

## HAPPENINGS

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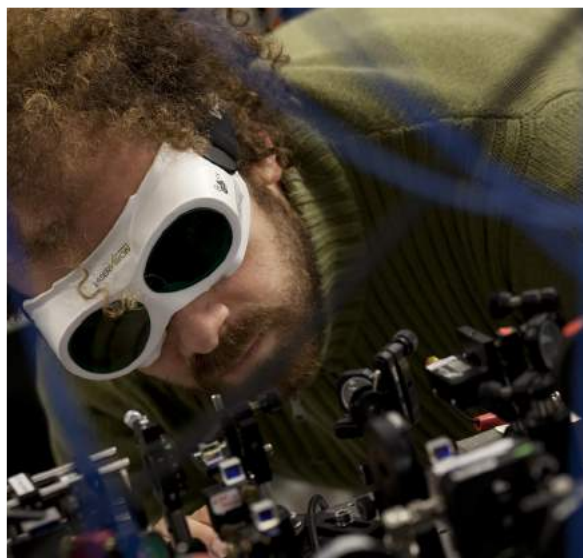
## THE LAST WORD

Interview with William D. Phillips

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# ICFONIANS 37

Community News Fall 2018



## A Home for Curious Minds

creating, exploring  
and advancing

## EDITOR'S CORNER

**Brook Hardwick**  
Coordinating  
Editor



# Stay Curious

What does it take to build  
a successful career in science?

"I believe that people are born curious and society or our educational system tends to squeeze that curiosity out of them", mused Bill Phillips in our interview for the High Profile section of this edition. The scientific enterprise is lucky to have Bill Phillips as an ambassador, having assumed a responsibility for science advocacy along with his 1997 Nobel Prize in Physics.

He and a host of inspired teachers, museums, researchers and outreach professionals, including members of the ICFO community, dedicate a great deal of time and energy to cultivating the curiosity of young people. They aim to play a role in a solid scientific education, and hope that some of the most outstanding students may find the inspiration to take their inquisitiveness to the next level, entering into successful careers in science.

Many years ago as I was settling into ICFO, a Group Leader told me "You won't find people at ICFO who did not like school. ICFOnians like to learn". I now recognize that this is just one of the traits that distinguishes a person that chooses to embark on a scientific career. I have observed that ICFO researchers tend to nurture a strong and persevering curiosity for just about everything, a general enthusiasm for a challenge, a growth mindset that keeps them open to new ideas, and of course, the capacity for hard work. These propensities seem to be prerequisites for a career in research.

In this issue of *ICFOnians*, we look at budding scientists as they contemplate joining the scientific enter-

prise. To test the waters, many young students forego typical beach holidays to spend a portion or all of their summer vacation in a research group at ICFO. Outstanding high school students join the institute for a few weeks of introductory activities, while university undergraduates and Master's students visit for longer stays as part of a formal internship program, participating in frontier research projects and gaining solid research experience.

Further contemplating the academic pipeline in this edition, we take an in-depth look at the PhD experience. "It always looks impossible until it is done", advertises Nelson Mandela in the ICFO reception area. It is almost as if he is speaking directly to the PhD students as they struggle through the trials of the highest academic degree. The PhD experience is a formative one that provides scientific training as well as a full skill set for project management, teamwork, and written and oral communication. The challenge does not end with a successful thesis defense however. As we learned in the BEYOND ICFO Panel with Alumni who have achieved Junior PI positions, advancing up the career ladder in academia has many rewards but also requires hard work and sacrifice.

This edition's focus on academia is well timed, coinciding with the "New Year's Resolutions" that abound with the start of the new academic year. Following the advice of Bill Phillips, one of my (many) resolutions and I hope yours as well, is to stay curious!

## Mystery ICFonian

Solution Ed #36

## Noelia Cuesta

Post-Award Management, Projects Unit

## Science Quiz

Answers from p.12

## 1. A 2. D

3. Solar energy

## COVER



When curious young minds are brought together in an environment that encourages creativity and exploration, the stage is set for scientific advancement. ICFO's founding mission

was to develop the careers of PhD students and postdoctoral researchers and over the past sixteen years, has expanded opportunities to undergraduate and Masters students as well as high schoolers in Summer Science programs.

