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Community News Spring 2019

Women for Science

A celebration for ALL ICFOnians because we all benefit by supporting women in science.

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EDITOR'S CORNER

Brook Hardwick
Coordinating
Editor



Women for Science Month

During this annual celebration, we showcase the successes of female scientists, analyze ways to improve the gender balance, and ask ourselves the question "What needs to change to make science better?"

ICFO is an institute that aims to make advances in science that will one day make the world a better place. We do this through our efforts to train young scientists, our ambitions to push the frontiers of knowledge, and our work to take new understandings out of the lab and into society. We often have exciting achievements, some of which you will read about in this edition of ICFOnians. On the road to these successes, we sometimes take a wrong turn. That is a natural part of the scientific process. When this happens, we must regroup, adjust our sites correcting for errors in calculations or interpretations, and incorporate the newest knowledge and insights from peers that will help us achieve our aims. When the goal is scientific excellence, we must constantly ask ourselves "what needs to change to make this better?"

Celebrating *Women for Science* month each year at ICFO, we go through a similar exercise. We consider gender diversity and equality in science. We celebrate women's successes and brainstorm actions that will help a higher percentage of women to achieve the recognition and leadership positions they deserve. It is an opportunity for all ICFOnians to ask ourselves what we are prepared to do to ensure that all scientists, regardless of gender, can contribute their unique perspectives to help advance the frontiers of knowledge. While women are

under-represented in our fields and in leadership positions, they are not asking for any special breaks. They want to be invited to share their opinions and to be taken seriously by their peers for their contributions. They would also like to see more women in and leading teams. The question that is asked repeatedly throughout *Women for Science* month is "what can we do to make this happen?"

Prof. Maria Josefa Yzuel, for whom ICFO's new fellowship for female masters and bachelor students has been named (see p. 8), is an interesting and inspiring case in point. When she received her degree in Physics in 1962, she was one of just two female students in her class at the University of Zaragoza, yet she went on to defend her PhD thesis in 1966, move to the UK as a young postdoc, and to later become the first female associate professor of physics in Spain. She has held international leadership positions like the Presidency of SPIE, and in general has been a trailblazer, role model and mentor for young scientists throughout her career. Fifty years since Prof. Yzuel started her career in academia, women in science have come a long way. However, even as an emeritus professor, age 79, she continues to look for ways to make an impact on the photonics community, working so that women will play a sizable role in its future.

COVER



Between the celebrations of the International Day of Women and Girls in Science (February 11th) and International Women's Day (March 8th), ICFOnians set aside time to recognize and support the valuable contributions of women towards the scientific enterprise. At ICFO, women are conducting cutting-edge research, working for technology transfer, and focusing on myriad details to ensure that researchers can focus on science. We all benefit by supporting women in science.

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Mystery ICFonian
Solution Ed #38

Laurent Ladepeche
Postdoctoral Researcher, SLN- Team Loza

Science Quiz 1. A 2. B
Answers from p.12 3. B

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HAPPENINGS



BUSINESS NEWS
 Graphene and Quantum Technologies at MWC19
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ICFO NEWCOMERS

Welcome to ICFO

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



Karuppasamy Soundarapandian
 PhD Student



Lukas Heller
 PhD Student



Elena Nolla Sabater
 HRE Support



Roberto Tricarico
 Visiting PhD Student



Radoslaw Gora
 Visiting PhD Student



Nicolas Morell
 Postdoctoral Researcher



Roshan Krishna Kumar
 Postdoctoral Researcher



Núria Campos Alfaraz
 Research Engineer



Giuseppe Calajò
 Postdoctoral Researcher



Maria Maffei
 Postdoctoral Researcher



Debraj Rakshit
 Postdoctoral Researcher



Joeri de Valença
 Postdoctoral Researcher



Frederic Català Castro
 Postdoctoral Researcher



Daniel Allepuz
 Student



Emanuele Distanto
 Postdoctoral Researcher



Paul Seifert
 Research Engineer



Laia Francàs Forcada
 Project Management
 Quantum Flagship



Gemma Bale
 Visiting Scientist



José Ramón Durán
 Postdoctoral Researcher



Julien Schreier
 Research Engineer



Jan Lowinski
 PhD Student



Nick Feldman
 Student



Andrés Black Moroccoima
 Research Engineer



Joan Agustí Bruzón
 Student



Maximilian Heithoff
 PhD Student



Diamantoula Maniaki
 Student



José Javier Ruiz
 Student



Dominic Hunter
 Postdoctoral Researcher



Francesco Ricci
 Postdoctoral Researcher



Guy Whitworth
 Postdoctoral Researcher



Mariona Dalmases Solé
 Postdoctoral Researcher



Matteo Scandi
 PhD Student



Jennifer Aldama Guardia
 PhD Student



Eva M. Garcia Cuesta
 Visiting Scientist



Miren Lamaison
 Student



Iwona Majewska
 Visiting PhD Student



Tymoteusz Salamon
 PhD Student



Sandhya Ganesh
 Student



Clara Gregori Pla
 Research Engineer



Laura Malo Roset
 Student



Joel Pérez Diaz
 Student



Javier Rivera Dean
 Student



Varun Varma Pusapati
 PhD Student



Daniel Goncalves
 Student



Arnau Fabra Ruiz
 Student



Raul Izquierdo López
 Student



Jordi Valls Conesa
 Student



Jonatan Höschele
 PhD Student

HAPPENINGS

ICFO NEWS

ICFO WEST



The **CELLEX- NEST building** donated by the **Cellex Foundation** in 2012 gave ICFO an important boost with space that allowed the institute to host new groups, accomplish many salient scientific and technological results and also secure several strategic sponsored projects.

