significance of its contributions in the area of the foundations of quantum physics.

UPC Thesis Awards 2019

The UPC recognizes ICFO PhD graduate with the Extraordinary PhD Thesis Award. The Extraordinary PhD Awards, given annually by the Technical University of Catalonia (UPC), aim to recognize the best doctoral theses which have obtained "cum laude" in their final PhD defense evaluation. This year, the UPC announced the list of five awardees in the area of Sciences, which includes the thesis of **ICFO PhD graduate Dr. Achim Woessner** among the list of extraordinary doctoral works for the academic period 2016/2017. Dr. Achim Woessner´s thesis, entitled ***Exploring Flatland Nano-Optics with Graphene Plasmons*** was supervised by **Prof. Dr. Frank Koppens**.



From H2020 to Horizon Europe

In order to create a smooth transition between the Horizon 2020 and Horizon Europe framework programs, the Ministry of Science, Innovation and Universities posted a call to optimize actions across European Networks and Managers from technological institutions. ICFO was awarded funding from this body for the project **ICFORIZON**, which aims to strengthen and provide new resources and tools to ICFO's Project Unit, to encourage their participation in European initiatives in science and technology, especially in the last biennium of implementation of H2020 and with a view to the new Program Horizon Europe framework.

GEFES 2019 Best Theoretical Thesis in Condensed Matter Physics

GEFES, the Condensed Matter Physics Division of the Spanish Royal Physics Society, has awarded Dr. Renwen Yu the prize for the best theoretical doctoral thesis in Condensed Matter Physics out of all theses defended between August 2018 and July 2019. His thesis entitled ***Toward next-generation nano-photonic devices*** was supervised by **ICREA Prof. at ICFO Dr. Javier García de Abajo**, and was **defended at ICFO on July 11**, 2019.

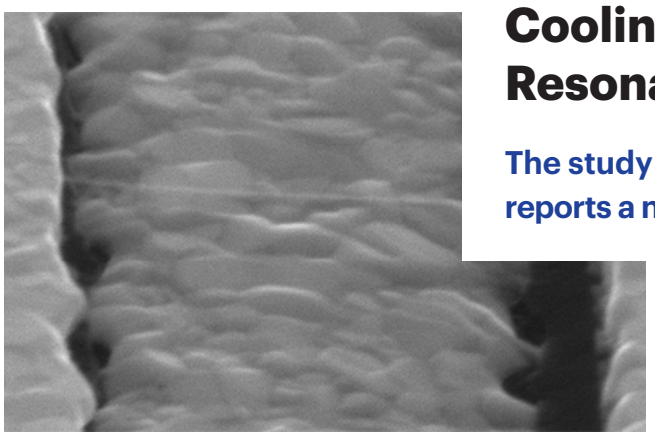
Three ICFO Highly Cited Researchers

Clarivate Analytics 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. **Three ICFO Group Leaders have been named Highly Cited Researchers**, according to the Highly Cited Researchers 2019 list from the Web of Science Group. **ICREA Professors at ICFO Javier García de Abajo and Frank Koppens** were listed in the "Cross Field" category recognizing their interdisciplinary work and publications of highly cited papers in several fields. **ICFO Prof. Maciej Lewenstein was listed in the Physics Category for the sixth consecutive year**.

2019 Pioneer Awards

The CERCA Institute (Centres de Recerca de Catalunya) annually promotes the PIONER Prizes to distinguish researchers from CERCA Research centers who have recently prepared and defended a doctoral thesis demonstrating clear potential for commercial exploitation. **ICFO PhD graduate Dr. Roland Terborg**, who defended his thesis entitled ***Lens-Free Interferometric Microscope for Transparent Materials*** in October 2018 under the supervision of **ICREA Prof. at ICFO Valerio Pruneri** received the 2019 award with the highlighting an original proposal with great potential for commercial applicability and interest. Although the technology is not yet ready for launch, the jury foresees that the new device could have a major impact as a quick and cost-effective system for diagnosing major infections.

LATEST ADVANCES

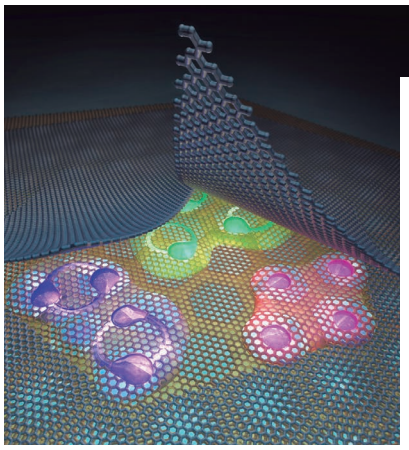


Cooling Nanotube Resonators with Electrons

The study published in *Nature Physics* reports a novel technique.

In a study published in *Nature Physics*, ICFO researchers Carles Urgell, Wei Yang and others led by ICFO Prof. Adrian Bachtold, in collaboration with researchers from ICN2 in Barcelona and CNRS in France, report on a novel technique that uses electron transport to cool a nanomechanical resonator near the quantum regime.