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# HAPPENINGS



**BUSINESS NEWS**  
3D Printing Advances

p.6

**ICFO NEWCOMERS**

## Welcome to ICFO

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



**Gustavo Castro Olvera**  
Postdoctoral Researcher



**Iacopo Torre**  
Postdoctoral Researcher



**Shaween Tosifian**  
Student



**Alba M. Damián**  
Student



**Albert Edo**  
Student



**Teo Gil**  
Student



**Bernat Molero**  
Student



**María Pedrosa**  
Student



**Renzo Bruera**  
Student



**Pablo Oscar Vaccaro**  
Nanophotonics Engineer



**Daniel Allepuz**  
Student



**Beatriu Domingo**  
Student



**Daniel Martínez**  
PhD Student



**Robert Moszynski**  
Visiting Scientist



**Shengtai Shi**  
Research Engineer



**Alba Torras**  
Student



**Mónica Marro**  
SLN Engineer



**Pau Farrera**  
Postdoctoral Researcher



**Yongjie Wang**  
PhD Student



**Baldo Luís Najera**  
Student



**Jessica Angulo Capel**  
Student



**Ipsita Das**  
PhD Student



**Justyna Stefaniak**  
Student



**Hamidreza Fayaz M.**  
PhD Student



**Loïc Reymond**  
Visiting PhD Student



**Matz Liebel**  
Research Fellow



**Chandan Samanta**  
Postdoctoral Researcher



**Hung-Wei Sun**  
PhD Student



**Natalia Alves**  
PhD Student



**Helena Villuendas**  
PhD Student



**Shanti Maria Liga**  
PhD Student



**Martina Mocera**  
PhD Student



**Javier Argüello**  
PhD Student



**Georgios Mouloudakis**  
PhD Student



**Sebastian Etcheverry**  
Visiting Scientist



**Varun Sharma**  
Visiting PhD Student



**Eliza Cornell**  
Student



**Francisco G. Bernal**  
Student



**Rodrigo I. Becerra**  
Student



**Joana Fraxanet**  
Student



**Lorenzo Orsini**  
Student



**Umut Karadeniz**  
Student



**Tiago Bezerra**  
Visiting PhD Student



**Iris Ruider**  
Student



**Oumaima Sliti**  
Postdoctoral Researcher



**Judith Salvador**  
Projects Unit



**Sara González Bolívar**  
Student



**Petr Stepanov**  
Postdoctoral Researcher



**Mariona Moreno**  
Visiting scientist



**Aykut Eken**  
Visiting Scientist



**Juan Manuel García**  
Visiting PhD Student



**Guillem Megias**  
Student



**Alberto Picinardi**  
Visiting Scientist



**Luca Bolzonello**  
Postdoctoral Researcher



**Ilaria Mannelli**  
Research Engineer



**Peter Kilbride**  
Visiting scientist

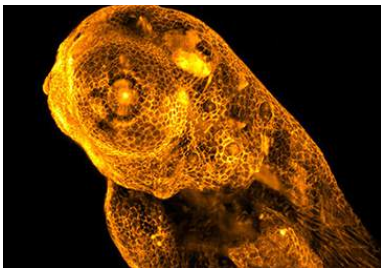


**David Plankensteiner**  
Visiting Phd Student

## HAPPENINGS

## ICFO NEWS

## European Recognition for Euro-Biolmaging



Following a two-year evaluation process by a panel of international experts, the European Strategy Forum on Research Infrastructures (ESFRI) has granted Euro-Biolmaging the Landmark status of "European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences" (EuBI). This status is recognized by the European Commission as a benchmark for quality, and signals that Euro-Biolmaging is the "go-to" Research Infrastructure to support imaging research across Europe.

The Super resolution Light microscopy and Nanoscopy (SLN) facility at ICFO participates in the Euro-Biolmaging infrastructure through the Super Resolution Node Barcelona located both at ICFO and at CRG and through the Mesoscopic Imaging Node Barcelona located at CRG, IRB and ICFO.

## The Graphene Flagship Enters New Stage



In the five years since the launch of the Graphene Flagship, its consortium has successfully completed the Core1 phase and is on its way to achieving its objective of developing the high potential of graphene and related 2D materials to the point of having a dramatic impact on multiple industries.

As the Flagship heads into the Core2 phase, a number of Spearhead projects- application focused projects motivated by future market opportunities- are taking off. Related topics range from integration of graphene into 5G communications and the internet of things, to novel batteries, solar farming and flexible (bio)-electronics. In addition, Core2 will witness the launch of the Network of Business Developers who aim to create the network connecting the research efforts to industry. ICFO is hosting one of the business developers, who will be devoted to the portfolios of Photonics and Optoelectronics and Flexible and Wearables technologies.

## In Memory of Mrs. Núria Pàmias Gibert



**Mrs. Núria Pàmias Gibert, widow of Dr. Pere Mir Puig, passed away on August 10, 2018.** She played a key role in many activities carried out by the Cellex and Mir-Puig Foundations, where she served as VP. For over a decade, both Pere Mir and Núria Pàmias demonstrated their belief in the ICFO project through their friendship, support, and generosity, enabling ICFO to become the institute that it is today.

## Durán Farell Award 2018



UPC Professor at ICFO Jordi Martorell, leader of the Organic Nanostructured Photovoltaics research group, along with members of his group Quan Liu, Johann Toudert, Paola Mantilla, Pablo Romero and Silvia Colodrero, were honored with the UPC's Durán Farell Award for their development of Organic photovoltaic cells based on nanophotonics with record efficiency. Granted bi-annually, the award aims to encourage research of excellence through the recognition of the quality of a research work carried out during the last three years in the field of technology.

## ICFonian Wins India's SSB Prize



**Congratulations to ICFonian Dr. Aditi Sen De, one of thirteen winners of the 2018 Shanti Swarup Bhatnaga prize, the most coveted award in multidisciplinary science in India.**

The award is given annually for notable and outstanding research, applied or fundamental, in biology, chemistry, environmental science, engineering, mathematics, medicine and physics, aiming to recognize outstanding work of Indian scientists under the age of 45 in science and technology.

Dr. Sen De, a member of ICFO's Alumni Network, was a postdoctoral researcher in the Quantum Optics Theory group led by ICREA Prof. at ICFO Maciej Lewenstein and is currently Associate Professors in the Physics Division of Harish-Chandra Research Institute.

## 5th Edition of Llum a les Ones



On September 28th, European Researchers' Night, science, music and literature met at the CCCB for the Grand Finale of the 5th edition of the unique Llum a les Ones '18 (Light on the Waves) contest.

This year's edition, organized in collaboration with CCCB Educació and the Magazine Principia, encouraged participants to write about climate change. A jury including Miquel Barceló, Sonia Fernandez Vidal, Xavier Duran, and Toni Pou selected the winning texts from more than 75 short stories and poems submitted to the contest. The winning texts were performed as lyrics to songs that were composed by local musicians. Alternating with the songs, researchers from Catalan centers offered short scientific talks about different aspects of climate change.

## First BIST MMRES Graduating Students



**The BIST-UPF Master of Multidisciplinary Research in Experimental Sciences (MMRES) launched in 2017 as the only one of its kind in Spain.** Now the 14 students of its inaugural class have graduated and a new group of 27 students has begun the second edition of the program. Many of the graduating students have already begun a PhD program either at one of the BIST centers, or at universities and institutes around the world, while others will begin research positions or follow other paths.