It quickly became apparent however that even more space would be needed to meet new research needs and the institute's potential. The late **Dr. Pere Mir, founder and former president of the Cellex and Mir-Puig private foundations**, once again proved to be visionary when he agreed to make possible a new expansion that will include an enhanced Clean Room facility and additional lab and workspace.

In January 2019, construction began on ICFO WEST- donated by the Mir-Puig Foundation, located just next to ICFO's current facilities. Construction is estimated to be complete in summer 2020.

BIST IGNITE Call Awardees



The **Barcelona Institute of Science and Technology's Ignite Program** promotes the initiation of new collaborations among BIST researchers, facilitating the exchange of knowledge among different scientific fields and exploring new approaches to address complex questions. Five multidisciplinary projects funded in April 2018 were given eight months to develop their projects, at which point they were eligible to apply for the second phase of funding. **Three outstanding multidisciplinary projects from this group have now been awarded grants to continue their work. ICFO participates in all three of the projects.**

PHASE-CHROM: aims to discover previously unknown parts of the cell (Dr. Juan Andrés Torreño Piña with CRG and IRB).

Q-SPET: aims to measure the quantum effects of proteins in photosynthetic bacteria and plants. (Prof. Niek van Hulst with IBEC, and ICIQ).

ENGUT: aims to develop a new cell culture method for personalised medicine applications (Dr. Emilio Gualda with IBEC and IRB).

Friedrich Wilhelm Bessel Research Award



The **Alexander von Humboldt Foundation** is a foundation established by the German government that promotes international academic cooperation between excellent scientists and scholars from Germany and from abroad.

ICREA Prof. at ICFO Dr. Jens Biegert was awarded the foundation's Friedrich Wilhelm Bessel Research Award for "pioneering contributions to atomic- and attosecond-resolution molecular imaging, and key advances towards element-selective attosecond x-ray spectroscopy of carrier dynamics in solid state systems". The award was celebrated at the Humboldt Foundation's award ceremony with its President Prof. Hans-Christian Pape and also His Excellency, the President of the Federal Republic of Germany, Frank-Walter Steinmeier. Through this award, Prof. Biegert will participate in a research stay at the Fritz Haber Institute of the Max Planck Society in Berlin, hosted by Prof. Martin Wolf, where he will explore the connection between electrons and the lattice within electronic and structural phase transitions and for superconductivity.

Research into the Science of Light Prize



The **European Physical Society (EPS) Prize for Research into the Science of Light** is a major prize awarded on behalf of the EPS through its **Quantum Electronics & Optics Division**. The prize is awarded every 2 years in recognition of recent work by one or more individuals for scientific excellence in the area of electromagnetic science in its broadest sense, across the entire spectrum of electromagnetic waves.

The **2019 Prize was awarded to ICREA Professor at ICFO Javier Garcia de Abajo** for "pioneering contributions to the understanding of the behavior of light at the nanoscale, in particular in plasmons and in light interactions with free electrons".

ERC Advanced Grants



The **European Research Council (ERC)** announced two new **Advanced Grants for senior researchers to ICREA Professors at ICFO Antonio Acín and Maciej Lewenstein**. Over the years, both have been extremely successful in securing ERC funding. For Prof. Lewenstein, this is the third consecutive Advanced Grant, the first received in 2008 just a year after the founding of

the European Research Council. This is Prof. Acín's fourth ERC grant, with European Council support marking various stages of his career. He earned a Starting Grant in 2008, the same year as Prof. Lewenstein, a Proof of Concept Award in 2012, and a Consolidator Grant in 2014. With these new awards, ICFO now holds 34 grants in total from the European Research Council: 10 Starting Grants, 4 Consolidator Grants, 10 Advanced Grants and 10 Proof of Concept Grants.

Prof. Maciej Lewenstein's project, entitled "**NOvel Quantum simulators - connecting Areas**" (NOQIA), is a theory project, aimed at introducing the established field of Quantum simulators + Topological effects in physics + quantum validation and certification into two novel areas: physics of ultrafast

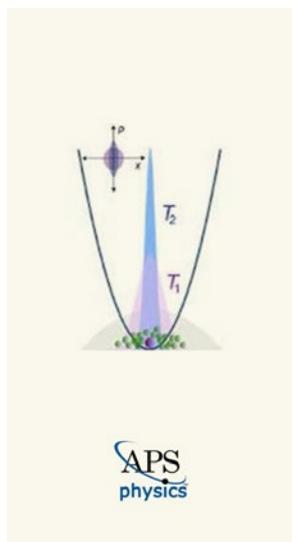
phenomena and attoscience, on one side, and quantum machine learning and neural networks on the other. This will open up new horizons and opportunities for research both in Attoscience and in Machine Learning and neural networks.

Prof. Antonio Acín's project, entitled "**Certification of quantum technologies**" (CERQUTE) aims to provide the tools to achieve quantum certification, ensuring that a quantum system is entangled, random, secure, and performing computations correctly. CERQUTE goes at the heart of the fundamental question of what distinguishes quantum from classical physics and will provide the concepts and protocols for the certification of quantum phenomena and technologies.

LATEST ADVANCES

Temperature Precision Measurements in Bose Einstein Condensates

Quantum thermometry seeks to determine the fundamental limits on how precise temperatures close to absolute zero can be measured.



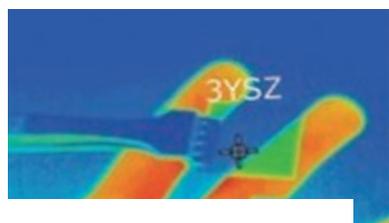
Current experiments have been able to achieve high precision thermometry at very low temperatures. However, the mechanism and the attainable accuracy varies quite considerably depending on the specific experimental platform.

