

HAPPENINGS

BCN City Council support for technological innovation

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COLLABORATION

NanoLight honoring Niek van Hulst

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COLLABORATION

ICFO Day

p.7

THE LAST WORD

Wolfgang Ketterle

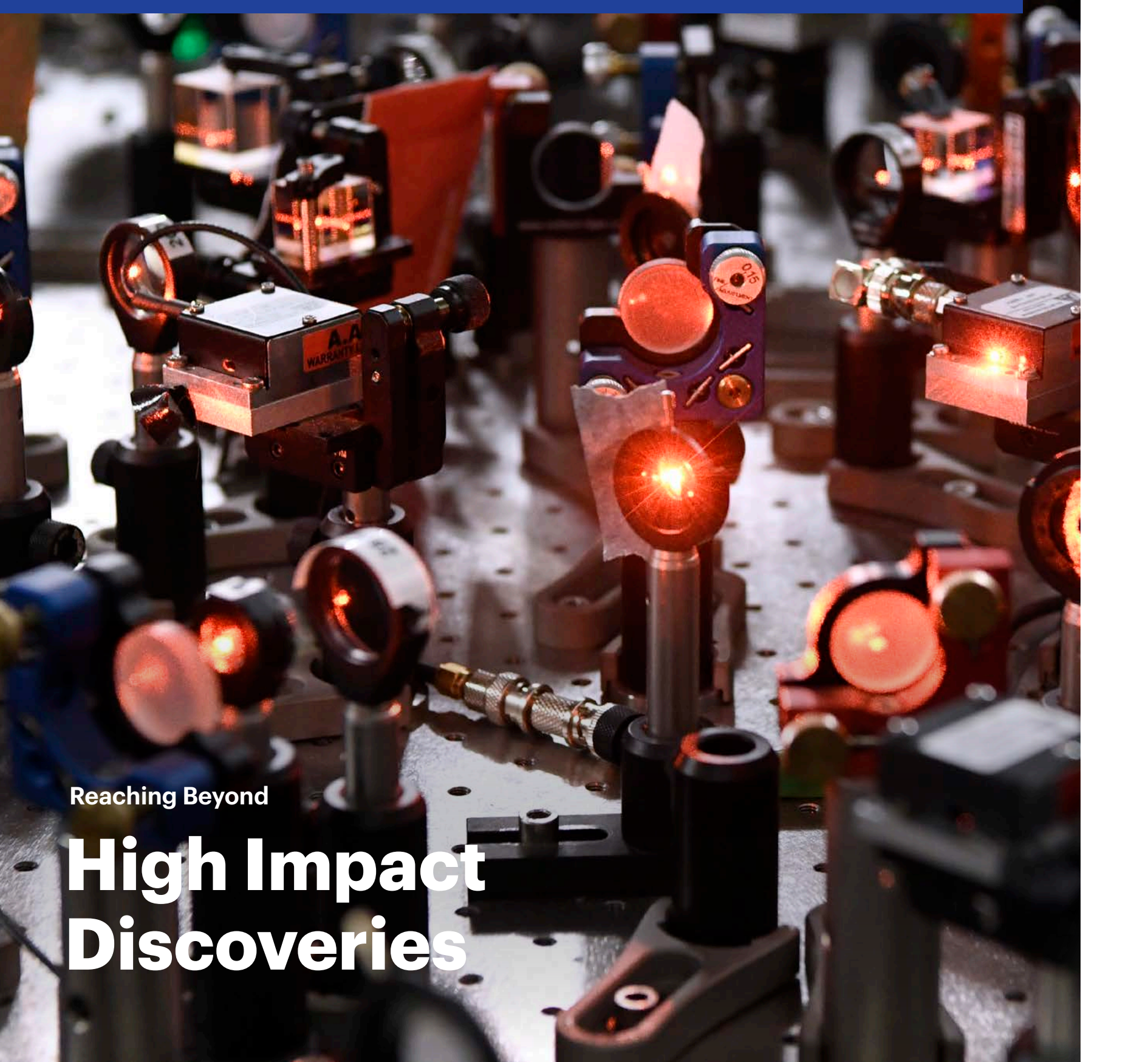
p.12

ICFONIANS 34

Community News Winter 2018

Reaching Beyond

High Impact Discoveries



EDITOR'S CORNER

Brook Hardwick
Coordinating
Editor



Raising The Bar

Definition: raising standards or expectations, especially by creating something to a higher standard.

I find myself referring to “raising the bar” quite often. This concept is built into the DNA of ICFOnians. Instead of basking in the glory of a job well done, we turn quickly to start something new, dead set on finding ways to improve, expand our reach, go further, faster... With this edition of *ICFOnians*, we head into 2018 with the aim of raising the bar even higher. In the world of science, are there any limits as to what you can achieve?

When the NEST building was under construction in 2011, it was clear that there was an important opportunity for new growth and achievement. Thanks to Fundació Mir-Puig we are once again on the verge of a new building project that will give us the space that we need so much to accomplish our goals. We will continue to improve, and those who join us will not come to maintain the status quo, but rather to be part of an institute on the rise, setting new expectations in terms of research excellence.

The bar is already quite high, with some landmark ICFO discoveries appearing in *Science*, *Nature* and other Q1 and D1 journals in the past months (p. 5), and others brewing in our labs. We continue to cheer on ICFO PhD graduates who ask original and ambitious questions, including five ICFOnians who recently defended their theses (p. 11). We highlighted the accomplishments of three PhD graduates who defended exceptional theses in 2014/2015, bestowing the ICFO PhD Thesis Awards

(p. 9). Friends, former students and collaborators gathered at ICFO for the NanoLight Symposium held in honor of the career accomplishments (to date) of our good friend and colleague Prof. Niek van Hulst who recently celebrated his 30x2 birthday. I am confident that if you ask Niek, he would assure you that we are all capable of stretching even higher and achieving even more amazing things in the years to come.

These accomplishments will not be the work of any one individual, but rather the collective effort of ICFO's management, researchers and support staff, as well as our friends and supporters who believe in the importance of frontier research in society. Recognizing the importance of a strong and supportive community in order for science to prosper, the high impact science journal *Nature* annually acknowledges lifetime and mid-career achievements for leaders in science. In December, our director, Lluís Torner, was selected from a pool of highly deserving candidates to receive the *Nature Award for Mentoring*, placing him in a very special and elite group of leaders who are “extraordinary in their ability to nurture emerging scientists of great diversity” (p. 4). There is clearly reason to believe that at ICFO, ambitious scientists will continue to find the encouragement and inspiration they need to rise to new heights.

On that note, we wish you a healthy dose of energy to help propel you towards whatever goals you set out to achieve in the year ahead.