## LATEST ADVANCES

## The Quantum Technologies Roadmap

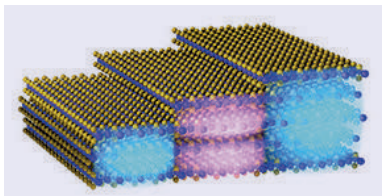
European experts publish an overview of the status of QT today, its main challenges and how science and technology will provide solutions



Rapid growth in the area of quantum technologies has been possible thanks to a well-aligned global research community that holds a common understanding of the challenges and opportunities that these technologies present. The European Quantum Physics community including ICREA Professors at ICFO Antonio Acín and Maciej Lewenstein has elaborated a *Quantum Technologies Roadmap* aimed to put into perspective the status, the needs and possible future solutions. A summarized version was recently published

in the *New Journal of Physics*. The content is divided into four main domains: quantum communication, quantum computing, quantum simulation and quantum sensing and metrology, plus two sections on quantum theory and software and quantum control, which are transversal to the four domains previously mentioned.

Although this roadmap is based on European coordinated efforts and all authors are Europeans, the scientific and technological status as well as the challenges and required advancement described in this roadmap are not perceived by the authors as specific to Europe, but global to the field of QT.

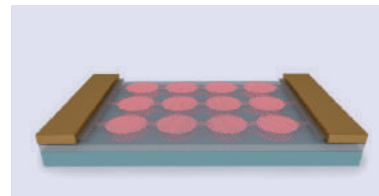


## Nano-imaging of intersubband transitions in few-layer 2D materials

Experimental observations were complemented and supported with detailed theoretical calculations revealing many-body and non-local effects

ICFO researchers Peter Schmidt, Fabien Violla, Mathieu Massicotte, Klaas-Jan Tielrooij, Gabriele Navickaite, led by ICREA Prof. at ICFO Frank Koppens,

in collaboration with the Institut Lumière Matière - CNRS, Technical University of Denmark, Max Planck Institute for the Structure and Dynamics of Matter, CIC nanoGUNE, and the National Graphene Institute have published a new report in *Nature Nanotechnology* presenting results that make strides in opening an unexplored field in 2D-materials. The researchers offer a first glimpse of the physics and technology enabled by intersubband transitions in 2D materials, such as infrared detectors, sources, and lasers with the potential for compact integration with Si CMOS. In their experiment, researchers applied scattering scanning near-field optical microscopy (s-SNOM) as an innovative approach for spectral absorption measurements with a spatial resolution below 20 nm. They exfoliated transition metal Dichalcogenides (TMDs), which comprised terraces of different layer thicknesses over lateral sizes of about a few micrometers. They directly observed the inter-sub-band resonances for these different quantum well thicknesses within a single device. They also electrostatically tuned the charge carrier density and demonstrated inter-sub-band absorption in both the valence and conduction band.

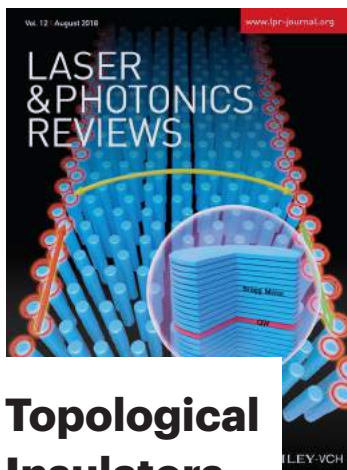


## Graphene as an infrared detector

Researchers efficiently detect mid-infrared light at room temperature and convert it into electricity

Detecting infrared light is of major importance for current applications in spectroscopy, materials processing, chemical, bio-molecular and environmental sensing, security and industry. To date, temperature

limitation has posed major drawbacks for the creation of detectors integrated in devices for consumer products. In a recent study published in *Nature Materials*, ICFO researcher Renwen Yu, led by ICREA Prof. at ICFO Javier García de Abajo, in collaboration with Prof. Fengnian Xia's group Yale University, have demonstrated that graphene can be used to fabricate very efficient mid-infrared detectors operating at room temperature. In their study, the team of researchers fabricated a device on a CVD graphene wafer composed of graphene-disk plasmonic resonators connected by quasi-1D graphene nanoribbons. Shining mid-infrared light (12.2 μm wavelength) onto the setup, they observed the excitation and high room-temperature absorption of IR plasmons on the surface. They also observed that, thanks to the graphene nanostructures, the absorption of light that was being converted into an electrical responsivity was strongly linked to the level of the plasmonic absorption, with response times enabling detection at GHz speeds.



## Topological Insulators

New mechanism of resonant coupling between edge states in topological insulators

In a recent paper published in *Laser and Photonics Reviews*, and selected to appear on the cover of the August issue of the journal, researchers from Xi'an Jiaotong University together with ICFO researchers Dr. Yaroslav V. Kartashov and UPC Prof. and Director of ICFO Lluís Torner, have reported on the existence of a physical mechanism that allows to resonantly couple topological excitations propagating at the opposite edges of polariton topological insulator built as honeycomb arrays of microcavity pillars. This mechanism uses weak periodic temporal modulations of parameters of microcavity pillars that leads to resonant switching between topological states with the same Bloch momentum, but located at the opposite edges. The proposed coupling mechanism based on topologically protected states can be used in various topological photonic and condensed matter systems, including Floquet insulators, gyromagnetic photonic crystals, semiconductor quantum wells, arrays of coupled resonators, and many others.