Even more, for cold atomic gases, most of the current techniques employed to measure temperature in the sub-nanoKelvin domain end up destroying the BEC after the measurement.

In a recent study published in *Physics Review Letters* and highlighted as an Editor's suggestion, ICFO researchers Mohammad Mehboudi, Aniello Lampo, Christos Charalambous, Miguel Angel Garcia, and ICREA Prof. Maciej Lewenstein, in collaboration with the University of Nottingham,

introduce a novel minimally-disturbing method for measuring temperature of BECs in the sub-nanoKelvin regime. In their theoretical approach, the team of researchers took an abstract standpoint and, by means of meticulous theoretical modelling and adopting experimentally relevant parameters, found that current precision standards in these systems can be improved. In particular, they demonstrated the possibility of measuring temperatures below 1 nK with large accuracy without destroying the BEC gas.

The results obtained in this study open a new pathway for obtaining accurate low-temperature measurements in ultra-cold systems, broadening the range of applications that can benefit from this discovery, in particular for emerging quantum technologies.

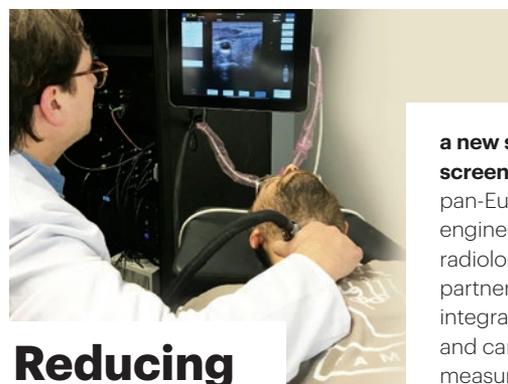


New Materials And Structures for Infrared Sensing

The Optoelectronics research group at ICFO recently published studies in *NanoLetters* and *Advanced Optical Materials* reporting on achievements that could improve the sensing capabilities of graphene-based nanostructures. In the *NanoLetters* study, Kavitha K. Gopalan, Bruno Paulillo, Daniel Rodrigo, and Nestor Barez, led by ICREA Prof. at ICFO Valerio Pruneri, in collaboration with researchers from the Technical University of Denmark, have reported, for the first time, using graphene nanostructures and a scalable nanoimprint technique to fabricate a tunable graphene nano-hole array surface capable of sensing plasmonic vibrations in the mid-infrared range (~1300–1600 cm^{-1}). Such proper-

ties make it an interesting nanostructure for industrial applications (such as mid-infrared biosensors or photo-detectors) since this technique is capable of exciting multiple plasmon modes, allowing it to do multiband sensing, something not feasible with nanoribbons or other localized resonant structures.

In the second study, Kavitha K. Gopalan, Daniel Rodrigo, Bruno Paulillo, led by Prof. Pruneri, in collaboration with Kamal K. Soni from Corning Inc, reported on the use of yttria-stabilized zirconia (YSZ) ceramic as a flexible and stable platform for infrared nano-optics. In their study, researchers combined the YSZ substrate with metallic nanostructures and graphene to demonstrate new plasmonic, polarizing, and transparent heating devices, overcoming the frailness and long-term functionality issues that other substrates, such as calcium fluoride and zinc selenide, present. They also showed that this material is mechanically flexible, ideally suited for making foldable or bendable devices, and for low-cost large-scale roll-to-roll fabrication processes. This discovery proves that this material is ideal for infrared applications, which could cover thermal imaging to chemical and biological vibrational spectroscopy, among others.



Reducing Uncertainties in the Diagnosis of Thyroid Nodules

The LUCA device will enhance the non-invasive characterization of the thyroid tissue

The goal of the ICFO coordinated Horizon 2020 project *Laser and Ultrasound Co-analyzer for Thyroid Nodules (LUCA)* is to develop a non-invasive, low-cost device that brings

a new solution for thyroid cancer screening. The interdisciplinary pan-European team of physicists and engineers, clinical endocrinologists, radiologists, together with industrial partners have now finished the integration of the LUCA demonstrator and carried out the first successful measurements with the new device, confirming promising results for the pilot feasibility studies, conducted by LUCA partner IDIBAPS, on healthy volunteers and patients at the Hospital Clínic de Barcelona in the final year of the project. This non-invasive tool for thyroid cancer screening was presented at the European Conference of Radiology in Vienna.

LUCA has developed this device to obtain more specific thyroid nodule screening and thus better diagnosis. By combining the traditional ultrasound imaging with a state-of-the-art photonics that obtains measurements of tissue hemodynamics and thyroid nodule composition with the use of light, the LUCA device will enhance the non-invasive characterization of the thyroid tissue, aiming to reduce the amount of uncertainties in the diagnosis of thyroid nodules.

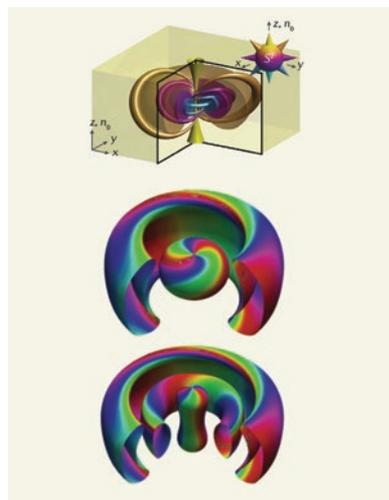
Frontiers of Light Trapping

In a paper published in *Nature Reviews Physics*, ICFO researchers Yaroslav Kartashov and Prof. and Director of ICFO Lluís Torner, along with researchers from the UPC and Tel Aviv University, provide an overview of the recent theoretical and experimental progress that has been made in the creation of dynamically stable, multi-dimensional, soliton-like states, with a focus on optical materials, matter-wave condensates and ultradilute quantum liquids, liquid crystals and ferrofluids.