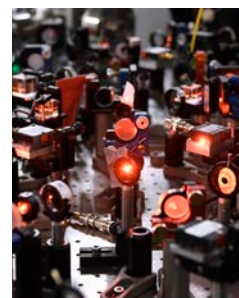
Mystery ICFonian
Solution Ed #33

Dr. Jordi Andilla
Postdoctoral
Researcher, SLN Facility

Science Quiz
Answers from p.12

1. D , 2. C, 3. Yes it's a real element. The movie was *Prometheus*.

COVER



This optical set-up is from the lab of ICREA Prof. at ICFO Dr. Hugues de Riedmatten. ICFOnians were able to visit this lab during ICFO Day, interact with members of the Quantum Photonics with Solids and Atoms

group, and learn about the first demonstration of an elementary link of a hybrid quantum information network that was recently reported on in *Nature*. (Learn more in LATEST ADVANCES on p. 5)

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Coordinating Editor
Brook Hardwick
Corporate Communications
Head

Editorial Committee
Silvia Carrasco
Knowledge & Technology
Transfer Director
Brook Hardwick
Corporate Communications
Head

Alina Hirschmann
Communications
Dolors Mateu
ICFO Manager
Laia Miralles
HR and Education Head
Morgan Mitchell
ICREA Group Leader at ICFO
Albert Ros
Alumni, Communications

Rob Sewell
Academic Programs
Coordinator

Contributors
Tomás Charles
Visual Communication
Alessio Celi
Research Fellow, Quantum
Optics
Marta Garcia Matos
Outreach, Knowledge and
Technology Transfer
Brook Hardwick
Corporate Communications
Head

Alina Hirschmann
Communications
Wolfgang Ketterle
Professor, MIT
Laia Miralles
HR and Education Head

Morgan Mitchell
ICREA Group Leader at ICFO
David Paredes
Head of Ground Segment,
Airstech Space
Albert Ros
Alumni Communications
Luis José Salazar
Operations Specialist,
Airstech Space
Lydia Sanmartí
Outreach, Knowledge and
Technology Transfer
Rob Sewell
Academic Programs
Coordinator

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HAPPENINGS



BUSINESS NEWS
Barcelona City Council Support for Technological Innovation.

p.6

ICFO NEWCOMERS

Welcome to ICFO

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



Catarina Gonçalves
PhD Student



Chung Yun Hsieh
PhD Student



M^a Monserrat Álvarez
PhD Student



Sergi Julià Farré
PhD Student



Stefano Severino
PhD Student



Eduardo Dias
PhD Student



Xinyao Liu
PhD Student



Berkay Bozok
PhD Student



Alejandro Mattar Flores
Postdoctoral Researcher



Allan Stewart Johnson
Postdoctoral Researcher



Bruno Paulillo
Postdoctoral Researcher



Hanan Herzig Sheinfux
Postdoctoral Researcher



Irénée Frérot
Postdoctoral Researcher



Juan Andrés Torreño
Postdoctoral Researcher



Kutlu Kutluer
Postdoctoral Researcher



Manish Verma
Postdoctoral Researcher



Sebastian F. Etcheverry
Postdoctoral Researcher



Seyoon Kim
Postdoctoral Researcher



Verónica Vicuña
Postdoctoral Researcher



Xiaobo Lu
Postdoctoral Researcher



Alexandra Duarte
Research Engineer



Iacopo Torre
Research Engineer



Ivan Nikitskiy
Research Engineer



Pilar Pujol Closa
Research Engineer



Rosa Anahi Higuera
Research Engineer



Adrián Gómez Sánchez
Student



Adrian Jesús Suñer
Student



Alvaro Ortega
Student



Gerard Valentí Rojas
Student



Helena Villuendas
Student



Leiza Hernández
Student



Shambhatee Annurakshita
Student



Johanna L. Figueroa
Visiting Scientist



Kasra Amini
Visiting Scientist



Saleh Rahimi Keshari
Visiting Scientist



Nicolas P. Schulthess
Management Cabinet

HAPPENINGS

ICFO NEWS

Fellow of the American Physical Society



Prof. Adrian Bachtold, leader of the Quantum NanoMechanics research group, has recently been elected a **Fellow of the American Physical Society (APS)**. The criterion for election is exceptional contributions to the physics enterprise; e.g., outstanding physics research, important applications of physics, leadership in or service to physics, or significant contributions to physics education. Fellowship is a distinct honor signifying recognition by one's professional peers.

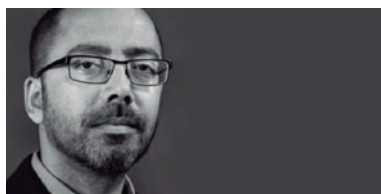
Empowering Women in Science Roundtable



At the end of November, BIST organized a round table **discussion on the topic of empowering women in science within the BIST community** in order to gain insights into the needs of the BIST research centers in terms of programs for supporting women in science as well as to learn about existing initiatives and success stories within our community. Discussion topics included leadership styles, reinforcing professional networks, balancing personal life and work, gender bias in selection processes, and barriers along the scientific career progression. The talking points will serve as starting point for developing a program to support women scientists in the BIST community.



Corning Stookey Award



The Corning Professorship and Laboratory at ICFO is a collaboration made possible by a long-standing productive relationship between **ICREA Professor at ICFO Valerio Pruneri**, and researchers at Corning. ICFO holds the Corning researchers with whom we have collaborated over the years in the highest regard. In particular, we welcome the opportunity to highlight the work of **Dr. Prantik Mazumder**, Senior Research Associate in Thin Films and Surfaces, Science and Technology at Corning Incorporated and a close collaborator within the ICFO-Corning partnership. Dr. Mazumder has been named recipient of this year's Stookey Award for outstanding exploratory research accomplishments at Corning Inc.

UPC Thesis Awards 2017



The Extraordinary PhD Awards, given annually by the Technical University of Catalonia (UPC), aim to recognize the best doctoral theses which have obtained "cum laude" in their final PhD defense evaluation. This year, the UPC announced the list of 37 awardees, which include the theses of ICFO PhD graduates **Dr. Federica Beduini**, **Dr. Juan Andrés Torreño** and **Dr. Jordi Tura** among the list of extraordinary doctoral works for the academic period 2014/2015.



Max Planck Medal



Prof. Ignacio Cirac, the head of the Theory Division and Director of the Max Planck Institute of Quantum Optics, as well as a Distinguished Invited Professor at ICFO and President of the institute's Scientific Advisory Board, was named the recipient of the Max Planck medal, the most prestigious award of the German Physical Society in the area of theoretical physics. Cirac, whose research interests range from fundamental mathematical calculations in quantum information theory, modelling of quantum many-body systems to concepts for the implementation of quantum optical systems, is recognized with this medal for his groundbreaking contributions to the field of quantum information and quantum optics.