## Quantum Storage

Results of study show the promise of fabricated systems to effectively fulfil the requirements for efficient and scalable integrated quantum storage devices

ICFO researchers Alessandro Seri, Darío Lago-Rivera, and Dr. Andreas Lenhard, led by Dr. Margherita Mazzera and ICREA Prof. at ICFO Hugues de Ried-

matten, in collaboration with Dr. Giacomo Corrielli and Dr. Roberto Osellame from IFN-CNR in Milan, publish a study in *Optica* (cover image) that reports on the demonstration of a novel platform for quantum single-photon light storage based on laser written waveguides. In their experiment, the team fabricated waveguides in a Pr<sup>3+</sup>:Y<sub>2</sub>SiO<sub>5</sub> crystal using femtosecond laser micromachining (FLM) in a new writing regime. They showed that the fabrication of these waveguides preserves the measured spectroscopic properties of Pr<sup>3+</sup>. They implemented a quantum storage protocol for heralded single photons, demonstrating excited-state storage times 100 times longer than in previous waveguide demonstrations and with improved confining capabilities. With respect to other waveguide realization, the FLM features unique 3D fabrication capabilities. Even more, the very good matching between the waveguide mode and that of standard single-mode optical fibers enables these Pr<sup>3+</sup>:Y<sub>2</sub>SiO<sub>5</sub> samples to be adhered directly to fiber patch cords with very low coupling losses, excellent for telecommunication setups.



## HAPPENINGS

## BUSINESS NEWS



## 3D Printing Advances

### ICFO researchers overcome color limitations in 3D powder sintering

In recent years, selective powder sintering for 3D printing has taken off as an increasingly affordable solution for manufacturing made-to-order elements of almost any shape or geometry, impacting multiple sectors of industry. In a paper recently published in *NanoLetters*, ICFO researchers Alex Powell, Alexandros Stavriniadis, and Ignacio de Miguel, led by ICREA Professors at ICFO Gerasimos Konstantatos, and Romain Quidant with the collaboration of ICFO's KTT unit report on a solution for overcoming color restrictions in this method using plasmonic nanoparticles.

Selective powder sintering involves heating a bed of powder to just below its melting point, using an IR light source to selectively melt a cross section of the powder, then adding more powder and repeating to form a 3D object. To reduce costs and increase printing speed, a photothermal sensitizer, typically carbon based, is often added to the powders, and techniques using such sensitizers such as high speed sintering have demonstrated print speeds that rival small batch production via established industrial methods. However, as the sensitizers are carbon-based, these can only produce black or gray objects. To create white or colorful prints, visibly transparent equivalents are needed.

ICFO researchers have addressed this problem by designing resonant photothermal sensitizers made of plasmonic nanoparticles that strongly absorb in the near-infrared, while only minimally

These results open a new route to utilize plasmonic nanoparticles to produce colorful and functional 3D-printed objects, a key advance for any field where prints must be beautiful as well as functional.

interacting with visible light Gold nanorods were mixed with polyamide powders to create stable colorful nanocomposite powders. At resonance, these composites showed greatly improved light-to-heat conversion compared to composites using the industry standard carbon black as a sensitizer. Furthermore, they appear much whiter and can produce brightly colored 3D objects when mixed with dyes.

These results open a new route to utilize plasmonic nanoparticles to produce colorful and functional 3D-printed objects, a key advance for any field where prints must be beautiful as well as functional. This discovery has also led to the filing of several patent applications related to new technology.

## KTT IGNITE

### ICONS and ICFO's KTT unit collaborate to deliver a workshop on tech transfer and business development



ICFO's Organization and Network of Students (ICONS) and the KTT Unit collaborated to bring to life a workshop on tech transfer and business development particularly focused on the process of creating and spinning out high-growth, deep tech companies from scientific research.

The workshop, sponsored by SPIE, consisted of two sessions. The first gave a brief introduction into the techniques applied by KTT@ICFO for the incubation of entrepreneurial projects and the mentoring of the scientific teams involved. It introduced two tech-based challenges on DNA data storage and Triboelectric power generation and formed teams to work on these challenges over the week, trying to effectively turn the concept into a marketable product with a consistent business strategy.

In the second session, teams competed against each other, pitching their business plans to a jury in a grand finale. The winning team was Grain Data composed by Alex LeBon, Bárbara Buades and Marcos López.

Eighteen ICFOnians took part in this workshop with mixed background and at different career stages, from Master students to postdocs and visiting scientists. The details of the workshop were developed by Sergi Ferrando, Alastair Cunningham and KTT's director Silvia Carrasco, along with members of ICONS.

*"I firmly believe exercises like this are essential to our professional growth, by allowing us to expand our horizons and look beyond the four walls inside our labs. I hope this is just the beginning and this program continues to grow as years pass by."*

**Juan Miguel Pérez**  
Former ICONS vice-president

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# COLLABORATION



**INTERNATIONAL CONFERENCE**  
Barcelona hosts 26th International ICAP Conference

p. 8

## IN FOCUS- TRAINING

# The International PhD Program at ICFO

Earning a PhD is an important personal, professional and intellectual challenge. ICFO students describe their experiences at different moments of the program

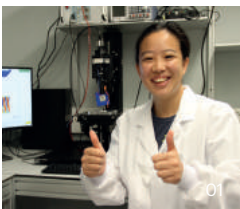
Since ICFO's founding sixteen years ago, 162 PhD students have defended their thesis at the institute. 138 PhD students are currently enrolled in the international PhD program, a number that will grow as new aspirants from the 2018 official fellowship call for PhD positions join the institute.

As we kick off the 2018-2019 academic year, *ICFOnians* takes a closer look at what it means to pursue a PhD by asking some of our current students to give us insights into their PhD experience at pivotal junctures in their studies.



ICFO aims to attract exceptional researchers to the PhD program who are motivated to work amongst the top scientists in their fields in an international research environment where traditional boundaries between fields and sectors are crossed and multidisciplinary projects undertaken.