The review aims to bridge different communities to promote the exchange of ideas and to facilitate the implementation

of concepts, which were originally developed for a specific physical setting and that now aim for completely different settings. This would allow the harnessing of opportunities offered by multidimensional settings for the creation of localized states with rich internal structures that are not possible in 1D geometries.

The article highlights the recent breakthrough regarding the experimental creation of quantum droplets, which are stable in 2D and 3D geometries and that owe their stability to quantum fluctuations. It also stresses that over the past decade, photonic settings and BECs in optical lattices proved to be powerful tools to mimic the behaviour of other physical systems that are much harder to access experimentally. The research on the formation of multidimensional self-trapped states should be seen from a similar perspective, hence its fundamental and far-reaching importance.



HAPPENINGS

BUSINESS NEWS



Graphene and Quantum Technologies Team Up at the Mobile World Congress 2019

Flagships present initiatives at the world's largest telecommunications event

The global telecommunications community makes an annual pilgrimage to Barcelona each year for the Mobile World Congress to learn about the very latest in mobile technology. At MWC19, as part of the congress's attraction, in the NEXTech Hall, attendees were able to visit the Graphene Pavilion of the Graphene Flagship exhibiting graphene-based technologies for the 4th consecutive year. The Quantum Flagship also participated this year with a stand in the pavilion to present the recently launched initiative and its goals.

In MWC 2016, the Graphene Flagship debuted with the Graphene Pavilion, curated by ICFO. In the subsequent four years, ICFO has played a central role in the organisation of this space ensuring that hundreds of thousands of visitors can learn about and interact with the most disruptive graphene-based technologies developed in Europe. This year's pavilion demonstrated how graphene enables a whole new connectivity approach, from the single connected device to a network of embedded processors, sensors and communication hardware that constitute the Internet of Things' ecosystem.

ICFO technologies and prototypes displayed included:

01. A graphene-based flexible, transparent and disposable UV sensor that can monitor the level of exposure to sunlight. It connects to a mobile device and alerts the customer when an extreme limit of sun exposure has been reached. Using the same base technology, ICFO's fitness band aims to measure heart rate, hydration, breathing rate, among other parameters.

02. Two other light-based graphene technologies, which include the world's smallest single pixel spectrometer and a graphene-enabled hyperspectral image sensor, both with broadband capabilities, beyond those obtained with the use of costly and bulky photodetection systems.



The Quantum Flagship space, coordinated by ICFO, was devoted to quantum technologies and aimed to give visitors a glimpse at how quantum technologies intend to radically improve the telecommunications arena. It was a popular and well-visited spot on the many Tech Tours that passed through the exhibition spaces. ICFO spin-off Qside, a partner in the Quantum Flagship, presented a prototype of a quantum random number generator chip.

The Graphene and Quantum Flagships have the common goal of taking and transferring the discoveries and research from the lab to the market into commercial applications that will help create the next generation of disruptive technologies. They seek to position Europe as a worldwide knowledge-based industrial and technological leader in both innovative fields.



Proof of Concept Grant

ERC Funding to develop a miniaturized coherent soft x-ray source for research and industry

The European Research Council, in its efforts to help ERC grant-holders to bridge the gap between their research and the earliest stage of a marketable innovation, created the Proof of Concept (PoC) funding scheme for researchers who have already been awarded an ERC grant. Not only does this program help ERC grantees to explore the innovation potential of their research and/or commercialize the results of their ERC-funded research, the program complements the efforts of ICFO's Knowledge and Technology Transfer Unit (KTT), which proactively searches for ways to translate newly generated knowledge into new technologies. ICREA Prof. at ICFO Dr. Jens Biegert has been awarded a PoC, the tenth award of this kind for ICFO in the past seven years, for the project titled miniX. The main goal of this project is to develop a miniaturized coherent soft X-ray source for research and industry.

New CLP Member

AIA Group joins ICFO's Corporate Liaison Program

Since 1988, Grupo AIA has been developing innovative software solutions, based on algorithms originated in the fields of Artificial Intelligence, Theoretical Physics, and Applied Mathematics, pioneering the creation of tailored advanced intelligent software products for a large diversity of business cases and industries. Its software is based on techniques for classification, prediction, optimization, simulation, machine learning, and artificial intelligence. AIA has accomplished the transfer of basic science: mathematics, physics, economics, and artificial intelligence to its goal markets. The Company has solved common complex problems with solutions applied to Energy, Financial Services, Retail and Healthcare, among others.



AIA Group joins ICFO's Corporate Liaison Program with the aim of establishing a long-lasting relationship with ICFO, building mutual knowledge and trust, and thus boosting mutual benefits. The collaboration between AIA and ICFO will look for synergies in the areas of Machine Learning, Big Data and Quantum Technologies; in particular in the domains of Quantum Machine Learning, Quantum Information and Quantum Simulation oriented to solving complex industrial problems.

COLLABORATION



OUTREACH
The Quantum Tour
p. 9

COMMUNITY



Women for Science Month received strong support from the entire ICFO community.



Prof. María García-Parajo introduced the global panorama for women in science and the agenda for ICFO's celebration.



Throughout the month, there were scientific seminars by women researchers at ICFO showcasing some of their significant contributions.

Women for Science Month

A celebration for ALL ICFOians because we all benefit by supporting women in science

Between the celebrations of the International Day of Women and Girls in Science (February 11th) and International Women's Day (March 8th), ICFOians set aside time to recognize and support the valuable contributions of women towards the scientific enterprise.

