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ICFO Receives ISO 45001:2018 Certification

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ICFONIANS 41

Community News Fall 2019

A Summer Filled with Science



EDITOR'S CORNER

Brook Hardwick
Contributing Editor



Change of Focus

During the summer months, most of us take some time to change our focus to new intellectual challenges, travel, sports, or even just time to relax.

As a result, we come back in September refreshed, with new experiences, ideas and motivation. That is why, even though the calendar tells us that the new year is still a few months away, I personally feel that the return to routine in September after the invigorating summer season feels like a new start, a new year, the beginning of a new cycle.

Each summer, ICFO becomes that “change of focus” for many young, scientifically inclined students. So close, yet so far from the sunny beaches of the Catalan coast, high school students come to ICFO for a very different type of summer activity. Through a variety of summer science programs, they are able to veer off the standard high school curriculum and take part in a more profound scientific learning experience than during the regular school year. At a different stage of their academic careers, undergraduate and Master’s students involved in the Summer Fellows program become members of ICFO’s research groups, delving deeper into ideas and subjects they find intellectually motivating and often taking a definitive step towards a career in research. For students who are inspired by new challenges and frontiers, a summer at ICFO provides a change of pace that helps expand horizons.

The start of the academic year brings many new ICFOnians to ICFO to start new projects and

collaborations. One new arrival this September that you can read about in this edition is Dr. Latifa Guesmi, recipient of the Women for Africa Foundation grant for senior researchers. The program supports research stays in Severo Ochoa research centers for African women scientists, allowing them to focus on aspects of their research that may be difficult in their home countries. The change of scenery will undoubtedly bring with it new findings that will allow Dr. Guesmi’s research to grow.

In this edition, you will read more about happenings at the institute, including new research results, tech transfer initiatives, a collaboration with Barcelona’s science museum, Cosmo-Caixa, to bring Quantum Physics to the general public, among other highlights. We also take time to celebrate our ICFO community, made up of current ICFOnians, Alumni, and our amazing support structure. We highlight ICFOnians accomplishments and summer stories, and also draw attention to the powerful influence of the Catalan business community (see High Profile interview with Joaquim Boixareu) that is putting its influence and support behind the initiatives of our institute, allowing us to aspire to grow in scope and excellence.

COVER



Twelve Master’s and undergraduate students took part in the 14th edition of the ICFO Summer Fellows program.

Who needs the beach to enjoy the summer holidays? Each year, ICFO welcomes students who are interested in experiencing life in a frontier research institute, carrying out projects in ICFO’s labs under the supervision of a Group Leader, postdocs or PhD students. Learn more about the experiences of participants of the 2019 Summer Fellows Program on pg. 7.

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Mystery ICFonian
Solution Ed #40

Juan Rombaut
PhD Student, Optoelectronics research group

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

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D.L.: B-54464-2008

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HAPPENINGS



BUSINESS NEWS
 Joint Lab in Quantum Processing
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ICFO NEWCOMERS

Welcome to ICFO

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



Zahra Khanian
 Visiting PhD Student



Guim Planella
 Student (SRF 2019)



Benjamin Pepper
 Student



Lene Gammelgaard
 Visiting Scientist



Sandra Diefenbach
 Research Engineer



Özlem Yavas
 Postdoc



Alessandro Seri
 Postdoc



Elisabet Roda Salichs
 Student (SRF 2019)



Stanislaw Kurdzialek
 Student



Martin Skenderas
 Student



Renwen Yu
 Postdoc



Tobias Grass
 Postdoc



Zhuoran Wang
 Postdoc



Sumana Chetia
 PhD Student



Ariadna Martinez
 KTT Project Manager



Klara Theophilo
 Postdoc



Paul Seifert
 Postdoc



Nima Taghipour
 PhD Student



Vinicius Salem
 Visiting PhD Student



Adolfo Esteban Martin
 Visiting Scientist



Rajashree Haldankar
 Student



Eric Kramer
 Student (SRF 2019)



Blanca Belsa Carné
 PhD Student



Sergi Batlle Porro
 Student



Rafael Luque Merino
 PhD Student



Sebastian Hägele
 Student



Javier Morgado Brajones
 Research Engineer



Emanuel Cristian Boghiu
 PhD Student



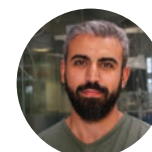
Lorenzo Vistoli
 Postdoc



Daniel Benedicto Orenes
 Postdoc



Latifa Guesmi
 Visiting Scientist



Ali-el-Hadi Zeineddine
 Visiting PhD Student



Jorge Arturo Rojas
 Visiting PhD Student



Nelson Romano
 Visiting Scientist



Roger Tormo Queralt
 PhD Student



David Cerviño Fungueiriño
 Student



Borja Requena Pozo
 PhD Student



Amélie Girardeau
 Visiting PhD Student

HAPPENINGS

ICFO NEWS

New Tenured Group Leader



Prof. Simon Wall, leader of the Ultrafast Dynamics in Quantum Solids group at ICFO has been awarded tenure by the Board of Trustees of the institute. Simon arrived at ICFO in 2012 as a NEST Fellow endowed by the Cellex Foundation Barcelona to support outstanding talented and creative young group leaders. He founded his research group focusing on the manipulation of the magnetic, structural and electronic states of matter with ultrafast electric fields to induce new properties when materials are driven out of equilibrium. In September 2017, the ERC awarded Simon the prestigious Starting Grant to pursue the project *"Probing nanoscale and femtosecond fluctuations in high temperature superconductors (See-Super)"*. In addition, he has had high impact publications, including the November 2018 study published in Science providing a new perspective on how light can be used to control matter.