On arrival at ICFO, PhD students are integrated into a research group from day one, and have access to cutting-edge experimental infrastructures. They receive active mentoring from ICFO Group Leaders and from Academic Programs as well as extensive administrative and technical support. The PhD program strives to significantly boost the PhD student's career perspectives and connections, enabling diverse career paths in the most important institutions worldwide in both academia and industry.



**01. Lynn Lin** (Taiwan) in the Neurophotonics and Mechanical Systems Biology research group led by Prof. Michael Krieg is a **recent arrival**.

*"I am excited about this next step towards pursuing my goal to develop my career as an engineer while immersing in Spanish culture and exploring the beautiful seaside scenery of Castelldefels."*



**02. Stella Avtzi** (Greece) in the Medical Optics research group led by Prof. Turgut Durduhan has recently **received approval for her thesis proposal**, solidifying the direction of her PhD, which will focus on assessing dementia in the elderly.

*"Going through the thesis proposal, like every important challenge, can be described as a stressful and demanding process. At the same time, it gives you the opportunity to revise what you have learned and envision the next steps, by taking into account edifying critique."*



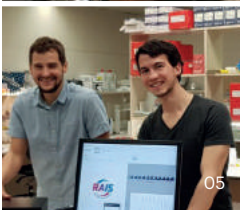
**03. Pamina Winkler** (Austria) joined the Single Molecule Biophotonics research group led by Prof. Maria Garcia-Parajo in 2015. She is steadily advancing in the study of dynamic processes in living cell membranes at ultra-small confinement volumes, but also making time to **connect with the ICFO community** through her involvement in the ICONs students network.

*"Big projects need strong teams to overcome obstacles and to achieve big goals like a PhD. The international community at ICFO is my essential motor keeping me on track in bright and dark moments."*



**04. Francesco Ricci** (Italy) started his PhD in the Plasmon Nano-Optics research group led by Prof. Romain Quidant in 2014. In the last couple of years, **he has participated in studies published in top journals** such as *Nature Nanotechnology* and *Nature Communications*.

*"A PhD is frustrating, that's for sure! But when you leave the lab at night with the data you have been working towards for weeks, perhaps months ... those moments give you sparkling vibes that make it definitely worthwhile."*



**05. Roland Terborg** (Mexico) is nearing the end of his PhD studies in the Optoelectronics research group led by Prof. Valerio Pruneri. He is now **writing his thesis** to present his research and findings, and will defend his thesis before the end of the year.

*"I developed a very simple but powerful lens-free microscope, to detect invisible objects like protein layers. There is still work to do, but the process of writing the thesis helped me to wrap-up and see the potential impact in our society. That makes you feel very good!"*

**06.** When the challenging journey is finally complete, PhD graduates are faced with the question of **"What comes next"**. **Dr. Mathieu Massicotte** (Canada) recently graduated with a thesis on "Ultrafast optoelectronics in 2D materials and their heterostructures" supervised by Prof. Frank Koppens. He is now Co-Founder and Technology lead at Edgohog, a tech start-up in Montreal.

*"My 3-step guide to job searching after a PhD. Step 1: Take some time to reflect on the next step, ideally in a calm setting such as the countryside. Step 2: Search and apply to jobs considered in step 1. Step 3: Wait for phone to ring. Repeat if necessary"*



TMD

## COLLABORATION

## INTERNATIONAL CONFERENCE

# Barcelona Hosts 26th International ICAP Conference

July 22-27

From July 22-27, Barcelona hosted the 26th International Conference on Atomic Physics (ICAP2018), the most important international conference in the field, which brought together scientists from around the world including six Nobel laureates in Physics.

## ICAP2018

Organized jointly by ICFO (Prof. Maciej Lewenstein, Chair), as well as the Universitat Autònoma de Barcelona (Prof. Verònica Ahufinger, Vice-Chair) and the University of Barcelona (Prof. Bruno Juliá-Díaz, Vice-Chair) the conference allowed participants to share results and visions about the field of atomic physics, with an emphasis on topics such as quantum computing and communication, quantum gases, atomic clocks and quantum metrology, intense fields and ultra-fast science, among other issues.

The ICAP Conference included two special events for both participants and the general public:



### NOBEL LAUREATE ROUND TABLE

Five of the six Nobel laureates participating in the conference were able to share and discuss their visions about the new trends in the field of atomic physics, the important achievements most recently obtained, as well as the discoveries that could be expected in the future.

**Panelists included:**  
**Claude Cohen-Tannoudji**  
**William D. Phillips**  
**Wolfgang Ketterle**  
**Theodor W. Hänsch**  
**Serge Haroche**



### PUBLIC LECTURE ON THE "NEW INTERNATIONAL SYSTEM OF UNITS (SI)"

Professors William Phillips (NL) and Vanderlei Bagnato offered a Master Class with content accessible to a non-specialist audience about the New SI, which will become effective in 2019. The lecture explained the meaning and importance of the changes in the definition of the kilogram, ampere, kelvin and mole and provided demonstrations on how these new definitions will be implemented.

**This lecture was presented in the framework of the Fundació Catalunya – La Pedrera • Ignacio Cirac Program Chair at ICFO as well as additional support from Cellex Foundation.**

## YOUNT TALENT

# ICFO School on the Frontiers of Light

July 2-6

## Emerging Photovoltaics

July 2-6, ICFO hosted the School on the Frontiers of Light within the framework of the Fundació Catalunya – La Pedrera • Ignacio Cirac Program Chair. The aim of this important annual summer school is to give talented young researchers and students worldwide a first introduction to a thematic research area and a taste of an international research environment.