2017 GEFES Prize for Best Experimental Thesis



The Condensed Matter Physics division of the Royal Spanish Society of Physics (GEFES) has awarded the prize for the best experimental doctoral thesis defended between August 2016 and July 2017 to **ICFO Alumnus Dr. Achim Woessner**. Dr. Woessner defended his thesis entitled "Exploring Flatland Nano-Optics with Graphene Plasmons" in May 2017. **ICREA Prof. at ICFO Frank Koppens** supervised this work, which focused on the study and understating of the fundamental properties and capabilities of graphene plasmonics for the future development of new applications.

Highly Cited Researcher



Clarivate Analytics annually produces a Highly Cited Researchers list that identifies researchers from around the world who are some of the world's most influential scientific minds. The list is compiled using indicators taken from Incites Essential Science Indicators (ESI) across 21 broad fields. The 2017 list of Highly Cited Researchers was determined by the number of papers that rank in the top 1% by citations for field and publication year in journals indexed in the Web of Science Core Collection during the 11-year period 2005-2015. **ICREA Prof. at ICFO Maciej Lewenstein** appears in this prestigious list for the field of physics for the seventh consecutive year.

Nature Mentoring Award



ICFO Director Lluís Torner was one of four scientists recognized by the international weekly journal of science *Nature*, for exemplary personal mentoring of other scientists. *Nature* has hosted these annual awards since 2005 to champion the importance of mentoring and inspiring a generation of young scientists. For the first time, the 2017 awards took place in Spain.

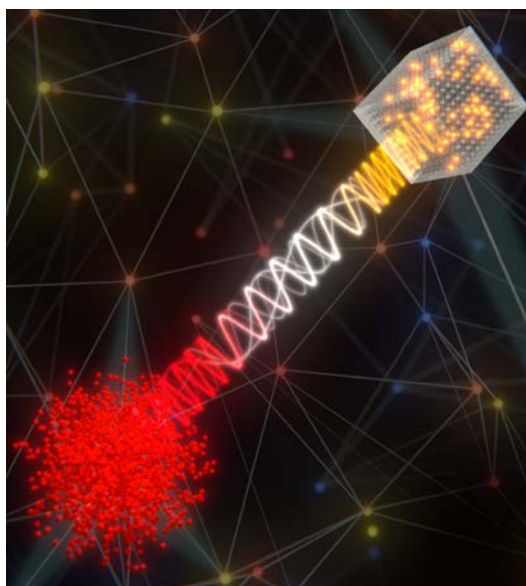
The joint recipients of the lifetime achievement award are:

- **Professor Carlos Belmonte**, founding Director of the Institute of Neuroscience of Alicante
- **Professor Margarita Salas**, former Director of the CSIC Centre for Molecular Biology Severo Ochoa in Madrid

The joint recipients of the mid-career achievement prize are:

- **Professor Carlos López-Otín**, a molecular biologist from the University of Oviedo
- **Professor Lluís Torner**, a physicist and founding director of ICFO.

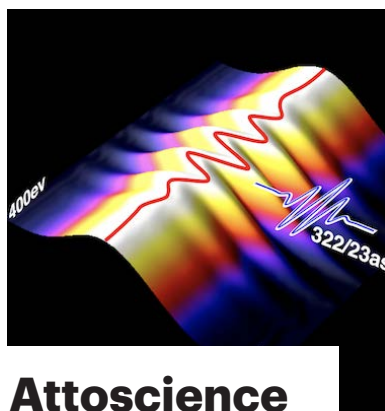
LATEST ADVANCES



Quantum Internet Goes Hybrid

Researchers report the first demonstration of an elementary link of a hybrid quantum information network, using a cold atomic cloud and a doped crystal as quantum nodes and single photons as information carriers.

In a recent study, published in *Nature*, ICFO researchers Nicolas Maring, Pau Farrera, Dr. Kutlu Kutluer, Dr. Margherita Mazzera, and Dr. Georg Heinze led by ICREA Prof. Hugues de Riedmatten, have achieved an elementary “hybrid” quantum network link and demonstrated for the first time photonic quantum communication between two very distinct quantum nodes placed in different laboratories, using a single photon as information carrier. Past studies have documented reliable transfers of quantum information between identical nodes, but this is the first time this has ever been achieved with a “hybrid” network of nodes. The ICFO researchers have been able to come up with a solution for making a hybrid quantum network work and solve the challenge of a reliable transfer of quantum states between different quantum nodes via single photons. In their study, they used two very distinct quantum nodes: the emitting node was a laser-cooled cloud of Rubidium atoms and the receiving node a crystal doped with Praseodymium ions. The results of the study have shown that two very different quantum systems can be connected and can communicate by means of a single photon. The ability to perform back- and forth-conversion of photonic qubits at the telecom C-band wavelength shows that these systems would be completely compatible with current telecom networks.

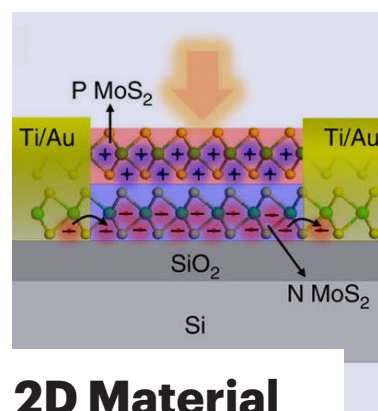


Attoscience Gets Element Specific

An ICFO study, in collaboration with researchers from Italy, Australia and Germany confirms the generation of isolated attosecond water-window XSR pulses.

In a study published in *Physics Review X*, ICFO researchers Seth L. Cousin, Nicola Di Palo, Bárbara Buades, and Stephan M. Teichmann, led by ICREA Prof. at ICFO Jens Biegert, in collaboration with researchers from Politecnico Milano, the Australian University and the University of Freiburg, have confirmed the generation of the first isolated attosecond water-window XSR pulse, setting an upper bound on the pulse duration of 322 as.

Scientists were able to measure isolated attosecond pulses in the water window soft X-ray regime, which, for the first time, combine ultrafast temporal resolution with the element selectivity of soft X-rays. They were able to generate these pulses with unprecedentedly high photon energy in the soft X-ray range up to 350 eV, sufficiently high to fully cover the K-shell absorption edge of carbon at 284 eV for spectroscopic applications. With this, it was possible to pinpoint the flow of electrons and material excitations with atomic site specificity inside a complex material.

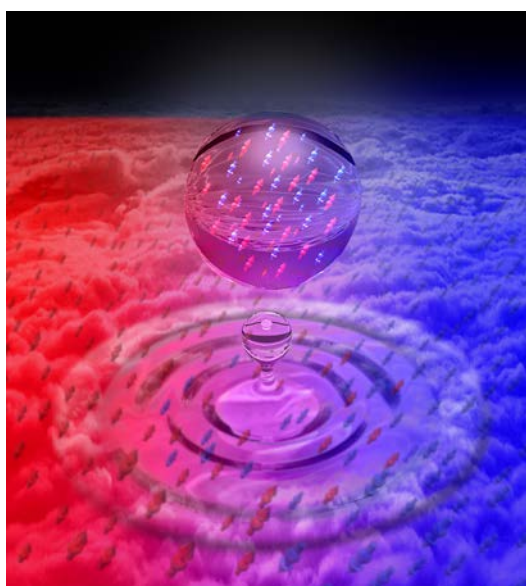


2D Material Photodetectors

A study published in *Nature Communications* reports on the development of very sensitive all-2D photodetectors.