American Physical Society Fellow



ICREA Prof. at ICFO Dr. Jens Biegert has been elected as fellow of the American Physical Society for 2019 in recognition of research and leadership. He was nominated by the APS Division of Atomic, Molecular, and Optical Physics (DAMOP) *"for the development of intense few-cycle mid-infrared sources for the generation of water-window high-order harmonics, and their use in fundamental space-time imaging of the dynamics of molecular structure."*

2019 ACS Photonics Young Investigator Award Lectureship



The Editors of ACS Photonics awarded ICREA Professor at ICFO Frank Koppens the 2019 ACS Photonics Young Investigator Award Lectureship. The lectureship, established in 2016, honors the contributions of a researcher, within the first 5-12 years of their independent research career, who has made major impacts on the field of photonics. *"Thanks to Frank's groundbreaking and pioneering work aimed at studying the fundamental behavior and potential applications of graphene and related 2D materials, today we have a deeper and better understanding of this unique class of materials,"* reported Harry Atwater, ACS Photonics Editor-in-Chief.

"la Caixa" Health Research Grant



The project Adaptive Retinal Implant Technology for Vision Restoration (i-VISION), which began in 2017 as a collaborative project between BIST centers funded through BIST IGNITE program, **has been awarded a "la Caixa" Health Research Grant.** The grant will provide the research consortia, including BIST founding members ICN2 (project coord), IFAE, and ICFO, in partnership with the Barraquer Foundation and the Institut de la Vision (University of Sorbonne), €1 million to carry out research to design the next generation of retinal prostheses using graphene-based electrodes, offering artificial vision to patients blinded by retinal degeneration. A total of 22 projects were selected out of 632 proposals submitted.

Secure Pan-European Quantum Communication Infrastructure



The European Commission announces the launch of a pilot project, OPENQKD, that will install a test quantum communication infrastructure in several European countries. The project, which will last three years with a budget of €15 million, consists of 38 partners covering a wide range of competences from 13 Member States and Horizon 2020 Associated States. As a consortium partner and coordinator of the European Quantum Technology Flagship project CiViQ, ICFO will leverage the technology developed within the project to implement a QKD test bed in the metropolitan area of Barcelona, in collaboration with partners of OPENQKD as well as with local entities, including governmental agencies.

NJP Early Career Award



ICFO postdoctoral researcher **Dr. Alexandre Dauphin**, from the group led by ICREA Prof. at ICFO Maciej Lewenstein received the **2019 NJP Early Career Award**, an international prize award given by the New Journal of Physics Editorial Board, the Deutsche Physikalische Gesellschaft (DPG) and the Institute of Physics (IOP). The award cites his outstanding performance in the field of quantum simulation, and his influential work in the detection of topological insulators in cold atom experiments in optical lattices and in photonics.

ISO 45001:2018



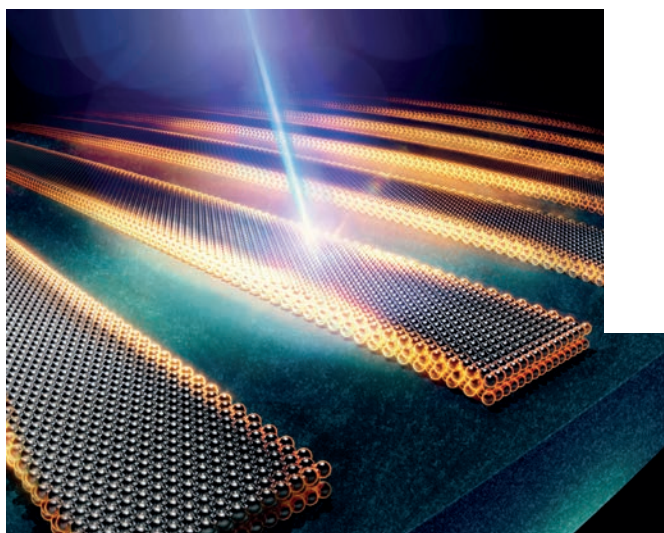
ICFO has become the first research institute in Spain to receive the ISO 45001:2018 certification, underscoring the institute's high standard for Occupational Safety and Health Management systems. In 2015, the Safety and Biosafety Unit at ICFO (OS&B) implemented an Occupational Health and Safety Management System establishing a continuous improvement process which requires the participation, cooperation and involvement of all ICFONIANS to constantly look for ways to improve working conditions.

"la Caixa" Junior Leader Program



Two ICFO postdoctoral researchers were awarded fellowships in the *Postdoctoral Junior Leader* program from the **Obra Social "la Caixa"**, which aims to foster high-quality, innovative research in Spain and Portugal and to support the best scientific talent by providing them with an attractive, competitive environment in which to conduct excellent research. Dr. Michael Tayler, in the group led by ICREA Prof. at ICFO **Dr. Morgan Mitchell** and **Dr. Tobias Grass**, in the group led by **ICREA Prof. at ICFO Dr. Maciej Lewenstein**, were both selected for this highly competitive award.

LATEST ADVANCES

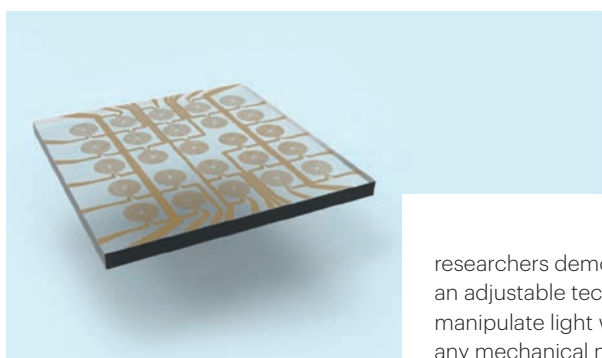


Near-infrared plasmons

Study proves atom-thin crystalline silver films could be the perfect alternative to highly-doped graphene

In a recent study published in *ACS Nano* (selected as cover image of the July issue), ICFO researchers Zakaria Abd El Fattah, Vahagn Mkhitryan, and Alvaro Rodriguez Echarri, led by ICREA Prof. at ICFO Javier García de Abajo, in collaboration

with researchers from Donostia International Physics Center, Centro de Física de Materiales CSIC-UPV/EHU, Yale University and Bar Ilan University, report on the fabrication and the excellent plasmonic and electronic properties of wafer scale atomically thin crystalline silver films composed of only a few atomic layers. Through a two-step process of fabrication and under ultrahigh-vacuum conditions, researchers grew high-quality flat silver Ag(111) films on silicon Si(111) wafers, with a thickness as small as ~1.5nm. The film quality was high enough to resolve quantum electronic states through angle-resolved photoemission. To excite and probe plasmons in these films, they first carved nanoribbon arrays, and then shined near-infrared light. Narrow plasmons with high quality factor (~4) were observed as spectral features in the reflected and transmitted light.