The team fabricated a resonator, inserted it in a dilution refrigerator and cooled it down to 70 mK. By applying a constant current, the electrostatic force of the electrons impacted the dynamics of the vibrations reacting back on the electrons and making a closed loop with a finite delay which can be used to amplify or reduce the thermal vibration fluctuations. Cooling reduces the thermal displacement fluctuations, allowing scientists to approach the quantum regime limit with a population number never reached before when compared to previous work. This new technique could be of utmost importance for nanomechanics and quantum electron transport, serving as a powerful resource for quantum manipulation of mechanical resonators.

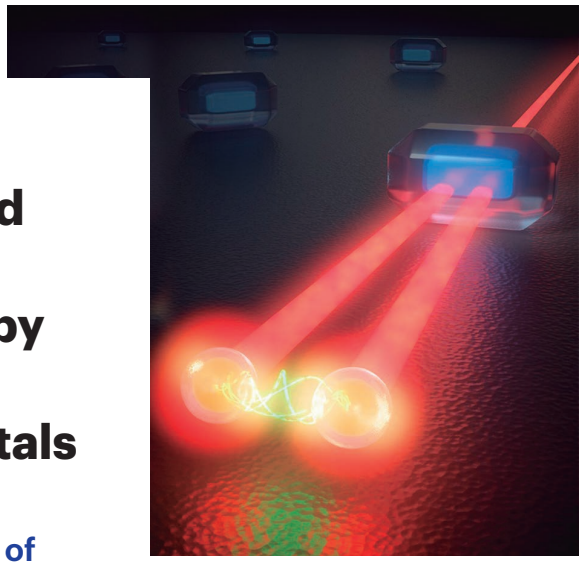


A Plethora of States in Magic-Angle Graphene

Twisted bi-layer graphene to unveil a new zoo of previously unobserved states

In a study published in *Nature* carried out at ICFO by researchers Xiaobo Lu, Petr Stepanov, Mohammed Ali Aamir, Ipsita Das, led by ICFO Prof. Dmitri Efetov, with support from ICFO Prof. Adrian Bachtold's research lab, and in collaboration with scientists at UT Austin, the Chinese Academy of Sciences, and the National Institute of Materials Science of Japan, researchers have taken the 2018 ground-breaking MIT discovery of "magic-angle" graphene several steps further, observing a zoo of previously unobserved superconducting and correlated states, in addition to an entirely new set of magnetic and topological states. The results have opened a completely new realm of richer physics.

To begin, Efetov et al began with a mechanical cleaning process to create extremely clean twisted graphene bilayers, resolving a multitude of fragile interaction effects. Then, by changing the electrical charge carrier density within the device with a nearby capacitor, they observed that the material could be tuned from behaving as an insulator, to behaving as a superconductor, or even an exotic orbital magnet with non-trivial topological texture – a phase never observed before. What's more, the device entered a superconducting state at the lowest carrier densities ever reported for any superconductor, a completely new breakthrough in the field. Researchers were also able to increase the superconducting transition temperature to above 3 kelvin, reaching record values which are twice as high as previously reported studies.



Ultrafast Stimulated Emission Microscopy of Single Nanocrystals

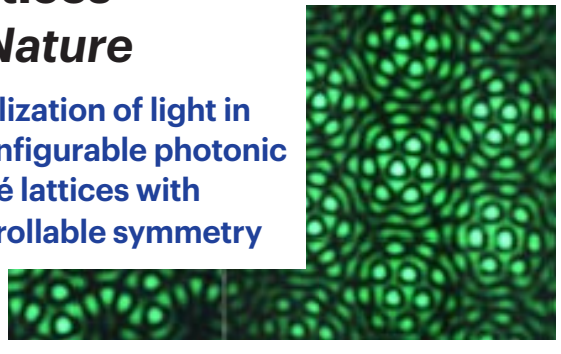
New technique allows imaging of nano-objects and investigation of their dynamic

ICFO researchers Lukasz Piatkowski, Nicolò Accanto, Gaëtan Calbris, Sotirios Christodoulou, led by ICREA Prof. at ICFO Niek F. van Hulst, in collaboration with researchers from Ghent University have published a study in ***Science*** about a technique for studying ultrafast events in individual non-fluorescent nano-objects.

They used a sophisticated combination of laser pulses to promote individual QDs into excited state, then forced them back down to the ground state for imaging and to discern the evolution of the excited charges within the entire photocycle. In their experiment, the first laser pulse brought an individual QD to the excite state, followed by a second laser pulse every few hundred femtoseconds to bring the charges down to ground state, inducing recombination and emission of an extra photon. For every probe photon shot into the system, two twin photons came back. These extra photons allowed the authors to image the QDs and to precisely track the evolution of the excited charges in the QD, unveiling how many charges underwent spontaneous recombination, stimulated recombination and excited state absorption. These results allow imaging and studying the dynamics of nano-particles and structures without the need of external fluorescent labels.