ICFO researchers Nengjie Huo and ICREA Prof. at ICFO Gerasimos Konstantatos report on the development of an ultrasensitive two-dimensional photodetector.

To achieve such sensitivity, the team of scientists employed an in-plane phototransistor with an out-of-plane vertical MoS₂ p-n junction as a completely novel sensitive scheme. They exfoliated a few layer MoS₂ flakes on the SiO₂/Si substrate using a micromechanical exfoliation method. To fabricate the MoS₂ out-of-plane PN junction, they used AuCl₃ P-type chemical surface doping and made the bottom N-MoS₂ serve as the carrier transport channel while the top P-MoS₂ was effectively isolated from the metal contacts. This novel sensitizing scheme permitted a quantum efficiency of nearly 10%, orders of magnitude higher than prior reports in 2D based phototransistors. The results of this study paved the way towards the use of these ultra-sensitive phototransistors in other 2D semiconductors or in combination of those to facilitate sensitization, particularly those possessing low-band gap to extend the spectral coverage of the 2D materials realm.



Quantum Liquid Droplets

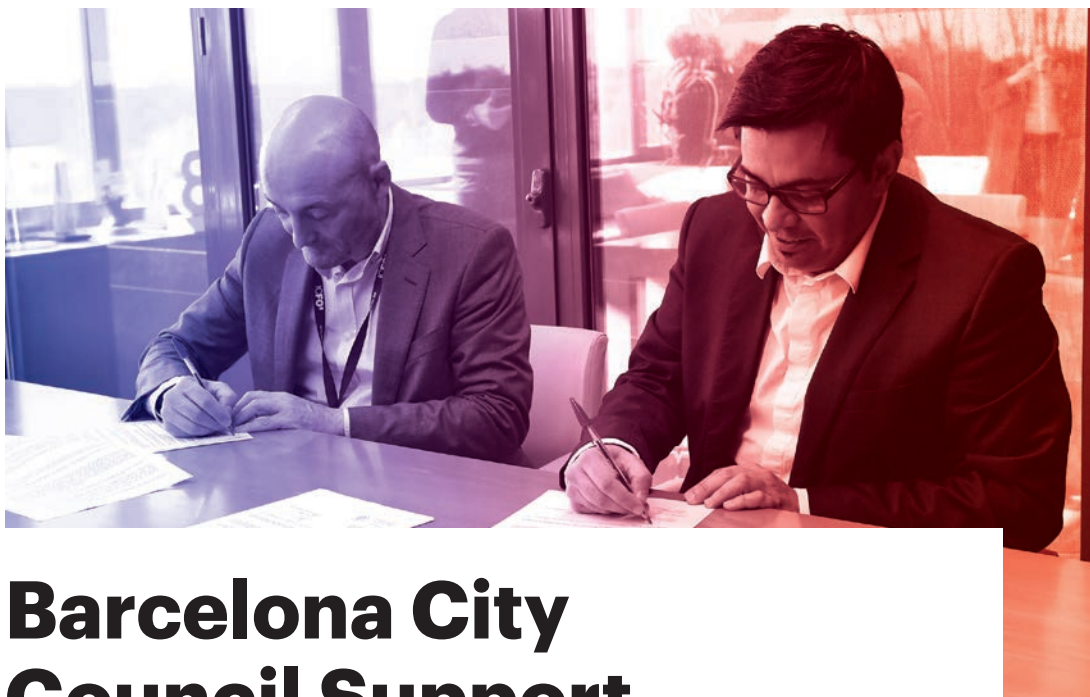
The experiments, published in *Science*, exploit a fascinating quantum effect to produce droplets of this exotic phase of matter.

ICFO researchers Cesar R. Cabrera, Dr. Luca Tanzi, Julio Sanz, Dr. Bruno Naylor, Philip Thomas, and Dr. Pierrick Cheiney, led by Cellex Nest ICFO Prof. Leticia Tarruell, have created a liquid one hundred million times more dilute than water and one million times thinner than air.

To achieve this, the team cooled down a gas of potassium atoms to -273.15 degrees Celsius, very close to absolute zero. Although at these temperatures the atoms behave as waves and follow the rules of quantum mechanics, they expand in the absence of a container. In contrast, when two of such gases are mixed together and attract each other, the atoms instead form liquid droplets. The existence of these liquid droplets is entirely due to quantum fluctuations. The unique combination of diluteness and “quantumness” makes quantum liquid droplets an ideal testing ground to better understand quantum systems made of many interacting particles, and to comprehend features they share with liquid helium, neutron stars or other complex materials.

HAPPENINGS

BUSINESS NEWS



Barcelona City Council Support for Technological Innovation

ICFO and the Barcelona City Council sign agreement in support of research benefiting Barcelona companies.

Gerardo Pisarello, First Deputy Mayor of Barcelona and Lluís Gomez, Barcelona Commissioner for economic promotion, business and innovation, visited ICFO to sign an agreement in which the city agrees to support research that will further innovation and new industrial photonics-based applications within Barcelona companies.

This agreement seeks to promote innovative ecosystems in science and technology with applications to the industrial world. Likewise, it aims to attract European funds, international activities and industrial investments in the area of graphene and quantum technologies, positioning the city among world leaders in research and economic exploitation of high-technology products based on photonics.

“It is very important for the Barcelona City Council to support these types of projects because they will reinforce the productive local ecosystem and make companies working in these areas stay in Barcelona, attracting talent from around the world.” - Gerardo Pisarello, First Deputy Mayor of Barcelona.



“This allows us to carry out research in photonics that can be applied to many fields, such as health, the environment, energy, smart cities, and other high social impact areas.”- Lluís Torner, ICFO Director

ICFO Teams Up with Accelerate Diagnostics

Signature of collaboration agreement



Lluís Torner, Director ICFO and Joan Martín, VP and Head of EMEA, Accelerate Diagnostics

ICFO and Accelerate Diagnostics, S.L. have signed an agreement establishing a framework to explore scientific and technological fields of common interest. Through this agreement, Accelerate Diagnostics, S.L. will have access to state-of-the-art Biology Lab facilities and equipment housed within ICFO for, amongst other things, quality control testing of company products and employee training.

The ICFO Biology Lab is a transversal facility that aims to provide scientific assistance and technical support for researchers' needs in biological sample handling, preparation and maintenance. The facility meets biosafety level 2 regulations and is equipped with tools and technology to facilitate research activities employing classical and next-generation microbiology, molecular biology and biochemistry techniques for *in vitro* and *in vivo* applications.