Statistics gathered from around the world show that the number of women in higher education is higher than it has ever been, even outnumbering in some areas that of men. Likewise, when analysing the pipeline for scientific vocations, women enter PhD programs in numbers similar to their male counterparts. In an age when women are more prepared than ever before to shine in all scientific disciplines, today's gender disparity as well as the shortage of women who

are successful in transitioning into leadership roles is troubling. At the very least, it warrants this month-long initiative in which ICFOians focus on promoting science by shining light on contributions by women.

Starting in the inaugural event on February 11th, presentations by ICREA Prof. at ICFO Dr. María García-Parajo and Dr. Rob Sewell, Coordinator of Academic Programs, underscored the theme of support for an important but under-represented part of the scientific community. Further demonstrating an investment in the careers of young women scientists, ICFO launched the María Yzuel Fellowship program targeting outstanding female bachelor and masters students interested in photonic sciences and related fields. (See p. 8). Prof. Yzuel, a respected member of the international Photonics community who has been a champion for women in our field throughout her long and successful career, also participated in the inaugural event to describe the importance of this program and her pleasure in its carrying her name.

Throughout the ensuing month, ICFOians celebrated by showcasing some of the significant contributions of women researchers at ICFO, and also by opening meaningful discussions on varied topics ranging from parenthood to the glass ceiling.

The conversations should continue. The planned debate on *Implicit Biases and how words matter* will be rescheduled so stay tuned. Likewise, all ICFO is invited to participate in the Women in Science Seminars which take place regularly throughout the year.



In the inauguration ceremony, Dr. María Yzuel, Emeritus Professor at the Universidad Autónoma de Barcelona launched the Fellowship program that bears her name.



Both female and male scientists with young children shared their experiences about combining a successful scientific career with family.



Posters in the NEST HALL presented a picture of where ICFOianas at ICFO come from, and where they go after ICFO.

COLLABORATION

TRAINING

María Yzuel Fellowships Awards

Supporting outstanding female bachelor and masters students

ICFO is dedicated to fostering the research careers of exceptionally talented young students and offers various internship programs that constitute for many a first experience in a frontier research project. Convinced that gender balance enhances innovation, creativity and excellence in research, ICFO has recently launched the María Yzuel Fellowships Awards targeting outstanding female bachelor and masters students interested in photonic sciences and related fields.

These fellowships are named in honor of Prof. María Josefa Yzuel, emeritus professor at the Autonomous University of Barcelona (UAB), who throughout her career has provided an outstanding example of leadership in science, education and the promotion of women in science. In addition to making important contributions in diverse fields ranging from diffraction image theory, to photolithography, optical pattern recognition, medical optics and liquid crystals, diffractive optics and polarization, publishing over 250 papers and supervising 20 PhD theses,



Prof. Yzuel has been very active in the international optics and photonics community.

Prof. Yzuel studied physics at the University of Zaragoza as one of only two female students in her class, going on to obtain her doctorate in 1966. After this, she joined an international group at the University of Reading as a postdoctoral researcher. "This international grant was very important for my career", she recalls. She became the first female associate professor of physics in Spain when she returned to the University of Zaragoza in 1971, and later joined the University of Granada professor of Optics in Spain before moving to the UAB in 1983. In 2009 she became president of the SPIE, the International Society for Optics and Photonics. She is a fellow of OSA, SPIE, IOP, and EOS, and the former president of the Spanish Optical Society, and secretary general of the European Optical Society.

Prof. Yzuel, who was greatly honored that these fellowships bear her name, commented that "I believe that the future is open. I would like to be one of these young people because I would like to know what is going to happen in the next twenty years!" She strongly encourages young women to consider careers related to optics and photonics. "Don't be afraid", she urged. "You can do it. You are really very well prepared!"

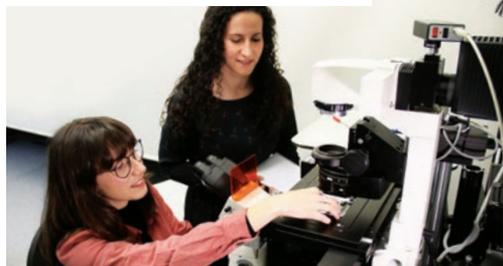
TRAINING

BIST Winter School and Symposium

Approximately 200 people from the BIST community registered to attend the day-long closing Symposium at ICFO

The BIST Winter School on Microscopy, Nanoscopy and Imaging Sciences, part of the training program of the BIST-UPF Master of Multidisciplinary Research in Experimental Sciences, was held during the first two weeks of February, culminating with a special BIST Symposium hosted by ICFO on February 8th.

The Winter School program was designed to introduce students to a core set of techniques and technologies that are used in a wide range of scientific fields.



BIST
Barcelona Institute of
Science and Technology

ICFO-IMPRS joint workshop on Quantum Technologies

March 20-22



The ICFO-IMPRS joint workshop on Quantum Technologies, a three-day workshop involving over 80 PhD students from both institutes, was hosted at ICFO from March 20-22

The aim of the workshop was to bring together PhD students from ICFO and the International Max Planck Research School on Quantum Science and Technology – a graduate school involving the Max Planck Institute of Quantum Optics, Ludwig-Maximilians-Universität München and the Technical University of Munich – and create a stimulating environment for discussions and networking. The program was put together by a scientific committee of PhD students – Caroline de Groot, Antonio Rubio Abadal and Fernandez Noelia from IMPRS, and Stefano Grava, Francesco Andreoli and Gerard Jimenez from ICFO. It included lectures from researchers from both institutes, and a select group of invited guests, as well as talks and posters from the PhD students.