The focus of this year's program was on Emerging Photovoltaics. Emerging solar cell technologies will play a key role in energy generation, and advanced technologies such as electrical vehicles, zero emission buildings, wearables or a new generation of smart devices. Harnessing energy from the sun is a rather complex interdisciplinary challenge that has been based on advances made both in material and photonic sciences. This course, co-organized by researchers from ICFO and ICMAB, and delivered by leading international experts, introduced the fundamentals of photovoltaic energy conversion both from an electronic as well as photonic point of view and emphasized the interplay of photonics with recombination and loss mechanisms, within the framework of the device physics for emerging



photovoltaic cells. Recent advances in specific emerging PV technologies were presented as case studies, in particular perovskite, organic and quantum dot solar cells.

These schools incorporate a dynamic and social learning environment including lectures, group discussions, direct interaction with leading scientists, poster presentations, and lab visits. Highlights this year included a round-table discussion entitled "Future Challenges of Photovoltaics", with leading industry representatives from Merck Chemicals, OPVIUS, Saul Technologies and QD Solar; and a lively discussion about Women in Science with lecturers Jenny Nelson and Maria Antonietta Loi, and special guest and SPIE President Maryellen Giger (University of Chicago).

### Invited Lecturers:

Eli Yablonovitch (University of California Berkeley); Thomas Kirchartz (University of Duisburg-Essen); Jenny Nelson (Imperial College London); Juan Bisquert (Universitat Jaume I, Castelló); Maria Antonietta Loi (University of Groningen); Gregory Kozyreff (Free University of Bruxelles).

### Local Organising Committee:

ICFO Professors Prof. Jordi Martorell, Prof. Gerasimos Konstantatos, Prof. Valerio Pruneri and Dr. Robert Sewell at ICFO, Dr. Mariano Campoy Quiles from ICMAB.

<http://frontiers.icfo.eu>



## YOUNG TALENT



## Summer Science at ICFO

### Nurturing Scientific vocations

One of ICFO's core missions is to have a formative influence on the next generation of scientists.

Throughout the year, academic programs as well as outreach events attract a steady stream of high school and undergraduate students to ICFO, offering a wide range of introductory activities as well as active internships that challenge young minds to get better understand the work carried out at the center.

During the summer months, these important visitors have a noticeable presence in our corridors and labs. ICFO offers a full series of Summer Lectures, designed to introduce newcomers to the many different lines of research at ICFO. A series of lab tours as well as projects conducted within ICFO's research groups provide the framework for these young scientists (and scientists-to be) to experience ICFO as a researcher, not just a visitor.

From June through September, we welcomed students in high schools, universities and graduate programs, sharing the excitement of the ICFO research experience.

## Summer Fellows 2018

Now in its 13th edition, the Summer Fellows program welcomed 15 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.

This program is part of ICFO's efforts to attract young top talent at an early academic career stage. It represents a unique opportunity for the fellows to collaborate in frontier research projects, to learn how these projects are conducted and to gain research experience.



#### PHOTO

(Left to Right) Top row: Joan Solà Porta, Adam Teixidó, Renzo Bruera (Outreach Summer Fellow), Beatriu Domingo, Bernat Molero, Irene Melgarejo, Teo Gil. Bottom: Piotr Węgrzyn, Alba María Damián, Albert Edo Pérez; Lluís Torner (ICFO Director), Mariona Colomer, Carlos Ramos, Jessica-Nathalia Sierra, María Pedrosa.

## High School programs

ICFO participates in a number of programs that offer high-school students their first research experience

### Fundació Catalunya La Pedrera PROGRAMA JOVES I CIÈNCIA

ICFO hosted six high school students for a one to two week stay within the E2C3-Centre Recerca program, supported by Fundació Catalunya-la Pedrera. Students worked on projects within the Theoretical Quantum-Nano Photonics group, the Quantum Optics Theory group and the Quantum Information Theory group.

[jovesiencia.cat](http://jovesiencia.cat)

### ACER<sup>R</sup>

This year, through the 4th Edition of the Extraordinary High School Prizes, the Catalan Association of Research Centers (Associació Catalana d'Entitats de Recerca - ACER) awarded three scholarships. The students worked on the project "Quantum physics" within the Quantum Information Theory group.

[www.acer-catalunya.org](http://www.acer-catalunya.org)

### CiMs + CELLEX

As part of the CiMs+CELLEX program, this year ICFO welcomed four CiMs+Cellex students who worked on projects within the Quantum Information Theory group, the Theoretical Quantum-Nano Photonics group and the Quantum Optics Theory group.

[www.cims-cellex.cat](http://www.cims-cellex.cat)

### BIYSC Barcelona International Youth Science Challenge

During ten days, ICFO welcomed ten students from around the world from BIYSC (Barcelona International Youth Science Challenge), a program organized by the Fundació Catalunya - La Pedrera. They discovered the counterintuitive world of quantum physics, guided by the researchers of the Quantum Information Theory group.

[www.biyisc.org](http://www.biyisc.org)

# PEOPLE

## BEYOND ICFO

# Careers in Academia

## The transition to PI

For many PhD students and postdoctoral researchers at ICFO and around the world, the idea of one day leading a research group represents the best of all possible professional scenarios. Aside from achieving high impact results, publishing and working very hard, what else does it take to obtain a coveted tenure-track position?

The Beyond ICFO Careers Event was launched in order to help provide productive “food for thought” to ICFOnians as they grapple with career questions. Alumni were invited to connect with current ICFOnians as they prepare to “Go and Fly”.

ICFO actively seeks to nurture an engaged Alumni Network encouraging ICFOnians to:

# #1

Return to the institute to visit with friends and colleagues

# #2

Collaborate on science

# #3

Give back to the experience of current ICFOnians



In this year's event, four alumni who have recently transitioned to PI positions talked with ICFOnians about their experiences launching their own research groups.

### 01. Jonatan Bohr Brask

Postdoctoral researcher in the Quantum Information Theory group led by ICREA Prof. at ICFO Antonio Acin (2010-2013). He is currently setting up his own group as an Associate Professor within the section for Quantum Physics and Information Technology at the Department of Physics of the Technical University of Denmark.