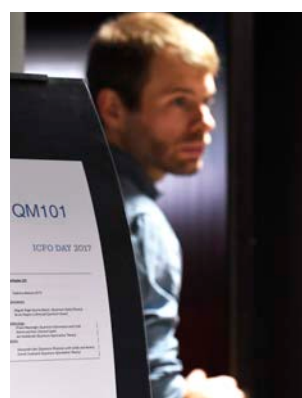
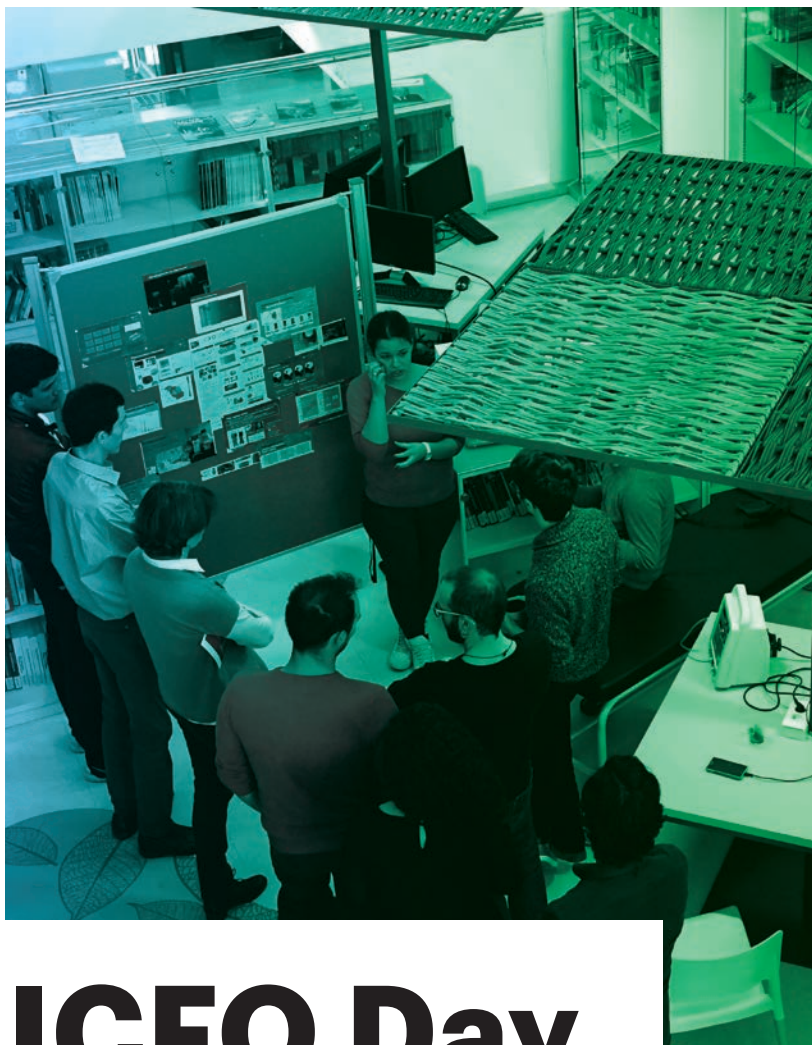
Accelerate Diagnostics, S.L. is an *in vitro* medical diagnostics company dedicated to providing solutions for the global challenge of antibiotic resistance and healthcare-associated infections. The company's parent organization, Accelerate Diagnostics, Inc. of Tucson, Arizona, USA, recently obtained FDA marketing authorization for antimicrobial susceptibility testing direct from positive blood culture samples using its Accelerate Pheno™ system and Accelerate PhenoTest™ BC kit. The system and kit leverage proprietary molecular identification methods and morphokinetic cellular analysis (MCA) to provide minimum inhibitory concentrations for a range of applicable antibiotics. The fully-automated system is designed to eliminate the lengthy culture and sample preparation steps required prior to antimicrobial susceptibility testing. Recent market studies suggest the solution offers results one to two days faster than conventional methods for analyzing blood samples, enabling clinicians to optimize antibiotic selection, dosage, and infusion strategy specific to the individual patient and their infection.

COLLABORATION



SPECIAL SYMPOSIUM
Nanolight. A symposium in honor of the landmark birthday of Niek van Hulst
p. 8

COMMUNITY



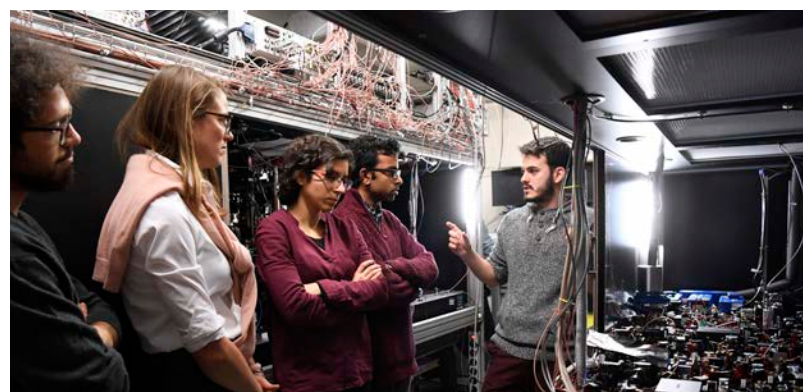
ICFO Day

Organized by ICFOnians for ICFOnians

On December 15th, the normal activities of the institute were put on hold to celebrate the third instalment of ICFO Day, a unique institution-wide event planned by ICFOnians for ICFOnians. This year's theme was "Quantum Technologies," which allowed all of us to have a better idea of the research and accomplishments that take place in this field all around the institute.

The day's activities included debates in the auditorium about quantum technologies, the 2017 Nobel Prizes in Physics and Chemistry, and an introduction to ICFO's new quantum technology spin-off QuSide. In parallel, short talks took place in seminar rooms, as well as a poster session and the institute-wide gymkhana. The traditional ICFO family photo was taken just before lunch, which was followed by lab tours and three-minute flash talks. The activities at the institute ended with a final word from ICFO director Lluís Torner and BIST director Gabriel Silberman. Taking advantage of the celebratory nature of the day as well as the attention of the entire ICFO community, the winners of the PhD thesis awards and the PhD poster awards were announced and celebrated.

The community event concluded on a high note with the annual Festive Dinner, which took place in the Fàbrica Moritz in Barcelona.



COLLABORATION

OUTREACH

Llum a les Ones 2018

April July 2018

Climate change theme for the 5th edition of The Light on the Waves science fiction writing contest



Get ready for the change! This year, ICFO launches the 5th edition of the literary contest, "Llum a les Ones" (The Light on the Waves), a science fiction writing contest aimed at bringing photonics closer to society by motivating high school students and the general public to write short stories or poems about light.