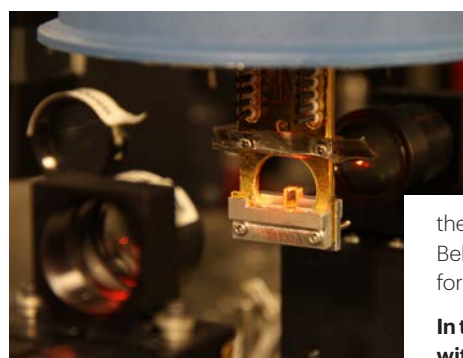


Shaping light with a Smartlens

Demonstrating a dynamically tunable lens capable of achieving almost any complex optical function

In a study recently published in *Nature Photonics*, a collaboration between researchers from the Institut de la Vision and ICFO scientists Laurent Philippet, Johann Osmond, Adeel Afridi, Marc Montagut, and Bernat Molero, led by ICREA Prof. at ICFO Romain Quidant, the

researchers demonstrate an adjustable technique to manipulate light without any mechanical movement. In this approach, coined *Smartlens*, a current is passed through a well-optimized micrometer-scale resistor, and the local heating changes the optical properties of the transparent polymer plate holding the resistor. This microscale hot region is able to deviate light. Within milliseconds, a simple slab of polymer can be turned into a lens and back: small, micrometer-scale smartlenses heat up and cool down quickly and with minimal power consumption. They can even be fabricated in arrays, with several objects located at very different distances being brought into focus within the same image by activating the Smartlenses located in front of each of them, even if the scene is in colors.



Quantum Memories

Researchers led by ICREA Prof. at ICFO Hugues de Riedmatten have a double hit in *Physical Review Letters*

In the first study, researchers report the first demonstration of the generation of entanglement in time between a photon and a collective spin excitation in a rare earth ion doped ensemble.

The researchers used a memory crystal and an interferometric filter crystal (cooled at 3.5K) to generate and measure entanglement between the photon and the crystal. The crystal was able to emit a pair of entangled photons with an embedded quantum memory

for one of the photons. The quality of this entanglement was analyzed by mapping the atomic excitation onto the photonic qubit and by using time-bin qubit analyzers implemented with the atomic frequency comb technique in the other doped crystal. The quality of the entanglement proved enough to violate the Bell inequality, making the device setup suitable for quantum communication's applications.

In the second study carried out in collaboration with researchers from CNR-IFN in Milan, researchers show the first demonstration of quantum storage of a frequency-multiplexed single photon into a laser-written waveguide integrated in the same crystal structure.

The experiment consisted of two main parts: a photon-pair source and integrated quantum memory. For the photon-pair source, the researchers used a source based on cavity enhanced spontaneous down conversion to generate a heralded single photon pair compatible with the quantum memory, with a spectrum consisting of 15 discrete frequency bins. The photon was then transmitted through a SM fiber and stored into an integrated quantum memory based on a laser-written waveguide. The photon absorbed in the waveguide was mapped into a collective superposition of atomic excitations. Researchers used electro-optical modulators to store the whole spectrum of frequency-multiplexed photons, allowing them to create 15 quantum memories at different frequencies, demonstrating this technique to be suitable for storing frequency bin entanglement. Altogether, combining spectral and temporal multiplexing, the researchers were able to store 130 modes in the crystal.

Flexible, transparent and graphene enabled health monitors

Low-power wearable devices



ICFO researcher Emre Ozan Polat supervised by Dr. Stijn Goossens and ICREA Prof. at ICFO Frank Koppens published a study in *Science Advances* demonstrating

a new class of flexible and transparent wearable devices that are conformable to the skin and can provide continuous and accurate measurements of multiple human vital signs. Prototype devices are capable of monitoring heart rate, respiration

rate and blood pulse oxygenation, as well as exposure to UV radiation from the sun. ICFO's advanced light sensing technology implemented two types of nanomaterials: graphene, together with a light absorbing layer made of quantum dots. Researchers demonstrated a broad wavelength detection range with the technology, extending the functionality of the prototypes beyond the visible range. Prospects for this technology point to a scalable route for the integration of graphene-quantum-dots into fully flexible wearable circuits to enhance form, feel, durability, and performance.

HAPPENINGS

BUSINESS NEWS



Launch of the Joint Lab in Quantum Processing

ICFO and spin-off Quside Technologies team up to create a space dedicated to developing quantum processing technologies.

ICFO and Quside announce the creation of a new Joint Lab in Quantum Processing, establishing a collaborative framework to foster the development of quantum processing technologies. Ongoing research initiatives that began before Quside spun-out of ICFO in 2017 are now beginning to produce salient results, providing the impetus for this new tech transfer initiative to produce novel processing technologies that aim to accelerate computational capacity, optimizing computer power and costs. The goal of the joint lab is to use advanced quantum physics concepts and models to solve new challenging problems that have been unsolvable with current existing computers and hardware.

There is a world-wide race to harness the power of quantum physics for next generation technologies. Quside, a deep tech spin-off that incubated in ICFO's Launchpad, designs and commercializes quantum components for all connected devices. By exploiting photonics technologies and by leveraging the maturity of the semiconductor manufacturing industry, Quside develops products that offer unprecedented security and performance for cybersecurity and high-performance computing.