Highlights included talks on Quantum optics in structured reservoirs, Prof. Ignacio Cirac (IMPRS), Synthetic gauge fields with ultracold atoms in periodically-driven lattices, Dr. Monika Aidelsburger (MPQ), Atomistic defect states as quantum emitters in monolayer MoS₂, Prof. Alexander Holleitner (IMPRS), Quantum memories for quantum repeaters, Prof. Hugues de Riedmatten (ICFO), Hybrid superconducting van der Waals Hetero-Structures and Magic Angle systems, Prof. Dmitri K. Efetov (ICFO), and Local manipulation of multipartite entanglement and compressed quantum simulation, Prof. Barbara Kraus (Universität Innsbruck), Saving the Quantum: How to make friends with the Environment, Prof. Sabrina Maniscalco (University of Turku / Aalto University).

Such events are a valuable addition to the education of the next generation of scientific leaders, and help to strengthen the relationship between ICFO and its partner institutions.

It included theoretical and practical classes hosted at five of the BIST institutes. ICFO researchers, under the leadership of ICREA Prof. at ICFO María García-Parajo, contributed to the program on advanced Optical Microscopy.

Approximately 200 people from the BIST community registered to attend the day-long closing Symposium at ICFO and enjoyed talks from leading international researchers on an extremely diverse range of advanced topics in Electron Microscopy, Scanning Probe Microscopy Imaging Science and Optical Microscopy.

Talks covered topics from cutting edge optical and electron microscopy – e.g. Nanoscopy applied to NeuroSciences, Markus Sauer (Wursburg, Germany), Surface dynamics explored in real-time with scanning probe microscopy, Cristina Africh (Istituto Officina dei Materiali (IOM-CNR), Laboratorio TASC, Trieste, Italy)

and Cryogenic TEM with liquid cells, Giuseppe Battaglia (UCL, ICREA & IBEC).

New to this year's edition was a focus on Correlative Microscopy – e.g. Correlative light and electron microscopy, Jacob Hoogenboom (Delft University, NL) and topics in Machine Learning – AFM combined with imaging and machine learning, Núria Gavara (Queen Mary University of London, UK) – and Big Data in imaging sciences – e.g. Massive data management using Big Data technologies, Jorge Carretero (IFAE/PIC).

Jordi Arbiol, ICREA Professor and Group Leader at ICN2 and coordinator of the Winter School, notes, "An exciting and continuously developing field, microscopy is nowadays a 'must know' for anyone interested in following a career in experimental sciences. Because SEEING the world is understanding... and understanding builds the knowledge of our society."

OUTREACH

The Quantum Tour

Immersing visitors in the exciting world of quantum physics & technologies



EXPERIMENTAL LAB: Step inside a quantum laboratory to take a 360° tour of an experimental set-up. Learn about what kinds of experiments take place in labs, and what these experiments hope to achieve.



APPLICATIONS CORNER: Discover how the counterintuitive principles of quantum physics can turn into useful and surprising new technologies.

THEORETICAL LAB: Ideas are often the starting point for experiments and new technologies. Explore this area to get a taste of quantum theory.



ICFO has a reputation for achieving difficult things. When it comes to the world of quantum physics, ICFO researchers have made breakthrough contributions to quantum optics, quantum information and quantum technologies. Fourteen research groups here have projects that explore the quantum regime. They regularly publish high impact findings in the leading scientific journals. Research from these labs has been spun out to create Quside Technologies, a company that develops quantum technologies for the cyber-security and super-computation worlds.

Now ICFO's KTT Outreach unit has joined forces with the quantum community at ICFO, with the support of the AXA Research Fund Chair, to launch an original and exciting way to learn about Quantum Physics and its underlying applications. The Quantum Tour seeks to bring the world of quantum physics closer to society in general and in particular to non-academic audiences.

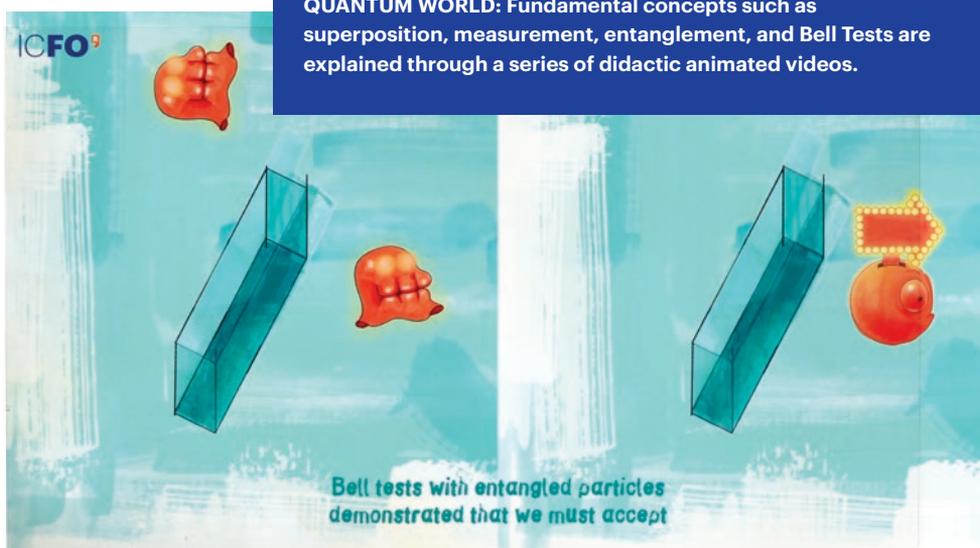
This virtual tour takes place on an ingenious platform that is segmented in areas inspired by the ICFO building, displaying information through beautiful animations and videos in which several Group Leaders and young researchers of ICFO have participated. Visitors can explore the facility to gain an overview of some of the core research and developments in this field as well as of some of the applications.