Participants are encouraged to write about climate change, imagining an alternative world (past, future, or extra-terrestrial), with a peculiar climatic scenario (utopian, dystopian or arcadian) that has been conditioned by civilization. How can solar sails or fluorescent tubes, fiber optics, spectrometers, infrared or ultraviolet rays, photovoltaic panels or any photonic artefact play a (relevant or discrete) role in your story?

The contest is organized by ICFO, in collaboration with CCCB Educación and the Magazine Principia. Those who participate are challenged to write a short story or poem that can be submitted within any of the three categories: ESO, Baccalaureate and formative cycles, and over 18

years of age. The different pieces should focus on the impact that climate change has or will have on the planet and/or its inhabitants.

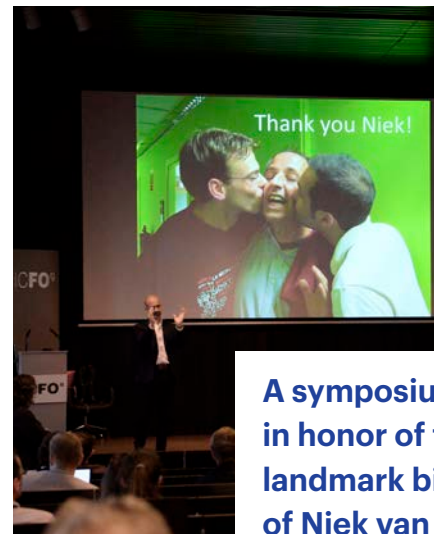
A prestigious jury of scientists and writers will select the winning texts, which will be published in the June 2018 issue of the Principia Magazine (in print and online). In addition, each of these winning texts will have the chance to become part of the lyrics of a song that will be composed by a musical group and performed at a final concert, which will take place at the CCCB theatre during the second semester of 2018.

Participants have until April 23rd to send in their texts. Don't miss this opportunity to participate in a unique contest that aims to inspire young generations to search for ways to solve increasingly problematic climate change issues that need an immediate solution!

+INFO
lallumalesones.icfo.eu

SPECIAL SYMPOSIUM

NanoLight



A symposium in honor of the landmark birthday of Niek van Hulst

To celebrate the landmark birthday of ICREA Prof. at ICFO Niek van Hulst, friends and colleagues came together to discuss some of his favorite topics in the field of Nanophotonics.

During the day-long symposium that took place at ICFO on Friday October 20th, speakers discussed the following subjects:

- Manipulation and control of molecular beams
- Precision spectroscopy of molecular hydrogen and the search for new physics
- Light twists at the nanoscale: a singular story about life-long fidelity
- Quantum networks based on spins in diamond
- Nanometer resolution single molecule localization with minimal photon fluxes
- Light microscopy with electrons, electron microscopy guided by light
- Nanoscale photonic networks to trap and control light
- Confocal-line scanning ophthalmoscope for age-related macular degeneration screening

In addition to the deep scientific discussions that took place throughout the day, there were also many shared memories and anecdotes from decades of personal and professional collaborations. Many thanks to the numerous colleagues, friends, students, and members of the Alumni Network who came together to make this event a special gathering to honor a highly esteemed member of the ICFO community.



OUTREACH

LIGHTtalks 2017

November 21

In collaboration with the Universitat de Barcelona, ICFO organized the 2nd edition of LIGHTtalks: Careers in Photonics addressed to university students and the general public

LIGHTtalks:
Careers in Photonics
Aula Magna de la Facultat de Física de la UB
21 de novembre 2017



On November 21, ICFO, in collaboration with the University of Barcelona (UB), organized the second edition of LIGHTtalks: Careers in Photonics. Held at the Physics Faculty of the UB and targeting an audience of university students, the event aimed to raise awareness about the ubiquity of photonics in our daily lives as well as acquaint participants with the different career paths in the world of photonics.

Dr. Silvia Carrasco, Director of the Knowledge and Technology Transfer Unit (KTT) at ICFO introduced and moderated the event. During the first session, Dr. Robert Sewell, ICFO's coordinator of Academic Affairs, offered an introduction to the science of light and

light-based technologies, how it affects our everyday lives, how transversal it actually is, and how the institute implements it through the multidisciplinary research it conducts.

Subsequently, a panel of nine professionals, all with very different profiles, were invited to explain their backgrounds, training and experiences within the field. Each explained from very different perspectives how they came to work in photonics and what type of work they carry out in their daily jobs. Panelists included a scientist, an entrepreneur, a businessperson, a manager, a lawyer, a communications officer and an engineer, among others.

The event ended with an informal luncheon where students were able to network with all the panelists, acquiring useful information for their future endeavors. As one of the students summarized, "what I enjoyed most was the diversity of the backgrounds presented, as well as the possibility to talk with all the speakers in a comfortable atmosphere."

COLLABORATION



BEYOND ICFO

David Paredes and Luis José Salazar share their "beyond ICFO" experience with ICFOnians.

p. 10

TRAINING



Initial Training Retreat

Following up the initiative launched last year, this November, the new cohort of PhD students that recently joined ICFO attended the second Initial Training Retreat, organized at ICFO.

As has always been ICFO's practice for the training of young scientists, from the day they arrived, they were integrated into an ICFO research group, conducting their studies and research project under the supervision of the corresponding group leader. Also, from the very beginning, they received support to help with onboarding. Informative sessions were organized covering topics such as general information about ICFO, specific information about the PhD Program, its duration, structure and follow-up activities, as well as information about facilities, services, support and mentoring.

Beyond that, and in order to help the new PhD Students prepare for the challenges they will face throughout their doctoral studies, especially as they settle in, these new students participated in an initial training retreat that included professional skills training and an opportunity to get to know one another.

The training was conceived to help maximize integration and productivity in the first stages of the PhD. It focused on skills crucial for the successful launch of doctoral studies, including topics such as time and project management, and communication skills.

The participants also took part in team-building activities designed to reinforce from the very beginning the interaction between research teams, encouraging not only the opportunity for the cross-fertilization of ideas, but also as a way of strengthening the ICFO network and creating a motivating and stimulating place to work.

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



Throughout the PhD experience, students can take advantage of ICFO+, which offers a unique package of wide-scope scientific and technical training, courses on entrepreneurship and commercialization techniques, as well as opportunities for professional and personal development.

The feedback received from attendees to these PhD retreats has been extremely positive and we are already looking forward to the next retreat in Autumn 2018 for the new cohort of PhD students joining ICFO during the upcoming academic year.

ICFO AWARDS



2016 ICFO PhD Thesis Awards

Martí, Peter and Dominik received the award in the ceremony held on December 15 in the scope of the ICFO Day

Among more than 15 theses defended by ICFO PhD Students in 2016, the committee had an in depth deliberation to select the PhD Theses Awards. This award was created in order to distinguish particularly brilliant PhD theses presented at ICFO. With this award, ICFO wishes to highlight and reward extraordinary PhD students whose research progress at the institute has proven to be highly creative and ambitious. **This year, the award has been given:**

In the theoretical field to:

Martí Perarnau in recognition of the exceptional thesis:
Thermodynamics and Quantum Correlations
Supervised by **ICREA Prof. Dr. Antonio Acín**.