Director of Knowledge and Tech Transfer (KTT) at ICFO, Silvia Carrasco points out that *"the continued development and incubation of ideas with Quside has allowed us to mature this idea and launch this new joint lab which we foresee will greatly accelerate the market reach of new quantum processing solutions"*.

Upon signing the agreement, **Carlos Abellan, co-founder and CEO of Quside**, mentions that *"We are excited to partner with ICFO to accelerate the development of new quantum processing technologies that have a near-term impact"*.

The Quantum Processing Lab will operate as an incubator of ideas and will launch a series of focused projects that will combine ICFO's world-leading research expertise as well as the skills and knowledge of the Advanced Computing Team at Quside. Applications will include advances in areas such as optimization problems, drug development simulation, and artificial intelligence.

José Martínez, Director of the Advanced Computing Team at Quside and manager of the Quantum Processing Lab states that *"Building on the merger of the quantum physics and data processing fields, this lab will enable the development and advancement of new, quantum-based, data processing technologies."*

As **Director of ICFO Prof. Lluis Torner** emphasizes, *"We are thrilled with the creation of the Quantum Processing Lab in partnership with Quside. The joint lab is a consequence of the visionary ideas of the KTT and Quside leaders and it will allow the exploration of truly breakthrough concepts in quantum processing, very much in line with the ICFonian spirit."*



ICFO Director Lluis Torner and Quside co-founder and CEO Carlos Abellan



Honoring Young Entrepreneurs

AIJEC recognizes Carlos Abellan as finalist for Best New Business Initiative for Quside Technologies spin-off

The AIJEC (Association of Young Entrepreneurs of Catalonia) is a private organization, with a public, independent and non-profit vocation that has brought together thousands of young entrepreneurs under the age of 41 from all sectors since 1985 to share their concerns and experiences.

As part of their mission to support young Catalan business people, they offer an annual *Young Business Person Prize* (Premi Jove Empresari). Now in its 26th edition, this annual event recognizes the hard work and perseverance of young people who are capable of generating employment and launching business projects. In an award ceremony that took place on 2 July, the AIJEC also awarded the *Best Business Initiative Award* (Millor Iniciativa Empresarial) to ICFO spin-off company **Quside Technologies**.

Quside, founded by ICFO alumnus Carlos Abellan, develops quantum technologies for the cyber-security and super-computation worlds, bringing unprecedented security and performance to the information era. The jury cited the relevance of Quside's strides to bring quantum technologies to market. They also noted the international recognition that the young company is attracting, explicitly highlighting Carlos's inclusion in MIT's list of Innovators Under 35 in Europe in 2018.

COLLABORATION



OUTREACH

Quantum physics for everyone in CosmoCaixa

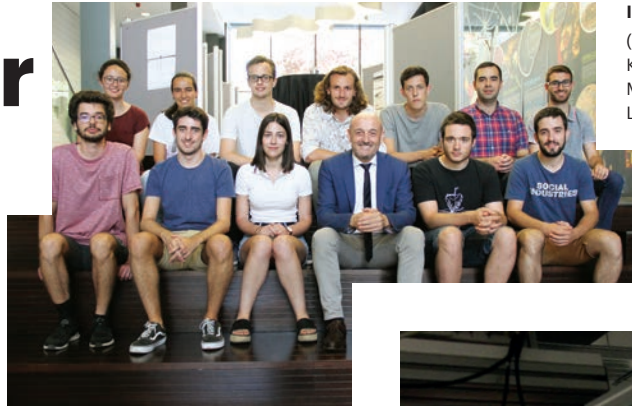
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YOUNG TALENT

ICFO Summer Fellows 2019

Now in its 14th edition, the Summer Fellows program welcomed 12 undergraduate and Master's students to ICFO to carry out challenging research projects under the supervision of a Group Leader and with the assistance of Postdocs or PhD students.

For this program, ICFO puts into motion a full series of Summer Lectures, designed to introduce newcomers to the many different research lines at ICFO, as well as lab tours and other activities, so that these young scientists can experience ICFO as a researcher.



ICFO SUMMER FELLOWS 2019 PHOTO

(Left to Right) Top row: Miren Lamaison, Laura Zarraoa, Eric Kramer, Simon Cichy, Gerardo Garcia, Santiago Valles, Adrià Marin. Bottom: Miquel Saucedo, Antoni Latorre, Elisabet Roda, Lluís Torner (ICFO Director), Guim Planella and Adrián Pinilla.



01. Simon Cichy

Ultrafast Dynamics in Quantum Solids group led by Prof. Simon Wall

The combination between the offered experience and the research topics covered at ICFO made me choose this program. Photonics is rising in importance and interest, and the opportunity to be part of a research group is not common for undergraduate students.

02. Eric Kramer

Outreach, Knowledge and Tech Transfer unit led by Dr. Silvia Carrasco

My internship at ICFO will help me to adapt more quickly to similar work environments in the future. In addition, thanks to the lab tours, I have been able to learn more about the latest advances in research both in photonics and in other fields.

03. Miren Lamaison

Nonlinear Optical Phenomena led by Prof. Juan P. Torres

Besides of all the things I have learned about the topic of my project, I have seen how real the research done at ICFO is. That has helped me to decide what do I want to do next.

04. Gerardo García

Quantum Optics Theory group led by ICREA Prof. at ICFO Maciej Lewenstein

Definitely, the best part of the program is being surrounded by people that share the same degree of scientific inquisitiveness. I am planning to do my Master's thesis with what I have learned at ICFO and it also has convinced me to pursue a career as a theoretical physicist.

05. Antoni Latorre

Quantum Nano-Optoelectronics led by ICREA Prof. at ICFO Frank Koppens

One of the highlights was learning that research in physics is not exclusive to physicists. This fellowship has helped me to build my future path in science, get experience in research, and get in touch with the hot topics in modern physics.

06. Adrián Pinilla

Organic Nanostructured Photovoltaics led by Prof. Jordi Martorell

Soon to return to ICFO as Master's Student. Surely that is a good sign!