#### Was your network / networking important for you?

Friends in your network can help you with your applications and give you tips on how things are done. You are not completely alone.

### 02. Daan Brinks

ICFO PhD graduate 2012 in the Molecular Nanophotonics group led by ICREA Prof. at ICFO Niek van Hulst. He started his own research group at Delft University of Technology in 2017, addressing neuroscience questions through functional imaging.

#### Did you ever think of going into Industry?

I thought about going into industry. We looked into starting a company in Boston. In the end, it was important for me to be able to work on things I find important, and to be my own boss. That is possible in industry, or when starting a company, but I found it in my current academic position.

### 03. Jana Nieder

Former postdoctoral researcher in the Molecular Nanophotonics group led by ICREA Prof. at ICFO Niek van Hulst (2011-2014). In 2014 she joined INL - International Iberian Nanotechnology Laboratory in Portugal where she is now a Group Leader and Head of the Nanophotonics Department. Denmark.

#### Is publishing in glossies important for getting a PI position?

Yes. It is always the first thing that you look at, but after that, it is important to inspire with a novel and credible research program.

### 04. Agustin Mihi

Postdoctoral researcher in the Functional Optoelectronic Nanomaterials group led by ICREA Prof. at ICFO Gerasimos Konstantatos (2011-2014). In 2015 he earned an ERC Starting Grant and started his own research group at ICMAB-CSIC in Barcelona researching photonic architectures to enhance the performance of emerging optoelectronic devices.

#### When should you start to apply for PI positions?

I started applying before I was prepared. I made many mistakes but that was OK because it helped me to understand what was missing in my CV and how I could improve it.

## Eugene Polzik

### Keynote talk

In his opening words for the Beyond ICFO Careers Event, ICFO's director Lluís Torner recalled that when the institute was founded in 2002, he defined its number one mission to develop the careers of PhD students and postdoctoral researchers. With this careers event framed in terms of ICFO's original founding mission, Prof. Eugene Polzik was invited to give a keynote talk about the evolution of his academic career. Prof. Polzik is the head of the Center for Quantum Optics at the Niels Bohr Institute at the University of Copenhagen, and Distinguished Invited Professor at ICFO since 2003. He has been an outstanding advisor of the institute through the years.

With a newly minted PhD in Soviet St. Petersburg in 1980, Eugene's opportunities for continuing in science were significantly influenced by the politics of the day. He made important advances in his work at the Mining Institute in St. Petersburg (80-88) before making the difficult decision to move with his family to the United States as a political refugee. That could have been the end of a very promising academic career, but determination and persistence earned him re-entry to the upper echelons of international science with a collaboration at Cal Tech in 1990 in Jeff Kimble's newly formed research group. For the past 25+ years, he has created his own luck, working hard, following opportunities, funding and collaborations. Today he and his family have very happily settled in Denmark. Having faced adversities that few of us will have to confront in our personal or professional lives, his story gave ICFOnians with an academic vocation perspectives and inspiration for managing their careers.

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#### As a PI, are you able to achieve a life balance?

It helps to find a cost and time effective way to relax. For me it is music. Don't abandon your skill for your academic career. I invented the Polzik Index for measuring your success as a scientist:

# of Citations

(Time on a 10k run—the world record for 10k)



## GO &amp; FLY

# 162 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 24, 2018

**Shahrzad Parsa**

*"High-power fiber-laser-pumped picosecond nonlinear optical sources from the near- to mid-infrared"*

**TD: ICREA Prof. Dr. Majid Ebrahim-Zadeh and Dr. Chaitanya Kumar Suddapalli**



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July 31, 2018

**Barbara Buades**

*"Attosecond X-ray absorption fine-structure spectroscopy in condensed matter"*

**TD: ICREA Prof. Dr. Jens Biegert**



161

September 13, 2018

**Nicolas Maring**

*"Quantum Frequency Conversion for Hybrid Quantum Networks"*

**TD: ICREA Prof. Dr. Hugues de Riedmatten**



156

July 2, 2018

**Lukas Neumeier**

*"Novel Regimes of Quantum Optomechanics"*

**TD: ICREA Prof. Dr. Darrick Chang**



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July 25, 2018

**Pau Farrera**

*"A versatile source of light-matter quantum states based on laser-cooled atoms"*

**TD: ICREA Prof. Dr. Hugues de Riedmatten**



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September 6, 2018

**Simon Coop**

*"Nonlinear Behaviour of Ultracold Atoms in Optical Dipole Traps: Large atomic light Shifts, a Quantum Phase Transition, and Interaction-Dependent Dynamics"*

**TD: ICREA Prof. Dr. Morgan Mitchell**



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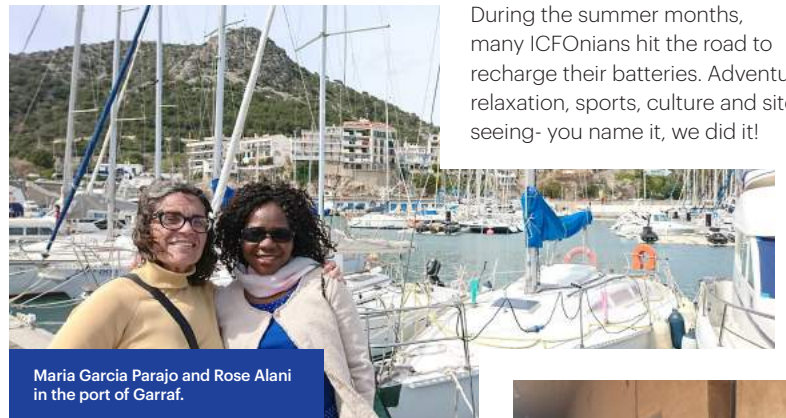
September 19, 2018

**Ivan Supic**

*"Device-Independent Certification of Quantum Resources"*

**TD: ICREA Prof. Dr. Antonio Acín**

## COMMUNITY PICTURES



Maria Garcia Parajo and Rose Alani in the port of Garraf.