Photonic Moiré Lattices in *Nature*

Localization of light in reconfigurable photonic moiré lattices with controllable symmetry



In a study published in *Nature*, ICFO researchers Yaroslav Kartashov and Prof. Lluis Torner, in a long-standing collaboration with ICFO Alum Fangwei Ye, now at Shanghai Jiao Tong University, and Vladimir Konotop in Lisbon, have reported on the propagation of light in photonic moiré lattices. The paper shows the creation of lattices by two superimposing periodic patterns with either square or hexagonal primitive cells, and tunable amplitudes and twist angle. Depending on the twist angle, a photonic moiré lattice may have a different periodic (commensurable) structure or aperiodic (incommensurable) structure without translational periodicity. The angles at which a commensurable phase (periodicity) of a moiré lattice is achieved are determined by Pythagorean triples or by another Diophantine equation, depending on the shape of the primitive cell. Changing the relative amplitudes of the sublattices allowed researchers to smoothly tune the shape of the lattice without affecting its rotational symmetry. Then, using commensurable and incommensurable moiré patterns, researchers observed for the first time the two-dimensional localization–delocalization transition of light. The utilized photonic moiré lattices can be readily constructed in practically any arbitrary configuration consistent with symmetry groups, thus allowing the creation of potentials that may not be easily produced in tunable form using material structures.

HAPPENINGS

BUSINESS NEWS

Corporate Liaison Program 2019

ICFO gathered international experts and corporate partners to discuss the future of Quantum Technologies for Artificial Intelligence.

The world is racing towards a future in which quantum technologies will have a profound impact on society, business and industry. In light of this, on October 25, ICFO hosted the 2019 Corporate Liaison Program Day, focusing on Quantum Techs for Artificial Intelligence. On this day, members of ICFO's Corporate Liaison Program had the opportunity to interact with worldwide experts in the field to have a grasp of what is occurring in the region and beyond.

This edition included speakers from leading international companies that discussed R&D, policy, entrepreneurship and business development, all in the quantum tech arena.

The event commenced with a welcome from ICFO's Director, Lluis Torner, who addressed the audience giving insights into ICFO's motivation for hosting the 2019 CLP Day focused on quantum technologies and quantum machine learning.

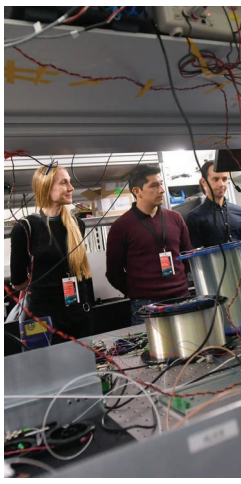
Then, participants of the event had the opportunity to learn about the experiences and advances in quantum technologies for artificial intelligence **from the following invited speakers:**

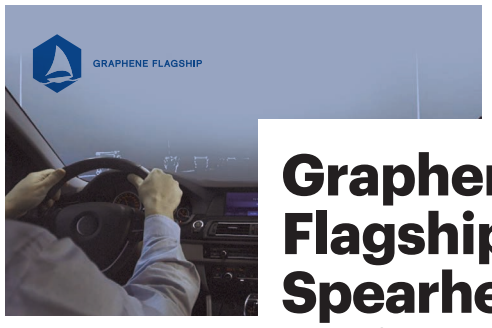
01. Paul Kristan Temme
Researcher, IBM, USA.
Offered general insight about Quantum Machine Learning and how to deal with coherence and error rates as well as noise for the advancement in the development of quantum computing.

02. Maria Schuld
Researcher, Xanadu and University of KwaZulu-Natal, South Africa.
Offered an overview of what her company is doing and how it is engaging with the full-stack quantum computing processes: hardware + software + algorithms + services.

03. Witold Kowalczyk
Director European Business Development from Zapata Computing.
Gave an overview of the company and what current challenges and applications in Machine Learning and Artificial Intelligence quantum computing is trying to solve.

04. Mark Fingerhuth
Co-Founder and Head of R&D, ProteinQure Inc., USA.
Focused on Quantum Machine Learning for life sciences.





Graphene Flagship Spearhead Projects

ICFO will lead project to develop Short Wave Infrared Radiation (SWIR) cameras for autonomous driving

The Graphene Flagship announced the launch of eleven new "Spearhead Projects", each aiming to advance graphene-enabled prototypes to commercial applications. The Flagship is investing €45 million in these commercialization projects led by key industrial partners in Europe such as Airbus, Fiat-Chrysler Automobiles, Lufthansa Technik, Siemens, and ABB. The project partners will co-fund the projectGraphene Flagship Spearhead Projects with a further combined contribution of €47 million, demonstrating their interest in the development of graphene-enabled products. The newly launched projects have been designed to increase the Technology Readiness Level (TRL) of graphene-based technologies — a metric used to determine the maturity of a technology and its estimated time to market.

ICFO will lead the AUTOVISION project, one of the eleven projects in the Spearhead initiative. It has teamed up with industrial partners, aiming to demonstrate an industry-ready graphene-based image sensor for infrared light and to use it within a high-resolution camera system critical for the safe functioning of self-driving cars.