Quantum physics has fundamentally changed our understanding of how light and matter behave at extremely small scales and has already had a great impact in the development of modern technologies that use and depend on quantum effects. The importance of this discipline promises to grow in the years to come. The Quantum Tour is a dissemination tool to deliver insights on quantum physics and technologies to a wide audience including students and teachers, communicating current and potential impact and transmitting the importance and potential of quantum physics.

www.quantumtour.icfo.eu

*Currently available in English. Spanish and Catalan versions coming soon.

QUANTUM WORLD: Fundamental concepts such as superposition, measurement, entanglement, and Bell Tests are explained through a series of didactic animated videos.



COLLABORATION / PEOPLE

OUTREACH

Young Photonic Congress 2019

47 secondary school students present light related research studies

On Friday March 15, ICFO celebrated the 4th edition of the Young Photonics Congress. Organized and hosted by the institute and supported by the Fundació Catalunya – La Pedrera • Ignacio Cirac Program Chair, this year more than 100 people from all over Catalonia attended the conference, which included a total of 47 speakers and 26 posters.



The Young Photonic Congress is an initiative that allows students to live the experience of a real scientific congress. In preparation for the congress, the participants collected and presented their experiences and learnings in a scientific poster format. They then submitted an abstract of their research or experience along with a formal scientific poster.

As part of the event, five young ICFO researchers gave flash talks to explain the research they carry out at the institute. Following these short presentations, the students had the opportunity to explain their own projects during a poster session, similar to the ones that take place usually in scientific congresses. ICFOians mingled with the students to listen to the presentations, as did the Hble. Joaquim Torra, President of Catalonia, whose visit to the institute, as luck would have it, coincided with the congress.

GO & FLY

183 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 ICFOians have recently succeeded in defending their PhD theses. Honoring ICFO's tradition, ICFOians 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.



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February 15, 2019

JORDI MORALES DALMAU
"From Cells to Tissues, Microscopy to Modeling: Towards Precise, Data-Driven Photothermal Therapy with Gold Nanorods"

TD: ICREA Professors Dr. Turgut Durduran and Dr. Romain Quidant



177

January 18, 2019

ION HANCU
"Controlling the multipolar interference of nanoantennas"

TD: ICREA Prof. Dr. Niek van Hulst



181

February 22, 2019

FRANCESCO RICCI
"Levitodynamics toward Force Nano-Sensors in Vacuum"

TD: ICREA Prof. Dr. Romain Quidant and Prof. Dr. Raúl Rica



178

January 29, 2019

MARIA MAFFEI
"Simulation and bulk detection of topological phases of matter"

TD: ICREA Prof. Dr. Maciej Lewenstein and Prof. Dr. Lorenzo Marrucci (Università degli Studi di Napoli)



182

March 6, 2019

CLARA GREGORI
"Correlates of Cerebral Vasoreactivity Measured by Non-Invasive Diffuse Optical Measurements as Biomarkers of Brain Injury Risk"

TD: ICREA Prof. Dr. Turgut Durduran



179

February 13, 2019

BORIS BOURDONCLE
"Quantifying Randomness from Bell Nonlocality"

TD: ICREA Prof. Dr. Antonio Acín



183

March 26, 2019

ALEXIA SALAVRAKOS
"Bell Inequalities for Device-Independent Protocols"

TD: ICREA Prof. Dr. Antonio Acín

BEYOND ICFO

Meet the new ICFO Alumni Representatives

The ICFO Alumni Network provides a platform and structure that allows ICFOnians to maintain common ties, supporting personal and professional relationships, as well as common interests and goals

Alumni are the key stakeholders in what the network has to offer, which is why the network depends on the collaboration of Honorary Alumni Representatives.

Helping to launch the Alumni Network in 2016, Armand Niederberger and Clara Osorio were the first Alumni Representatives. Their support and feedback have been of immense value during these past three years. While they now step down from their roles, we hope to continue counting on their involvement and support. Thank you Clara and Armand!

The new Alumni Representatives, who will hold this position for three years are:

Naeimeh Behbood

Naeimeh started her PhD at ICFO in 2008 in Prof. Morgan Mitchell's group, where she worked on light-matter interaction and generated quantum spin singlets in cold atomic ensembles of rubidium atoms. "A great experience in many different ways: from working on cutting edge research on quantum optics to having the chance to work with amazing people and the privilege of using fantastic laboratories, great infrastructure and the support of a great human resource department." After finishing her PhD, Naeimeh collaborated with the Academic Affairs office and also the Corporate Communications unit. She was part of the team that organized the first Alumni reunion in 2016. "I see the Alumni network as a powerful and high potential network, with people that can give insights on what is happening in technological fields all around the globe. It is an honor to be part of it!" Naeimeh is now the co-founder of SANA Meditech, which provides IoT solutions for home care risk prevention. Before joining SANA Meditech, she was project manager and researcher in Monocrom, a laser company that tailors lasers to the needs of their clients.



Roser Juanola

Roser began her journey as an ICFOniana doing her BSc thesis under the supervision of alum Gabriel Molina-Terriza, continued with her MSc thesis under Prof. Romain Quidant, and finally started as a research engineer with Prof. Valerio Pruneri. "My time at ICFO, almost 5 years, allowed me to explore different fields of research early in my career and gave me the skills to further my career as a researcher. The encouraging atmosphere made my time there unforgettable, and solidified both professional connections and friendships". She left ICFO in 2010 to pursue a PhD in Astrophysics, and since 2015 has been working at NASA Goddard Space Flight Center. Her current research activities include modeling coronagraph instruments for the next generation of space telescopes and corresponding wavefront sensing and control. She is also very active with the Alumni Network community, and recently came to ICFO to give an Alumni Seminar and to talk about her career. "The Alumni Network helps me keep in contact with the people I started my career with, as well as connecting me with very bright and enthusiast researchers in very different fields of research all over the world, and I am thrilled and honored to be part of it."