07. Guim Planella

Quantum Information Theory group led by ICREA Prof. at ICFO Antonio Acín

What I value the most about my stay at ICFO is what I learned about the day-to-day of working in science and the patience that it requires. I realized most of the times things don't quite work as you expected, and you have to constantly come up with alternatives.

08. Adrià Marin

Quantum Information Theory group led by ICREA Prof. at ICFO Antonio Acín

I was happily surprised at how prepared everything was for our arrival. The incorporation process was extremely easy, and everything was designed so that we could start working as soon as possible.

09. Laura Zarraoa

Quantum Photonics with Solids and Atoms led by ICREA Prof. at ICFO Hugues de Riedmatten

ICFO has really cool and modern infrastructure and many resources, both for scientific research and social activities. That caused a good impression when first coming here. I have gained a lot of experience in the lab and I have met some wonderful people, from which I have learned a lot both in and outside the group.

10. Miquel Saucedo

Quantum Information Theory group led by ICREA Prof. at ICFO Antonio Acín

What stands out the most to me was the fact that I had to spend weeks working on a problem until I could find a solution, which in retrospect looked obvious. The group was very helpful, and its members were welcoming and nice, and helped me to gain more interest in physics.

11. Santiago Valles

Quantum Photonics with Solids and Atoms led by ICREA Prof. at ICFO Hugues de Riedmatten

I was surprised by the large amount of research groups and labs that there are at ICFO. I feared that I would not be able to fit in during my short stay, but in the end I felt very welcomed by my research group.

12. Elisabet Roda

Atomic Quantum Optics group led by ICREA Prof. at ICFO Morgan Mitchell

I already had a gratifying experience at ICFO, where I was mainly involved in The Big Bell Test project. Since then, I have considered this a place where I would like to enroll in a research group to broaden my education and research training. The kindness, proximity and help that group members have given me has been very important to confront and develop my project.

COLLABORATION

BEYOND ICFO

Careers in Data Science

The Beyond ICFO event is an annual opportunity for Alumni who have successfully transitioned into new roles in academia or industry to give back to ICFO, sharing their insights and advice with current ICFOnians who are contemplating career options outside ICFO.

Data Science has become a popular career choice for many ICFO alumni.

#1

Strong demand for qualified professionals

#2

Competitive Salaries

#3

High degree of reported job satisfaction



The analytical profiles of ICFO researchers are particularly well aligned with the requirements of this industry. For all of these reasons, for the third edition of the Beyond ICFO Careers event, the focus was on Data Science.

Four Alumni in different stages of the Data Science track participated in this year's round table discussion, debating topics such as training, salary and general career expectations. The panelists also fielded questions from ICFOnians. Following the panel, there was time for current ICFOnians, panelists and more visiting alumni working in Data Science to network informally over refreshments.

01. Igor Blanco. Senior Manager at KPMG Data Analytics & AI. ICFO PhD graduate (2015) in the Medical Optics group. Previous to his PhD, he worked for a decade in Ireland within the financial services sector where he held several positions in Fraud and Risk Management. He is now responsible for the KPMG Data & Analytics practice in Barcelona which is part of the Lighthouse global R&D KPMG network. *"You can be really good with your algorithm, but it is removed from reality. You must be able to envision the larger architecture. In industry you have to manage the client's expectations in a limited time."*

02. Tommaso Caneva. Senior Data Scientist at Glovo. Postdoctoral researcher (2012-2015) in the Theoretical Quantum-Nano Photonics group. A data Scientist with a PhD in Condensed Matter Physics. He worked for five years as a postdoctoral researcher before switching careers to become a Data Scientist. Before joining Glovo, he worked as a Data Scientist in KDP, a consulting company, and eDreams, an online travel agency.

"To envision yourself in the future you have to envision the technology and how it will change. And right now, there is a lot of offer in Data Science."

03. Anna Kubasiak. Cloud Solution Architect in the GBB organization at Microsoft. ICFO PhD graduate (2011) in the Quantum Optics Theory group. After earning her PhD, her passion for statistics and machine learning led her to change careers and become a data scientist. After several years developing her career across industries, she took a role at Microsoft in the Global Black Belt group where she is now leading the incubation of new AI technologies.

"With a PhD or Postdoc, you are not a beginner anymore. You are just transitioning from academia to industry, with the same set of skills."

04. Armand Niederberger. Principal Data Scientist at Noodle.ai. ICFO PhD graduate (2010) in the Quantum Optics Theory group. Armand worked as a researcher at Stanford University, The University of Strathclyde, and Hewlett Packard Laboratories before moving to industry. He led the algorithms and software team at Leia Inc, commercializing glasses-free mobile 3D technology based on diffractive gratings before moving to Noodle.ai, where he works as principal data scientist.

"Don't think about what you want to do in 10 years. Think of what you would like to play with and that will help you develop those skills and discover your strengths."

Ángel Sánchez, everis

Keynote talk



The event kicked-off with a keynote talk by Ángel Sánchez, Executive Vice President of the Space Division of everis, a consultancy company. Starting with his PhD in Quantum Optics, Ángel traced the evolution of his career and how he leveraged skills learned as a scientist to find his niche outside academia. At everis and everis family companies since 1998, Ángel's scientific background, love of entrepreneurship and technology have combined to prepare him to take on a range of roles and challenges.

Words of encouragement for ICFOnians:

"If you understand Quantum Theory, you can change fields and do whatever you want! In comparison, a venture capital fund is a game for you – you just have to learn the rules."

TRAINING

ICFO School on the Frontiers of Light

July 8-10

Attosecond science and extreme photonics

Supported by the Fundació Catalunya – La Pedrera • Ignacio Cirac Program Chair (FCLP), ICFO Schools on the Frontiers of Light aim to give talented young researchers and students worldwide an introduction to a thematic research area and a taste of an international research environment.