Autonomous driving is the future. Low visibility conditions are one of the main challenges for the reliable deployment of advanced driver assistance systems (ADAS) & automated driving systems (ADS). Current state-of-the-art cameras used in such systems rely on the visible spectrum of light and therefore, perform poorly in these conditions. **Antonios Oikonomou** (Graphene Flagship business developer at ICFO) mentions that *"currently (short-wave) infrared cameras are based on image sensors made from materials of low-manufacturability and high cost, hindering their uptake in mass markets such as the automotive".*

"The AUTOVISION Spearhead Project will create a new high-resolution image sensor for autonomous vehicles that can perform better under adverse weather (e.g. fog) as well as at night time" emphasizes **Stijn Goossens** (project leader). The graphene-based CMOS image sensor, a concept and development demonstrated by ICFO, has the potential to bring the combined SWIR vision advantages to ADAS/ADS systems. As **Frank Koppens** (responsible group leader) also stresses, *"Graphene photodetector technology provides high manufacturability, ensuring wafer-scale production, facile integration with silicon readout electronics, and therefore, enabling its mass adoption. Compared to other technologies, graphene reduces the temperature dependence of the sensitivity, making active cooling obsolete and allowing the realization of low-power systems, a pre-requisite for the automotive industry".*

Once the pilot line production phase is completed, the project will undertake extended testing to allow for the launch of evaluation kits in 2023. The collaboration with one of the leading Tier-1 automotive suppliers of self-driving mobility solutions will help the consortium partners accelerate the product development and prepare for attaining the automotive quality and production standards for market compliance.

COLLABORATION

TRAINING
María Yzuel Fellows at ICFO

p. 9

COMMUNITY

ICFO Day 2019: 2020 and Beyond

ICFO celebrated its fifth annual ICFO Day on December 13th, organized by ICFOnians for ICFOnians.

In this year's edition of ICFO Day which focused on the theme "2020 and Beyond", the program was designed to highlight a sprinkling of institutional activities, achievements and ongoing initiatives. In response to the growing size of the ICFO community, the organizers introduced a brand new format, and for the first time celebrated the event outside ICFO's premises, at the Hotel Don Jaime, in Castelldefels.

The day started with an introduction by ICFO's Director Lluís Torner, and moved straight into presentations of two hot topics of interest to ICFOnians: Magic-Angle Graphene, followed by Quantum Communications and the role that ICFO will have in a future European Quantum Communications Infrastructure. After a short break featuring a holiday music selection performed by a chorus and orchestra of ICFOnians, we learned more about the institute's recruitment and on-boarding processes from the management units involved. Later, we examined what ICFO is doing to transfer Photonics from labs to the clinics and why.

Finally, talks turned to awards. This year's Nobel Talk introduced the "contributions to our understanding of the evolution of the universe and Earth's place in the cosmos". On a lighter note, the IgNobel awarded to ICFO alumnus Herbert Crepaz and colleagues at Nanyang Technological University, was delightfully elucidated. The morning event was capped with an ICFO Awards distinguishing the winners of the Poster Contest, as well as the PhD Thesis Awards and recognitions for ICFOnians who have been at ICFO for fifteen years. As is now the tradition, the day ended with the annual Festive Dinner celebration in Barcelona.

ICFO AWARDS

PhD Poster Session and Award

The ICFO Student Poster Session, now in its 10th edition, was created as an opportunity for the exchange of ideas and knowledge among ICFOnians of different groups and areas.

This year, the poster presentation took place in the week leading up to the ICFO Day celebration with the winners announced in the awards ceremony during ICFO Day. One prize was awarded through a popular vote from all ICFOnians and was sponsored by ICONS. Another official PhD Poster Prize was awarded based on an assessment by the PhD Committee, for which only PhD students were eligible.

ICFO PhD Poster Prize
CARLOTTA CIANCICO
Interfacing narrow linewidth quantum emitters with 2D materials
Group: **Quantum Nano-Optoelectronics**
Group Leader: **ICREA Prof. at ICFO Dr. Frank Koppens**

ICONS Prize for Best Poster
ANDRÉS DE LOS RIOS SOMMER
Resolved-Sideband Cooling of a Levitates Nanoparticle in the Presence of Phase Noise
Group: **Plasmon Nano-Optics**
Group Leader: **ICREA Prof. at ICFO Dr. Romain Quidant**

2018 ICFO PhD Thesis Awards

The PhD Committee launched an in-depth deliberation of the 31 PhD Theses defended at ICFO in 2018 to determine the recipients of the PhD Thesis Awards. This award was created in order to distinguish particularly brilliant PhD theses presented at ICFO. With this award, ICFO wishes to highlight and reward extraordinary PhD students whose research progress at the Institute has proven to be highly creative and ambitious. **The recipients of the 2018 Thesis Award are:**

INDUSTRIAL FIELD
CARLOS ABELLAN, in recognition of the exceptional thesis:
Quantum Random Number Generators for Industrial Applications.
Supervised by **ICREA Prof.** at **ICFO Dr. Valerio Pruneri** and tutored by **ICREA Prof.** at **ICFO Dr. Morgan Mitchell.**

EXPERIMENTAL FIELD
CESAR CABRERA, in recognition of the exceptional thesis:
Quantum Liquid Droplets in a mixture of Bose-Einstein Condensates.
Supervised by **Prof. Dr. Leticia Tarruell**.