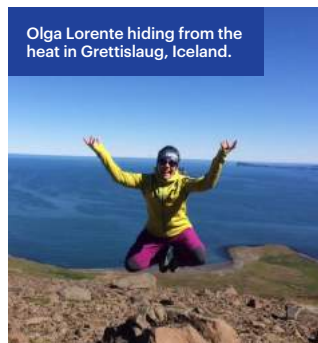
During the summer months, many ICFOnians hit the road to recharge their batteries. Adventure, relaxation, sports, culture and site seeing- you name it, we did it!



Albert Ros in Monument Valley, at the border between Utah and Arizona.



Maciej Lewenstein going into Sahara at 36°C in a 4-wheel drive.



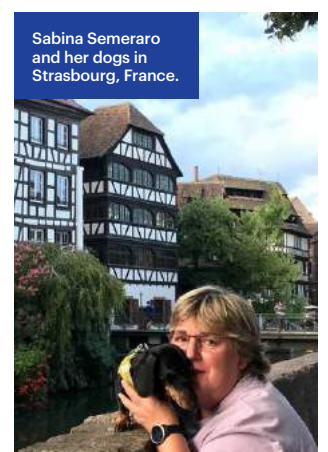
Olga Lorente hiding from the heat in Grettislaug, Iceland.



A group of ICFOnians (Antoine, Kevin, Nicolas and Simon) topped the Col d'Aubisque, France.



Luc Duempelmann, his wife Julia, with the now born Felix and their van WhiteWheely, at a beach near Valencia.



Sabina Semeraro and her dogs in Strasbourg, France.

## 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 is an incorrigible foodie with a (very) sweet tooth.
2. He has a big crush on Japanese culture
3. He is definitely a cat person.
4. His family produces wine.
5. He is a person who probably understands your brain the best!

# THE LAST WORD

HIGH PROFILE

## William D. Phillips

**Bill Phillips is a fellow of the Joint Quantum Institute, a cooperative operation of the University of Maryland and the National Institute of Standards and Technology. In 1997 he was awarded the Nobel Prize in Physics, along with Steven Chu and Claude Cohen-Tannoudji, for the development of methods to cool and trap atoms with laser light.**

**You are very active in scientific outreach through fantastic public lectures. Why is sharing science with the public important to you?**

Nurturing young people's natural excitement about science is one of the most important things that a scientist can do in order to ensure that the scientific enterprise continues. One of the things about having a Nobel Prize is that I feel that it gives me the responsibility to act as an ambassador for science, to do the things that will draw people—especially young people—to a lecture where they can get more excited about science, while at the same time engaging the general public. I have two messages. One is that science is fun. The other is that science is relevant.



*"I have two messages. One is that science is fun. The other is that science is relevant."*

**What recent scientific advances outside your field are you excited about?**

There are so many! A little bit further afield is the idea of quantum information. It was and has been one of our motivations for making atoms really cold, but now we have quantum information in other platforms- solid state platforms. Completely outside my field, there is LIGO—a new way of looking at space with gravitational waves. We all believed that there would be gravity waves, but I thought we were probably going to have to do something more to learn something new...but no! We have been learning something new from the very beginning!

**How have you managed to balance a rich personal life with the demands of a highly competitive scientific career?**

Being connected to my family is very important to me. When our daughters were young, I would always be sure to go home for dinner with the family. I would put the kids to bed, read them a story, recite poetry, say prayers ...and then I would go back to the lab! On the weekend, my wife Jane often worked and I would take the kids to children's theatre, parks, whatever. I knew that my colleagues were working all weekend and I just thought, "Well, that is the way it is going to be." I was able to achieve a balance. Everybody has to face this; you just have to decide where you are going to draw those lines. I do have hobbies. Nowadays, I am a member of a Gospel Choir at our church. We are an irreverent bunch for a choir and have a great time singing and joking around. It renews my soul in a way that is really important to me.

**What is your advice for young scientists?**

Stay curious! Obviously, you must work hard. Pay attention to writing- you need to be good at it both from the point of view of making your science useful to other people and advancing your career. One of the ways you become a good writer is by reading good writing of all kinds. Learn to craft good sentences, paragraphs, and concise arguments. Stay open minded. When I am involved in a scientific discussion, I will routinely change my mind as people in the discussion come up with good arguments against the position that I had originally taken. All the scientists I know do this. In political or religious spheres, when do we see people say, "That is a great argument. Maybe I will have to think a little more about that"? We have the experience of being open minded about science. If we were not, we would not be able to be scientists. I wish we were all as open minded in other spheres of thought.

### Science Quiz

**The Nobel Prize in Physics for 2018 was awarded to Arthur Ashkin, Gerard Mourou, and Donna Strickland "for groundbreaking inventions in the field of laser physics".**

**1) The 1985 Optics Communications article by Strickland and Mourou, in which they introduce chirped pulse amplification, was Strickland's**  
**A) first published article B) second published article**  
**C) fourth published article**

**2) Chirped pulse amplification is used for:**

- A) accelerating protons to high energy for cancer treatment**
- B) making smartphone screens**
- C) laser eye surgery**
- D) all of the above**

**3) Arthur Ashkin, at 96 years old, is the oldest Nobel to date. When asked "Are you going to celebrate?", he responded, "Well, look, I'm writing a paper now and I'm not celebrating about old stuff. I've got something new and important. I'm working on \_\_\_\_\_ and I think I've gotten some important stuff."**

**What did he say he was working on?**

\* Find answers on pg. 2

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