This year's school on **Attosecond science and extreme photonics** was co-organized by Prof. Jens Biegert, Prof. Maciej Lewenstein and Dr. Robert Sewell. It included lectures and research seminars on a wide range of cutting-edge topics terminating in a lively round table discussion with all lecturers on the future of Attosecond Science.

Thanks to generous support from the FCLP and the Optical Society of America, ICFO offered travel fellowships for talented young students to attend the school. This year we hosted 80 students from more than 20 countries world-wide, including a mix of senior researchers, post-docs, PhD students, Masters student and two brave undergraduates, who came from as far afield as Taiwan, Pakistan, India and Iran, as well as from leading European universities, and local research groups.



ICFO Schools on the Frontiers of Light

Attosecond science and extreme photonics
8-10 July 2019, Barcelona

OSA®
The Optical Society

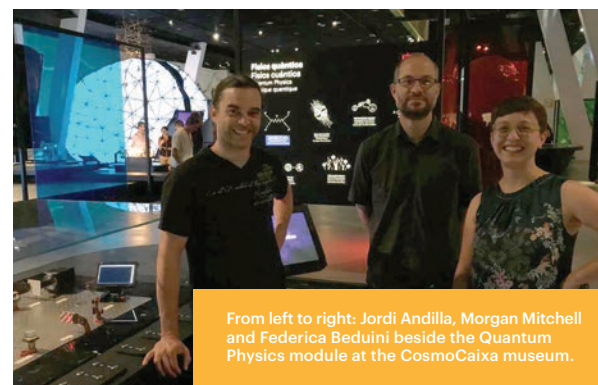
100
Since 1916

Fundació
Catalunya
La Pedrera

OUTREACH

Quantum Physics for Everyone in Cosmocaixa

ICFO collaboration helps bring quantum physics to the general public.



From left to right: Jordi Andilla, Morgan Mitchell and Federica Beduini beside the Quantum Physics module at the CosmoCaixa museum.



General view of the new exhibition space.

On July 11th, in honor of CosmoCaixa's 15th anniversary, a new permanent exhibit was unveiled at the museum- the Sala Univers (Universe Exhibit). The museum's exhibition space was completely renovated to house the most innovative interactive setups explaining the latest advances in science.

Leading international scientific institutes, including ICFO, played an important role in ensuring scientific rigor. Through an intense participation by various ICFOnians, most notably Drs. Jordi Andilla, Federica Beduini, Marta García-Matos and ICREA Prof. at ICFO Dr. Morgan Mitchell, ICFO contributed to creating, designing and technically implementing a novel, interactive quantum physics experiment that aims to bring quantum physics to life for the first time in a museum.

Contented with the outcome of the setup, **Federica Beduini, from ICFO's outreach team** notes that *"Bringing quantum physics to a science museum has been a real challenge, because quantum effects appear only at very precise conditions, not easy to reproduce outside a controlled environment of a lab."*

The result of a two year-long collaboration between ICFO and CosmoCaixa conceived by Mr Jordi Portabella, at that time CosmoCaixa Director, and ICFO's Director Prof. Lluís Torner, has ushered the creation of an interactive piece that allows visitors of the science museum to explore concepts of quantum physics, in particular "quantum superposition". By playing around with filters and obstacles, those curious minds that visit the setup can interact with a real optical setup, changing the behavior of light from a classical state to a quantum state, observing in real time the behavior of photons thanks to the help of an ultra-sensitive camera.

As researcher **Jordi Andilla** comments, *"Setting up a research instrument for a non-scientific public has*

been a very interesting challenge of synthesis, understanding and simplification. We had to provide a clear demonstration of a quite difficult concept in few steps. Nice challenges like this one, that bring science to general public, are one of the reasons for doing science".

Finally, **ICREA Prof. and Group Leader at ICFO, Dr. Morgan Mitchell** highlights that *"We wanted to make wave-particle duality, the heart of quantum physics, accessible to a non-expert public. This is a really hard challenge. It requires a precision experiment, precise enough to make visible the interference of single photons. The museum visitor must be able to see very quickly what is going on. And it has to survive in an environment much more chaotic than a research laboratory"*

+INFO

www.cosmocaixa.es/ca/museu-ciencia-barcelona

YOUNT TALENT

The Next Generation of Scientists

ICFO offers scientifically inclined high-school students a wealth of opportunities to indulge their appetite for scientific discovery.

Fundació Catalunya La Pedrera

PROGRAMA JOVES I CIÈNCIA

Three students visited ICFO for two weeks in the Low-Dimensional Quantum Materials and Quantum Optics Theory groups as part of the E2C3- Centre Recerca program, supported by Fundació Catalunya-la Pedrera.

jovesiencia.cat

ACER^{RJ}

Two winners of the Extraordinary High-School Prize offered by ACER, the Catalan Association of Research Centers, visited the Organic Nanostructured Photovoltaics group to work on the project "Sunlight energy conversion into electrical energy using transparent devices."

www.acer-catalunya.org

CiMs+CELLEX

As part of the CiMs+CELLEX program, 3 CiMs+Cellex students came to ICFO to work on projects within the Quantum Information Theory and Quantum Optics Theory groups.

www.cims-cellex.cat

BIYSC Barcelona International Youth Science Challenge

Participants in the international summer science program organized by Fundació Catalunya - La Pedrera were guided by researchers of the Quantum Photonics with Solids and Atoms, Quantum Optics Theory and Nanophotonics Theory groups to discover the secrets of quantum cryptography.

www.biyisc.org

Generalitat de Catalunya

Two students from the La Salle institute of Manlleu completed their high school research project at ICFO through the Generalitat's Technology and Mathematics (CTM) program.

PEOPLE

IN FOCUS



Women for Africa Foundation at ICFO

Contributing to sustainable development in Africa through the drive of female scientists like Dr. Latifa Guesmi

ICFO participates for the fourth consecutive year in the Science by Women program, sharing our knowledge and facilities, while benefiting from the expertise and perspectives of a visiting senior researcher in the ICFO community.