PAU FARRERA, in recognition of the exceptional thesis:
A versatile source of light-matter quantum states based on laser-cooled atoms.
Supervised by **ICREA Prof.** at **ICFO Dr. Hugues de Riedmatten**.

COLLABORATION

SOLIDARITY

ICFOnians for La Marató

The annual telethon run by the Fundació *La Marató* de TV3 is a revered tradition that allows all of Catalonia to participate in fund-raising efforts towards biomedical research of excellence into diseases that are currently incurable.

ICFO researchers have been honored to participate and lead research financed by *La Marató* donations on several occasions. This year there was also a movement by the ICFO community to actively join the fund-raising side of the initiative.

Throughout the month of December, **ICFO PhD students Pilar Pujol, Marina Cunquero and Helena Villuendas Garcia coordinated volunteers throughout the institute who conducted a series of activities to collect donations**. These included a yoga class offered by Irene Alda; an informative presentation about *La Marató* given by Prof. Turgut Durduran co-located with a sale of goodies baked by ICFOnians; "guess how many M&Ms" challenge; foosball tournament; a trivia challenge; and raffle ticket sales for a holiday give-away at the ICFO Festive Dinner.

The *La Marató* telethon raised a total of €9,404,256 towards research for rare diseases this year including a €1,206.40 contribution from ICFOnians fund-raising efforts. **Could this be the start of a new annual ICFO tradition?**

LA MARATÓ RESEARCH AT ICFO

On October 30, 2019, the Foundation Board announced the distribution of over €13 million raised in the 2018 Marató for research on cancer. A project submitted by **Dr. Monica Marro, a researcher in the ICFO SLN facility led by Dr. Pablo Loza-Alvarez**, and Dr. Pedro Luis Fernández Ruiz, Head of the Pathological Anatomy Service at the Germans Trias Hospital, received funding to study the molecular profiles and integrated microspectroscopics of breast carcinoma and its resistance to neoadjuvant therapy.

Through the years, **ICFOnians have been proud to conduct research financed by many editions of La Marató**:

2016: Stroke and traumatic spinal and brain injuries
Prof. Turgut Durduran: Cerebral blood flow-guided early rehabilitation intervention after stroke: a pilot randomized (Institut de Recera de l'Hospital de la Santa Creu i Sant Pau – IIB Sant Pau – ICFO).
Dr. Angel Sandoval and Prof. Turgut Durduran: Anemia or Blood Transfusion: A Clinical Dilemma in patient with traumatic brain injury (Fundació Hospital Universitari Vall d'Hebron (VHIR) – ICFO).

2014: Heart Disease
Dr. Pablo Loza-Alvarez: Molecular imaging of the retina in patients with Multiple Sclerosis by Raman Spectroscopy (IDIBAPS – ICFO).
Dr. Pablo Loza-Alvarez: Dissecting protein trafficking in retinal neurodegeneration by super-resolution imaging on animal models and human iPSCs (Universitat de Barcelona – CABIMER – ICFO).

2009: Rare Diseases
Prof. María García-Parajo: Development of nanomedicines for substitute enzymatic replacement therapy on Fabri disease (ICFO – Institut de Recerca Hospital Universitari Vall d'Hebron – Facultat de Quimica UB – Hospital de la Santa Creu i Sant Pau – Institut de Ciència de Material de Barcelona – Institut de Biotecnologia I Biomedicina UAB).

TRAINING

ICFO-UNAM International Schools on the Frontiers of Light: Biophotonics

October 21-25

In partnership with CFATA-UNAM – the Centre for Applied Physics and Advanced Technology of the Universidad Nacional Autónoma de México (MEXICO), ICFO launched the first ICFO-UNAM International School on the Frontiers of Light, devoted to Biophotonics, held in Querétaro, Mexico.

The school featured leading experts from ICFO and UNAM in an intensive 1-week course directed to young students wishing to enter the vibrant field of biophotonics.

Organising Committee:
Dr. Pablo Loza-Alvarez (ICFO), **Dr. Remy Avila** (UNAM), **Dr. Robert Sewell** (ICFO), and **Dr. Jorge Luis Domínguez-Juárez** (UNAM) and was made possible by a generous support from the **OSA**.

Invited Lecturers:
Turgut Durduran (ICFO), **María García-Parajo** (ICFO), **Stefan Wieser** (ICFO), **Michael Krieg** (ICFO), **Pablo Loza** (ICFO), **Roberto León-Montiel** (Instituto de Ciencias Nucleares, UNAM), **Remy Avila** (Centro de Física Aplicada y Tecnología Avanzada, UNAM), **Ataúlfo Martínez** (Instituto de Neurobiología, UNAM), **Christopher Wood** (Instituto de Biotecnología, UNAM), **Rubén Ramos García** (INAOE)

http://frontiers.icfo.eu/icfo-unam

Quantum Machine Learning Workshop

October 24

This intense, **1-day workshop, co-located with the CLP Day on Quantum Artificial Intelligence** included a series of seminars by leading researchers from academia and industry for an audience of PhD and masters students and Postdocs, with the aim to bring them up to date with cutting-edge advances in the field.