Danny Krautz

Danny spent almost 5 years at ICFO. After a first internship, he did his master thesis in the field of organic electronics and started a PhD here. "The time at ICFO was not only about doing a PhD, it was about the whole experience; learning a new language, building up the lab facilities, seeing ICFO grow, starting collaborations, and making a lot of friends." He moved back to Germany to continue working in his studies, before making the jump to industry. He is now Senior Manager at ZEISS Ventures, where they invest in technology-driven startups with interlinked software and hardware systems and the potential of scalable business models for global B2B markets. "ICFO offers a tremendous network and has gained a high reputation. I am happy to support the Alumni network in all aspects, and ICFO in particular with a H2020 project and the sponsorship for IONS19. I believe a network lives through active members, being diverse and being truly international. Please reach out to me for any questions; I am willing to help and to support."



Giovanni Volpe

Giovanni started his PhD at ICFO in 2004 in the group led by the late Prof. Dmitri Petrov, to work on optical trapping. "During my days at ICFO, I acquired a taste for becoming part of a project in its early stages with a bright future ahead". Afterwards he worked at the Max Planck Institute for Intelligent Systems as a postdoctoral researcher and at Bilkent University as assistant professor. He is now associate professor at the University of Gothenburg, where he leads the Soft Matter Lab. With more than 80 articles published and a book co-authored, he is also a recipient of an ERC Starting grant. Giovanni has never broken his tie with ICFO and has been an active collaborator in the Alumni Network from the start. "The ever-growing ICFO Alumni network provides an inexhaustible source of professional and social opportunities. I strongly encourage current ICFOnians and alumni alike to take advantage of it!"



Mystery ICFOnian

How much do you know about the people you work with? ICFOnians are a fascinating group, with hobbies, interests and talents that may surprise you. Have a look around and see if you can guess who this edition's Mystery ICFOnian is! Look for the answer in the next edition of ICFOnians.

1. She is the co-founder of a tech company
2. She has worn all colors in her hair except black
3. She used to work in music technology
4. She ran a hackathon for 6 years in the Sónar festival
5. Her dog's snoring is very popular in its category at freesound.org

THE LAST WORD

HIGH PROFILE

Àngels Chacón

Consellera of Business and Knowledge of the Government of Catalonia and Chair of the ICFO Board of Trustees

How is Catalonia doing on the international research and technology scene?

The citizens and the economy of Catalonia have access to a system that is considered a reference for knowledge in Europe, thanks to a consensus model characterized by a strategy that targets excellence, both in the attraction of talent and in the competitiveness of its institutions. Catalonia's system is broad and consolidated with 12 universities, 61 centers, 1,744 research groups, more than 46,000 professionals participating in R & D activities, 3 large scientific infrastructures, etc. This makes it possible for a region that constitutes only 1.5% of the population of the EU to generate 3.7% of its scientific publications, to have two universities in the TOP-150 of the best in the world, capturing 2.7% of the EC's Horizon 2020 competitive funds, 3.2% of ERC grants or 3.9% of Marie Curie scholarships, for example.



Under your leadership, the Generalitat has recently launched the promising "Pacte Nacional per la Societat del Coneixement" (National Agreement for the Knowledge Society) What are its main instruments? What role will research centers like ICFO play?

The National Agreement for the Knowledge Society (PN@SC) was created with the aim of promoting a shared strategy between the university and research system on the one hand, and the productive economy on the other, contributing to build the Catalonia of the future as a knowledge based society. The PN@SC is the instrument that will ensure that innovation is the backbone of future government policies with the objective of guaranteeing that the percentage of economic activity based on knowledge here is comparable to other leading countries in the world. The agreement ambitiously strives for great consensus,

"It is of fundamental importance in the fostering of scientific vocations in girls and young women, that they are familiar with the work of the excellent female researchers in our centers and universities."

not only among institutions, but also with all the agents of the knowledge and innovation system, among which, of course, are research centers that are leaders on the global stage. This is the case of ICFO, which is a member of the plenary and of the permanent board of the PN@SC, and chairs the panel devoted to the research system.

This month we celebrate "Women For Science Month". As a Woman for Science yourself, what would be your message to ICFOians in regards to the impact they can have on the society?

Despite the progress made in recent years in reducing the "gap" between men and women in science, we are still far from reaching the goal of gender parity. For this, we must continue designing and implementing measures that favor the balance of work and family life, and overcoming sexist bias in the recruitment of researchers, for example. It is also vital to emphasize another aspect that, while symbolic, in my opinion is no less effective: to give women more visibility in science. It is of fundamental importance in the fostering of scientific vocations in girls and young women, that they are familiar with the work of the excellent female researchers in our centers and universities. In this way, we may advance step by step towards gender equality in science. Preferences and societal norms do not happen in a vacuum, they depend on available alternatives, role models and expectations. Let's strive to create new female role models.

Science Quiz

Amini et al. "Imaging the Renner-Teller effect using laser-induced electron diffraction", PNAS April 2019, is authored by 11 ICFOians from the Attoscience and Ultrafast Optics, Quantum Optics Theory, and Nanophotonics Theory groups.

1) The Renner-Teller effect is:

- A) Non-adiabatic motion of nuclei, caused by symmetry-breaking in molecules
- B) Tunneling of nuclei in the process of hydrogen fusion
- C) A magic trick involving a nail gun.

* Find answers on pg. 2

2) When was the Renner-Teller effect first predicted?

- A) 1924
- B) 1934
- C) 1944

3) How fast do the nuclei move in the experiment (order of magnitude)?

- A) 0.01 Å/fs
- B) 0.1 Å/fs
- C) 1 Å/fs

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