The Women for Africa Foundation's (Fundación Mujeres por Africa) mission is to contribute to sustainable development in Africa through the drive of female scientists. Thanks to the foundation's fellowship program which this year has also received the support of the CLH group, ICFO has the privilege of welcoming Tunisian scientist **Prof. Latifa Guesmi** to our institute for a six-month sabbatical. While ICFO will enjoy the benefits of her expertise, the foundation also hopes to make her achievements in the international scientific community more visible, and thus, promote African women's access to research activities.

Dr. Latifa Guesmi
Doctor of Information and Telecommunications Technologies from the University of Carthage

Research Interests

Her research focuses on the development of efficient modulation format recognition (MFR) and optical performance monitoring (OPM) techniques for the next generation optical networks. For better quality of transmission, adaptive impairments compensation and efficient system management, OPM and MFR are essential at the intermediate network nodes.

Work at ICFO

Dr. Guesmi will work on the development of monitoring techniques for quantum communications based on nonlinear optics with recognition techniques in the Optoelectronics research group led by ICREA Prof. at ICFO Valerio Pruneri.

*"In its latest report **Women and Science**, UNESCO ranked Tunisian women among the best in the world in terms of scientific research."*

What inspired you to pursue a career in science?

Dr. Latifa Guesmi I have loved science since primary school, and at the university I could not imagine a career that was not in science. I decided to focus on networks and telecommunications, the subject that I most enjoyed in my studies. I was lucky to have teachers that inspired me and really believed in my ability to excel as a scientist.

What motivated you to participate in the Visiting Senior Research Fellowships program?

LG: Complex management is essential to dealing with today's fastest standardized Ethernet rates with the increasing requirements for higher bandwidth. In order to study this, I needed to be able to perform experiments on my project in a well-equipped laboratory like the ones here at ICFO. That was my main motivation for participating in this fellowship program. This is a good opportunity for me to gain excellent laboratory experience, which is good for my career.

Were there obstacles that you had to overcome to launch your career in science?

LG: The most common problem that researchers face in launching their careers is the lack of support and funding programs, and also the absence of equipped research laboratories. I have been able to participate in some scientific training related to my research topics to alleviate this problem.

What issues remain in Tunisia to increase the impact of its scientists and how can programs like the Women for Africa Foundation help?

LG: In its latest report *Women and Science*, UNESCO ranked Tunisian women among the best in the world in terms of scientific research. Women for Africa Foundation is of great importance to help scientific women in Tunisia to pursue their careers in the best research centres at Spain.

What are your first impressions of ICFO?

LG: ICFO is a well-organized research centre where I found a team who work daily to anticipate and meet the needs of researchers. It offers a good environment to work and share ideas with many researchers from around the world.

+INFO
www.mujeresporafrica.es

FUNDACIÓN
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GO & FLY

196 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.



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July 2, 2019

OZLEM YAVAS

"On-Chip Biosensing Platforms based on Gold and Silicon Optical Nano-Resonators"

TD: ICREA Prof. Dr. Romain Quidant and Dr. Vanesa Sanz



194

July 3, 2019

ALESSANDRO SERI

"A Multimode Solid-State Quantum Memory for Single Photons"

TD: ICREA Prof. Hugues de Riedmatten and Dr. Margherita Mazzera



195

July 11, 2019

RENWEN YU

"Toward Next-Generation Nanophotonic Devices"

TD: ICREA Prof. Dr. Javier García de Abajo



196

September 6, 2019

Alexander Block

"Quantifying Nanoscale Carrier Diffusion with Ultrafast Optical and Photocurrent Microscopy"

TD: ICREA Prof. Dr. Niek van Hulst

IN MEMORY



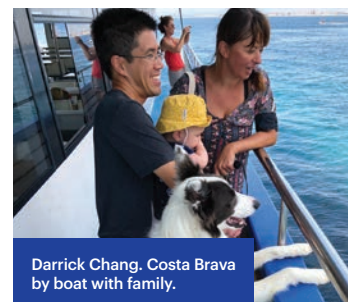
ICFOnians celebrate the life of our friend and fellow ICFonian Dani Infante who lost his brave battle with Ewing sarcoma on July 25, 2019.
#TodosSomosDani

COMMUNITY PICTURES



During the summer months, many ICFOnians hit the road to recharge their batteries. Adventure, relaxation, sports, culture and site seeing- you name it, we did it!

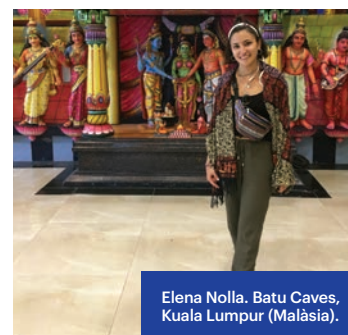
Anne Gstöttner. Ireland with changing weather and family.



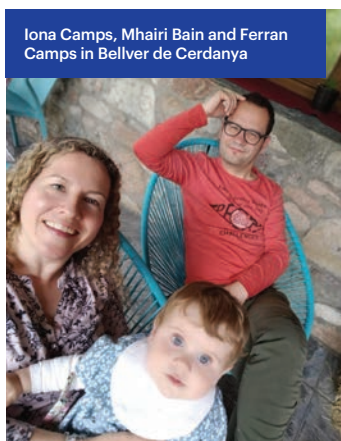
Darrick Chang. Costa Brava by boat with family.



Niels Hesp and Suchi Gupta, conquering the High Tatras in Slovakia.



Elena Nolla. Batu Caves, Kuala Lumpur (Malasia).



Iona Camps, Mhairi Bain and Ferran Camps in Bellver de Cerdanya



Anita Kosmalka and her son Joan in Japan, wearing a traditional yukata.