As part of the program and for a reduced number of participants, ICFO researchers ran a hands-on tutorial on machine learning tools for quantum scientists for students interested in applying these techniques in their research.

Invited Speakers:
Naftali Tishby (Hebrew University of Jerusalem), **Antonio Córcoles** (IBM), **Vedran Dunjko** (Leiden Institute of Advanced Computer Science), **Marko Cetina** (Joint Quantum Institute, University of Maryland), **Maria Schuld** (Xanadu and University of KwaZulu-Natal), **Dave Wecker** (Quantum Systems, Microsoft Azure), **Phillip Hauke** (University of Trento & Heidelberg University.

TRAINING

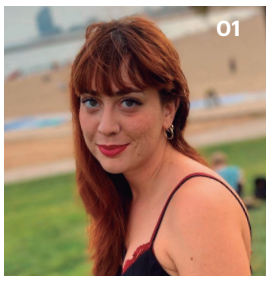
María Yzuel Fellows at ICFO

ICFO is pleased to welcome three recipients of the first edition of the María Yzuel Fellowship Awards, a strategic program that aims to attract outstanding female students to conduct a research internship or Master's Thesis in an ICFO research group.

These awards aim to attract, retain and promote female talent towards future research careers in the photonic sciences by offering young women the possibility to explore science in a stimulating and supportive environment.

The Fellowship program is named in honor of **Prof. Dr. María Josefa Yzuel Giménez, a respected leader and role model in the international Optics community**. She is also a longstanding advocate for the promotion of the role of women in science and an active member of the **Asociación de Mujeres Investigadoras y Tecnólogas** (AMIT-Association of Women Researchers and Technologists).

Meet the Fellows



01. Rachele Catalano
Italy
MSc student in Photonic Engineering, **University of Pavia**

ICFO Group:
Neurophotonics and Mechanical Systems Biology

I started as a student of Bioengineering at the University of Pavia in Italy, working for my bachelor's thesis in the Optoelectronics group. This work involved the development of a portable near-infrared sensor and encouraged me to pursue further studies in the field of photonics. I learnt about ICFO from my colleagues during my period as an intern at the University of Gent and I immediately decided to apply for María Yzuel Fellowship expressing my interest for NMSB group. In the future, I would like to keep working on the verge of computer science, optics and biology and apply my analytical and engineering skills to basic research.

02. Bárbara Andrade
Brazil
MSc student in Theoretical Physics at the **Institute for Theoretical Physics - Unesp**

ICFO Group:
Quantum Optics Theory

I am a theoretician deeply interested in fundamental physics, especially concerning quantum many-particle systems, quantum optics and quantum information. I first heard about ICFO and the María Yzuel Fellowship from Dr. Leonardo Guerini (ICFO Alumnus and currently ICTP-SAIFR postdoc). In ICFO I was captivated by the cooperative and multidisciplinary environment, just as my colleague had described to me. After finishing my master studies in São Paulo, I want to pursue a PhD and continue my academic career as a theoretical physicist, but working in more applied topics than what I was doing before the research internship in ICFO.

03. Estafanía Guillena
Spain
BSc in Telecommunications Engineering and Aerospace Engineering at the **Universitat Politècnica de Catalunya**

ICFO Group:
Quantum Nano-Optoelectronics

I am from Barcelona and for many years have been a professional athlete. At 32, I decided to make a radical life change and started a double degree in telecommunications and aerospace engineering. During my studies, I have been attracted to Photonics and have decided to work in research in this area. This fellowship has given me the opportuntiy to take my first steps in research in an environment that is at the very highest level in the field in which I want to pursue my research career. Once I complete my stay at ICFO, I would like to continue my studies and pursue a Master in Photonics.

TRAINING

PhD Retreat

Maximizing integration and productivity in the first stages of the PhD

ICFO's newest cohort of PhD students attended the fourth annual Initial PhD Retreat, a two-day training workshop designed to provide participants with a grounding in key transferable skills and an opportunity to get to know one another.

The retreat was conceived to help maximize integration and productivity in the first stages of the PhD. It offered participants a conceptual framework to understand and deal with challenges that arise during the PhD and a set of practical tools and methods immediately applicable, including topics such as time and project management and communication skills.

The participants also took part in team-building activities designed to reinforce interactions between research groups. Not only did these activities serve to encourage the cross-fertilization of ideas, they also helped to establish a cohesive group identity and to strengthen the ICFO network thus creating a motivating and stimulating place to work.

For newly incorporated PhD students, the retreats are their first experience within the well-established ICFO+ Training and Development program.

COLLABORATION

OUTREACH

Inauguration of the Espai Roqué at ICFO

ICFO will host an exhibition inspired by light created and conceived by the renowned sculptor Agustí Roqué.

On November 15th, 2019, representatives of the world of culture, friends and relatives of the late Agustí Roqué met at ICFO for the inauguration of a permanent exhibition space "Espai Roqué", where models of the artist's last works, inspired by light, will be permanently exhibited.