In the experimental field, to:

Peter Weber, in recognition of the exceptional thesis:
Graphene Mechanical Resonators Coupled to Superconducting Microwave Cavities
Supervised by **Prof. Dr. Adrian Bachtold**.

In the experimental field, to:

Dominik Kufer in recognition of the exceptional thesis:
Photodetectors based on low-dimensional materials and hybrid systems
Supervised by **ICREA Prof. Dr. Gerasimos Konstantatos**.



PhD Poster Session and Award

The ICFO Student Poster Session was created as an opportunity for the exchange of ideas and knowledge among ICFOnians of different groups and areas. Now in its 8th edition, it took place in the scope of the ICFO Day event. This year, 30 posters were exhibited at the ICFO Nest Hall for more than two weeks ensuring that all ICFOnians would have the opportunity to take a look at them and benefit from the broad range of topics covered. ICFOnians were given the opportunity to vote for the best poster. Taking this popular vote into account and also after deliberation of the PhD Commission from one side and from an external committee on the other, the poster awardees were chosen as follows:

First Prize:

Nicolas Maring
Poster: *Photonic quantum state transfer between a cold atomic gas and a crystal*
GL: **ICREA Prof. at ICFO Hugues de Riedmatten**

Second Prize:

Roland A. Terborg
Poster: *Portable lens-free microscopy with sub-nanometric depth sensitivity for thin films and protein detection*
GL: **ICREA Prof. at ICFO Valerio Pruneri**

Third Prize:

Miriam Marchena
Poster: *Direct growth of 2D and 3D graphene nano-structures over glass substrates by tuning a sacrificial Cu layer*
GL: **ICREA Prof. at ICFO Valerio Pruneri**

COLLABORATION / PEOPLE

BEYOND ICFO

David Paredes and Luis José Salazar

David and Luis José share their “beyond ICFO” experience with ICFOnians.

ICFO Alumni David Paredes (postdoctoral researcher in the group led by Prof. Hugues de Riedmatten and years before, summer research fellow in the group led by Prof Morgan Mitchell), and Luis José Salazar (ICFO PhD graduate in the group led by Prof Juan P. Torres) are both working at the high-tech space company AISTECH on intelligent space technologies.

What is AISTECH?

David: The founders of AISTECH discovered that there is a gap in the access to imaging information for agriculture, disaster prevention, hydrological management...all of which they could fill with pre-existing space technology. The idea was not to reinvent the wheel, but to put it to work.

Luis: We are doing developments that adapt existing technologies to our own needs. We can save a lot of resources because we can use things that have already been designed and tested to go into space.

David: We are working with powerful shoebox-sized nanosatellites that have a fabrication and launch costs orders of magnitude inferior to that of conventional satellites. This will allow us to offer products and services with a very low cost. We aim to democratize space resources. We want to be the “Henry Ford” of space.

Luis: Another important feature of the use of nanosatellites is that they allow us to be a very fast company in terms of innovation. Our satellites have a short life compared to others, and that means that we can replenish our fleet and improve it more frequently. The company aims to surround the planet with a “constellation” of satellites.

What is your job in the company?

Luis: Of the three services that AISTECH’s satellites provide, aerial surveillance, communications and imaging, we both work on imaging. I am currently leading the team that is developing a multispectral telescope for Earth observation that can generate images in the visible wavelengths, which other companies are also doing, but also short-wave infrared and thermal infrared, which differentiates us from the competition.

David: My job involves working on how to download, process and secure all these images. Luis is working on the optomechanical aspects of the telescope, and there is another person in our team in charge of the electronics.

What is the most exciting part of your work?

David: First, it’s space! I also like the huge variety of tasks that I have to confront. It is similar to doing research, but in a completely new area in which I had no previous experience. We are lucky to have an amazing team.



Aistech is a space company whose main purpose is to get valuable information from Earth using their own nanosatellite network.

Luis: Given my background as a physicist and electrical engineer, I have been able to play with electronics and with optics. At AISTECH, I have the opportunity to deepen my knowledge in mechanical design since electronics, optics and mechanics are topics that are strongly related in this project. I have to learn a lot quite fast, but I enjoy it. I also like having an active voice within the company. We are still a small team, so we all can contribute to the project, and all the ideas are taken into account.

Passing ICFO every day on your way to work at the AISTECH offices on the PMT campus, what do you miss most about your time inside our institute?

David: At ICFO, you have the chance to meet a large circle of people with different backgrounds. Working in a small company, I miss that.

Luis: I now appreciate how ICFO offered a wide range of quality seminars and invited speakers. As a member of ICONS, we even had the chance to have coffee with some prestigious invited researchers. Also, ICFO’s administration makes life easy for you and I was incredibly grateful

for that. They are the gears that really make ICFO go.

David: I also want to highlight the proactive work of ICFO’s KTT office. They have many contacts in the industry, which gives scientists the feeling that there are plenty of opportunities and ways to interact with companies. Not all centers are this lucky.

Any advice for ICFOnians interested in working in a high-tech company?

Luis: You have to meet people- not just in your lab, but as wide a group as possible. Open your mind and learn from others independently of their background. I am in AISTECH because on one occasion I accepted a parcel for my neighbor! You have to actively work at meeting new people.

David: Also, do not ignore things that are outside your immediate field. A physicist can learn from a biology seminar, and vice versa. You have to be attentive to what happens around you. I think this applies not only to tech companies, but also to everything else.

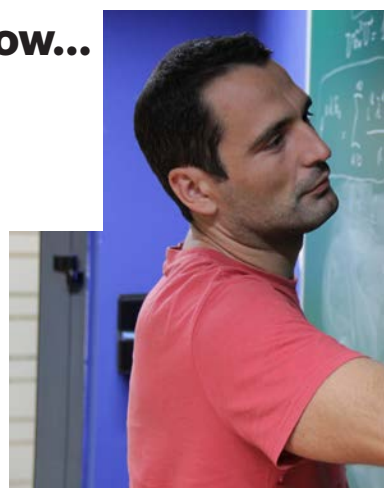
+INFO
aistechspace.com

OUTREACH

YOUNG MINDS want to know...

Why is it not possible to go faster than the speed of light?

The Outreach team at ICFO welcomes school groups to the institute, allowing them to explore the facility and encouraging them to ask questions and develop a mindset based on the scientific discovery and process. Seemingly simple questions pave the way for insightful conversations that introduce some basic concepts behind the science of light.