Cycling through Catalunya and carrying tents and musical instruments to play from village to village: that was Caravan project 2019 ! Initiated and animated by some ICFOnians: Antoine, Eric, Fabien, James, Sandra and Lisa. @elcaravanproject

Mystery ICFonian

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

ICFOnians are a fascinating group, with hobbies, interests and talents that may surprise you. Have a look around and see if you can guess who this edition's Mystery ICFonian is! Look for the answer in the next edition of ICFOnians.

1. He gets on his mountain bike religiously every Sunday morning.
2. He used to brew (and drink!) his own beer.
3. He is a big gardening enthusiast in his free time
4. He is a veteran ICFonian
5. He loves spicy food!

THE LAST WORD

HIGH PROFILE

Joaquim Boixareu

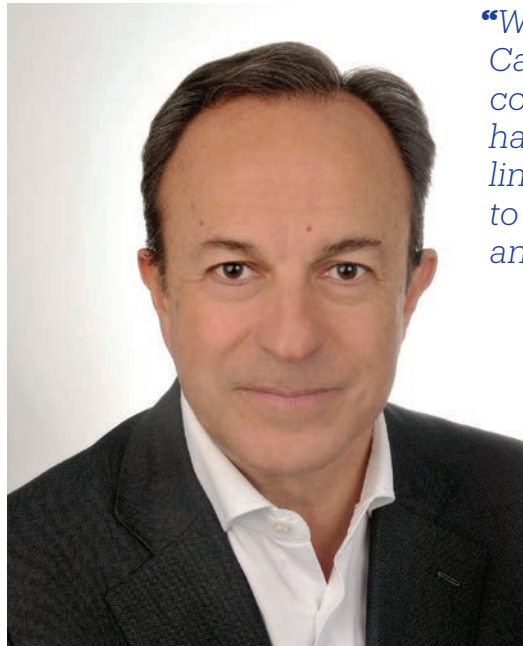
Chairman and CEO of IRESTAL group and one of leading founders of the FemCat business association

What role does industry have in supporting a strong culture of innovation in society?

Society has improved over the years thanks to industrialization which is simply innovation implemented in industrial activities, from the artisans to the factories and robots, and beyond. The growth of economies is inextricably linked to technology and industrialization, which was perfectly illustrated by the shifting distribution of GDP when the industrial revolution allowed Europe and the US to overtake China and India between the early 19th and mid-20th centuries. By 2050, as China and India become increasingly industrialized, their percentage of GDP is projected to once again overtake that of Europe and the USA. Industry is the base of value added and productivity increase. What does industry represent for society? Everything!

What was your motivation to lead the foundation of the FemCat business association back in 2005?

I reached a point in my career when I realized that my professional activity was important but that I also wanted to make some additional contribution to society. This was the basic motivation when, together with a group of business leaders in Catalonia, we founded FemCat. FemCat aims to make Catalonia one of the most developed countries in the world. I was the first chairperson but many others have come after and now this shared mission connects more than 100 business leaders from many different industries and sectors of the economy. This is not a networking association but rather a group of business people dedicated to FemCat's mission.



“We all agreed that to make Catalonia one of the leading countries in the world, we should have frontier research centers in line with what ICFO was working to create. That is why we like ICFO and support it as much as we can.”

Your support of ICFO over the years has been extremely important for the institute. What is it that motivated you to help us?

I was first introduced to ICFO through a very good friend, Professor Andreu Mas-Colell, who has played a crucial role in the current strength of the Catalan research system, and I first visited with FemCat's Vice-Chairman, Albert Esteve, Chairman of Esteve pharmaceutical group. ICFO was already becoming a reference in its field and ICFO's Director Lluís Torner helped us to see all the extraordinary developments that the institute was starting to achieve. We were convinced that this was a very good project to support so we took the opportunity to introduce the chairman and founder of Cellex Foundation, Dr. Pere Mir, to ICFO. We all agreed that to make Catalonia one of the leading countries in the world, we should have frontier research centers in line with what ICFO was working to create. That is why we like ICFO and support it as much as we can.

What are your main professional passions?

My passion for Industry came from my father- I was born in a stainless steel pressure cooker! My second passion, for research, started about 12 years ago, through FemCat, when I was involved in the renewal of the board of trustees of the Catalan Universities. This led to my becoming Chairman of the Board of Trustees of the UPC (Universitat Politècnica de Catalunya), where I was intensively involved for 5 years. Although I do not come from a scientific background, I contracted the “virus” of research and realized how important it is for a nation like Catalonia. All the leading countries in the world are very much involved in research activities in different fields. If we want to be one of them, we have to push for research.

What is your advice to young ICFOians considering a career in industry?

Of course, knowledge is important, but even more important is a proactive attitude with positive thinking. Life is full of problems. If you have a positive attitude, you can become part of the solution. Something else that is very important is a consistent and long-term commitment to the company and the industry. This is in the mission statement and foundation of FemCat. Short-term evaluations do not allow you to see the returns of investments like those made in research or industry.

Science Quiz

New Twists on Twisted Light

ICFOians recently reported two new inventions combining light and helices:

Tunable vector-vortex beam optical parametric oscillator, Varun Sharma, S. Chaitanya Kumar, A. Aadhi, H. Ye, G. K. Samanta & M. Ebrahim-Zadeh, Scientific Reports (July 2019)

Robust Ultrashort Light Bullets in Strongly Twisted Waveguide Arrays, Carles Milián, Yaroslav V. Kartashov and Lluís Torner, Phys. Rev. Lett. (September 2019)

1 What is a light bullet?

- A) A high-speed train made from carbon-fiber materials.
- B) A persistent 3D optical soliton.
- C) An optical pulse with enough energy to pierce 100 μm steel.

2 How does twisting help stabilize light bullets?

- A) Centrifugal forces
- B) Circular birefringence
- C) Topological protection

* Find answers on pg. 2

3 What describes a vector vortex beam?

- A) The central phase singularity is replaced by a topological singularity.
- B) The phase front and the polarization both spiral around the beam axis.
- C) Like a Sharknado, but with mosquitos.

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