Agustí Roqué was born in Barcelona in 1942. He achieved international renown as an outstanding representative of contemporary sculpture, carrying out important projects and works of public sculpture in Europe and the United States, with numerous exhibitions at prestigious museums and galleries. **Driven to evolve and explore throughout his career, Roqué began collaborating with ICFO in 2014, in search of the scientific context for an exhibition about a phenomenon that was increasingly present in his studies, and to which he wanted to pay a particular tribute: light.**

ICFO enthusiastically participated in the project, contributing scientific inputs that would provide metaphorical inspiration for the artist's creativity. Through intense dialogues with Marta García-Matos, former member of ICFO's KTT team, and ICFO director Lluís Torner, Roqué was immersed in the science and essence of light, space and the universe. He used these new ideas to inspire the form and materials for the composition of his works in the sculptural project entitled *"There's a crack in everything, that's how the light gets in"*.

The artist intended to exhibit the final large-scale format sculptures at the 57th Venice Biennial, however this unfortunately never came to pass due to his untimely death in February 2017.

The models of the nine sculptures created in this project will be permanently exhibited at ICFO's facilities in Castelldefels, paying tribute to the memory of the artist and his work.

OUTREACH

NightUp Castelldefels

ICFO launches a new citizen science experiment about Light Pollution

Light pollution is a major problem for modern cities and surrounding areas, obscuring the view of the star-filled sky but even more importantly, affecting the living cycle and natural rhythms of species and ecosystems in these areas. Many ongoing projects are studying light pollution in cities and its effects on the environment, searching for ways to reduce it in order to improve the quality of nocturnal life of the human and animal population.

ICFO is coordinating the new project NightUp Castelldefels, aiming at understanding how the color of nocturnal light sources can affect all living being.

NightUp Castelldefels aims to gather a significant statistical database of light sources in Castelldefels and make it openly available so that light pollution experts, who need considerable amounts of data on artificial lighting, can better understand its effects on the environment and on the population.

Participants in the experiment will be asked to click on a website and with their smartphones and mobile devices go out at night and take as many pictures as possible of the light sources around the city, on the streets, in the park, at the beach, etc.

NightUp Castelldefels is a pilot program running through spring 2020, limited to the area of Castelldefels, which expects to gather over 1000 photos. Before expanding the initiative internationally, the coordinators plan to evaluate the data collected to verify that the experimental approach is scientifically robust and reliable for the extraction of valuable information.

The project is made possible by the support of external scientific partners, such as Dr. Alejandro Sánchez de Miguel (University of Exeter) and of local institutions, such as the Castelldefels City Council, the Ramón Fernández Jurado library and the Bibliolab project by the Diputació de Barcelona.

How to contribute to NightUp Castelldefels

1. **Go to nightup.icfo.eu with Chrome on your mobile device**
2. **Take photos of artificial light sources you find on the streets of Castelldefels.**
3. **Every picture you take will be saved in a database with the information of the location of the light source and the date and hour it was taken.**
4. **All pictures will be anonymous**

+INFO
nightup.icfo.eu

LEADERSHIP

New Board for ICONS

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.

ICONS promotes long-term educational activities for students and helps to improve their career opportunities by drawing them closer to the photonics community. The network also endeavors to intensify the interaction and collaboration of its members by organizing social events like Social Friday event as well as the annual International Food Festival.

As we welcome the new leadership team, we also express our gratitude to the hard work and dedication of the **2019 leaders**: **Pamina Winkler** (President), **Pilar Pujol Closa** (Vice President), **Samyobrata Mukherjee** (Secretary), and **Sarah Keary** (Treasurer).

2020 ICONS Leaders

PILAR PUJOL
President

ARTURO VILLEGAS
Vice-President

ALEXIA STOLLMANN
Secretary

JANA OCKOVA
Treasurer

GO & FLY

199 Women and Men

have successfully defended their theses at ICFO since its founding in 2002.

Together they have helped us measure what we have learned, how far we have come, and how much we have yet to learn. The following ICFOnians have recently succeeded in defending their PhD theses. Honoring ICFO's tradition, ICFOnians gather to celebrate your accomplishments and encourage you to Go & Fly! Remember that wherever you go, you will always be a part of the ICFO community.

197

October 4, 2019

MARCO PAGLIAZZI
"Time Domain, Near-Infrared Diffuse Optical Methods for Path Length Resolved, Non-Invasive Measurement of Deep-Tissue Blood Flow"

TD: ICREA Prof. Dr. Turgut Durduran

198

October 7, 2019

RINU ABRAHAM MANIYARA
"Nano-structured Transparent Conductors for the Optoelectronics Industry"

TD: ICREA Prof. Dr. Valerio Pruneri

199

October 15, 2019

ALEJANDRO POZAS-KERSTJENS
"Quantum information Outside Quantum Information"

TD: ICREA Prof. Dr. Antonio Acín

COMMUNITY PICTURE

ICFO Alumni at the SCOP-2019 OSA Student Conference

Gathering of ICFO alumni who were invited speakers at the SCOP-2019 OSA Student Conference at the Physical Research Laboratory, Ahmadabad, India. (left to right):

- G.V. Pavan Kumar, Associate Professor at the Indian Institute of Science Education and Research, Pune
- Chaitanya Suddapalli, Laser Scientist at Radiantis and Visiting Scientist at ICFO, Castelldefels
- Goutam Kumar Samanta, Associate Professor at the Physical Research Laboratory in Ahmadabad
- Sudheer Cherukulappurath, UGC- Assistant Professor at Goa University, Goa

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. Even though she has a PhD in a related field, she does not work as a scientist at ICFO.