Students from the Instituto F.X. Lluch i Rafecas in Vilanova i la Geltrú ask: **Why is it not possible to go faster than the speed of light?**

Dr. Alessandro Celi, postdoctoral research in the Quantum Optics research group, responds: Because we have never observed any object doing it! Physics is an experimental science. We observe that 1) the speed of light is always measured to be the same independently of the source’s motion; 2) no other object has ever been observed to go faster than light. Einstein formulated a theory called Special Relativity that assumes that 1) and 2) are true. This theory has many additional consequences, e.g. you need infinite energy to accelerate a mass to the speed of light. Physicists work to determine and test these consequences in experiments, looking for holes in the theory. To date, no one has been able to refute the **Special Relativity theory**- in big particle accelerators and in everyday life. Your mobile phone GPS relies on special (and general) relativity!

GO & FLY

140 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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October 6, 2017

Ivan Nikitskiy
Photodetectors based on Quantum Dots and 2D Materials

TD: Prof. Dr. Frank Koppens and Prof. Dr. Gerasimos Konstantatos

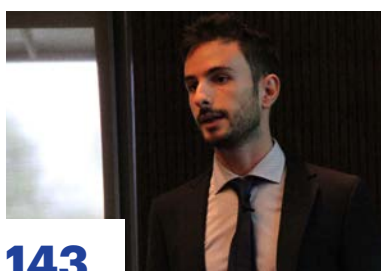


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October 17, 2017

Alejandro Mattar
Quantum Information with Black Boxes - Lifting Protocols from Theory to Implementation

TD: Prof. Dr. Antonio Acin



143

October 19, 2017

Marco Manzoni
New Systems for Quantum Nonlinear Optics

TD: Prof. Dr. Darrick Chang



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October 23, 2017

Kutlu Kutluer
Quantum Memory Protocols for Photonic Solid-State Devices

TD: Prof. Dr. Hugues de Riedmatten



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December 14, 2017

Ferran Martin
Coherent Sensing of Magnetic Waveforms with Spin-squeezed Atoms

TD: Prof. Dr. Morgan Mitchell and Dr. Robert Sewell

COMMUNITY PICTURES



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 probably one of the first people to arrive at ICFO in the morning.
2. He is very keen on outdoor activities, although on several occasions they have led to breaks and bruises.
3. When he was just 13 years-old, he saved up his money to buy his first mixer table. He still enjoys this hobby, and has an extensive collection of vinyl discs.
4. One of his favorite hobbies is travelling. He has travelled to more than 25 countries!

THE LAST WORD

HIGH PROFILE

Wolfgang Ketterle

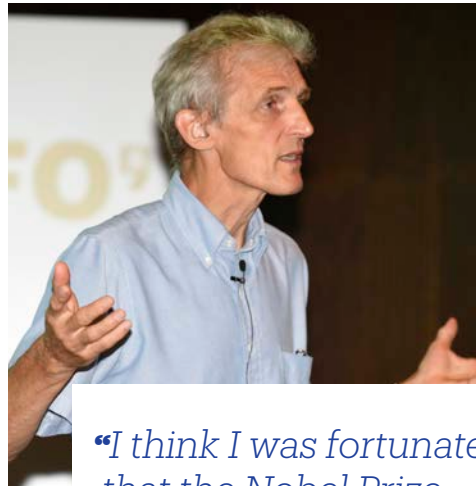
Wolfgang Ketterle has been the John D. MacArthur Professor of Physics at MIT since 1998. He leads a research group exploring new forms of matter of ultracold atoms, in particular novel aspects of superfluidity, coherence, and correlations in many-body systems. He is co-recipient of the 2001 Nobel Prize in Physics for his observation of Bose-Einstein condensation in a gas in 1995 and the first realization of an atom laser in 1997.

What do you think will be the most far-reaching gift that the study of ultracold atoms will give to society?

Let me first make a disclaimer. Predictions of what will happen in the future are an extrapolation of what we are currently doing, and notoriously, when you project into the future, you miss the breakthroughs and the really disruptive changes. Nevertheless, we should think about what is the possible impact of our research in the future and I believe that fundamental research today on cold atoms will lead to new materials and devices.

Which of your accomplishments to date would have most surprised the young Wolfgang Ketterle?

When I was in high school, I saw myself following a career in industry, developing products, working more



“I think I was fortunate that the Nobel Prize did not change my life in a major way. I was able to continue doing what I did before, mainly spending lots of time on research with my group”

on commercial aspects of science and technology. Just the fact that I am a university professor now would have surprised me. And of course, the fact that I am performing research at such a high level, that my work is well known and has been recognized with awards, that is something you may sometimes dream about but can never take for granted that it may come true. In my personal life, I would have been surprised that I have five children! I didn't see that in the cards, but that is a wonderful situation. Life has been full of surprises.

How did fundamental research win you over from a career in industry?

After my PhD and three years as a postdoc, I was clearly at a crossroad. I felt I should go into industry

and connect my talents in research with something that society needs more immediately. I applied to around 20 companies, had ten interviews and multiple job offers. I came very close to accepting an offer in industry but instead decided to stay in academia, but in applied research (laser combustion diagnostics). While doing this, I realized that I am a person who excels if I have a bigger, open challenge. My preference is not to solve problems, but to work on problems where it is not even clear if there is a solution. I also realized that in my applied research I was constantly pooling knowledge and ideas from more fundamental laser physics into the applied area. Eventually I concluded that while society has immediate needs and needs many people to work on those, it also has long-term needs and it makes sense for me to contribute to society where I am at my best. From that moment, I knew what I wanted. I went into fundamental research and I have never looked back.

What are your secrets to keeping your head on straight while working in the most competitive level of science?

In order to stay grounded, you need other things in life. For me, these are family, sports, and sometimes doing repairs and project in my house; doing something with my hands. The combination of these three things keeps me balanced.

How has winning the Nobel Prize in Physics changed your life and work?

I think I was fortunate that the Nobel Prize did not change my life in a major way. I was able to continue doing what I did before, mainly spending lots of time on research with my group at MIT, and having time for my family. I turned down many invitations and didn't do the big lecture tour which many laureates do. The Nobel Prize has definitely helped me to keep my research at a high level and secure continued funding but I have not tried to use it to obtain more grants and enlarge my research group, or to get a different position. I already had most of what I wanted before the Nobel Prize.

Science Quiz

1. In their article "Photonic quantum state transfer between a cold atomic gas and a crystal" (*Nature*, Nov 2017), Nicolas Maring and co-workers extract a photon from a cold gas, send it by fiber, and store it in a praseodymium-doped crystal. Which of these wavelengths did **not need to be stabilized to better than 100 kHz in this experiment?**

A) 606 nm **B)** 780 nm **C)** 994 nm
D) 1552 nm **E)** 1569 nm

2. In their article "Quantum liquid droplets in a mixture of Bose-Einstein condensates" (*Science*, Dec 2017), Cesar Cabrera and co-workers describe a new phase of matter, a liquid stabilized by quantum fluctuations. Is the base material:

A) Palladium **B)** Promethium **C)** Potassium
D) Polonium **E)** Praseodymium

3. Is Promethium even a real element? Wasn't that a movie by Ridley Scott?

* Find answers on pg. 2

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