2. She has lived in Spain almost as long as she lived in her home countries (USA and Argentina).

3. She shares a birthday with her twin and her husband.

4. She's addicted to Mate and loves Reese's Pieces Peanut butter cups.

THE LAST WORD

HIGH PROFILE

Àngel Font

Corporate Director of Strategy and Research at "la Caixa" Foundation

"Philanthropy has neither the constraints of industry nor those of public administration and is uniquely positioned to make the relationship between the two much more fluid."

Can you tell us about your current role at "la Caixa" Foundation?

As the Director of Research, I am responsible for the co-ordination of the team that drives "la Caixa" Foundation's policies regarding fellowships, research and innovation. This includes the transversal function of oversite of the strategy and long-term planning in this area. In this sense, our underlying mission, which connects us with ICFO, is to propel the institution's scientific policy. As a director of Strategy, I am also responsible for the evaluation of the Foundation's internal programs.

What in the Foundation's mission resonates with your own personal and professional motivations?

Over the past thirty years, through the foundations in which I have worked, I have had the luxury of combining my professional development with the desire to contribute to make a better society.

There are many paths to making the world a better place- through the public sector, the corporate and private sectors... but it seems to me that foundations are particularly well equipped to promote projects with professional rigor which, at the same time, work for the common good. This for me is very motivating.

What type of societal impact does the "la Caixa" Foundation seek to have through their support of scientific excellence?

"la Caixa's" creation of the first pension fund for the working class in Spain 110 years ago stemmed from a motivation to introduce positive changes for society. Today, the Foundation maintains this vision, which is why we focus on programs with strong potential for social impact. Our actions span three main areas: talent, research and innovation.

We support young people's careers. Our fellowships program is our longest standing program. It started in 1982 awarding fellowships to pursue graduate studies abroad. More recently, this program has evolved to include pre-doctoral and post-doctoral fellowships targeting young people from all over the world who want to develop their research career in Spain and Portugal.

We promote research through open calls and projects, predominately in the areas of health and social sciences. The selection processes of our calls follow the highest international standards of transparency and excellence. That's the best way to guarantee that we are funding the best research.

Through programs such as *CaixaImpulse*, we support innovative projects providing financing and a robust accompaniment program so they can be closer to the market. Through the commercialization of a new treatment or a new invention, society will truly benefit from the impacts of research.

Can you comment on your views about the importance of scientific philanthropy for research?

Philanthropy has neither the constraints of industry nor those of public administration and is uniquely positioned to make the relationship between the two much more fluid. From our position in the middle, we can facilitate a closer connection between the public and private sector, which is something that we see as especially lacking in southern Europe. Philanthropy can play a catalytic role in transferring more science from the public sector to the private sector by accompanying talent, investing in science, and also accompanying this transferability of the research produced to the most direct sector.

What is your message for ICFOnians?

We have long considered ICFO a point of reference for research excellence because as an institution it has clearly made it a priority. ICFOnians know that the only way to compete at the international level is through quality and relevance. We do not doubt that when we open a call for pre-doctoral or post-doctoral fellows, candidates coming from ICFO will be at the highest level because fellows who have been at ICFO all have had top-level publications and scientific achievements. My message would be congratulations for all the outstanding achievements and best wishes for the coming years. I believe that ICFO is in optimal conditions to operate at the highest level of science and technology at the national and international level.

Science Quiz

ICFO and NEST (Nanoscience Institute in Pisa, Italy) report on a simple and inexpensive process that turns electricity into stored hydrogen.

Water splitting of hydrogen chemisorbed in graphene oxide dynamically evolves into a graphane lattice, Laura Ciammaruchi, Luca Bellucci, Gabriel Comerion Castillo, Guillermo Martínez-Denegri Sanchez, Quan Liu, Valentina Tozzini, Jordi Martorell, Carbon 153, 234 (2019)

1 What is graphane ?

A) "Graphene" in Italian

B) Fully-hydrogenated graphene

C) Mono-unsaturated graphene

2 Why is graphane interesting for green energy?

A) Stores a lot of hydrogen

B) Superconducting at room temperature

C) Zero friction

3 What voltage does it take to split water into H2 and O2?

A) ~ 1 V

B) ~ 10 V

C) ~ 100 V

4 What role does oxygen play in graphane hydrogen storage?

A) Prevents the growth of bacteria

B) Topological protection

C) It crinkles the graphene so it is not flat

* Find answers on pg. 2

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To get in touch, please send us an email to: communications@icfo.eu indicating your name, email address, and institution.