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COLLABORATION

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Community News Summer 2019



Teaming up with Industry

to produce new knowledge and superior results

EDITOR'S CORNER

Brook Hardwick
Contributing Editor



The Virtuous Circle

Our institute has a widely publicized triple mission, which is to conduct research at the highest level, train the next generation of scientists, and to take what is produced at ICFO useful to society through knowledge and technology transfer.

In each edition of ICFonians, elements of this mission are reflected in the activities that we report, but rarely do we have such a plethora of clear examples of the varied and important roles that industry plays in collaborating to ensure that science flourishes in meaningful ways for society.

The KTT team led by Dr. Silvia Carrasco is untiring in its efforts to identify and team up with industries, hospitals and businesses to work on innovative projects. Active participation in international platforms and associations like Photonics21, SECPhO and EPIC, also bring ICFO in contact with members of the industrial sectors where together we can make a positive impact. The recent *EPIC World Industrial Quantum Photonics Technology Summit*, hosted by ICFO, was a perfect example of the intersection of science and industry, in this case pushing forward the second quantum revolution that is expected to produce paradigm-shifting changes in all of our lives.

ICFO's long-standing relationship with B. Braun is another highly relevant example of industry playing an enabling role in scientific advancement. ICFO and B. Braun have recently published results on a project to prevent biofilms on medical implants. Clearly, this type of industrial collaboration works to produce new knowledge and superior results that will bring benefits to healthcare and quality of life.

Public entities are banking on science's role in working side by side with industry to produce economic

benefits as well for society. Not only has the city of Castelldefels recently granted Silvia Carrasco an award commending ICFO's role in innovation and promotion of the economy of the city, they also renewed an agreement with ICFO for the support of an incubator fostering photonic-based companies in the area.

Finally, ICFO has been fortunate to benefit from scientific philanthropy from foundations that channel the proceeds of industrial success into funding for science. The Cellex and Mir-Puig Foundations, founded by Dr. Pere Mir-Puig thanks to a highly successful career in the promotion of various companies and patents, has had a long standing special relationship with our institute that has made possible the enhancement of our world-class facilities, top global talent attraction, and ambitious research programs. Most recently, the Moore Foundation, founded by Gordon Moore, well known for his role in the foundation of Intel Corporation, announced the award of a \$1.1 million research grant to ICREA Professor at ICFO Dr. Hugues de Riedmatten, for an ambitious project to link quantum nodes for the quantum internet.

It is undeniable that industry and science are intertwined and it is exciting to have so many manifestations in one edition of ICFonians of how this special relationship can be such a power for good.

COVER



Surgical implants, covered with gold nanoparticles (pile of meshes on the left) compared to the original surgical meshes previous to the treatment (pile of meshes on the right). In an industrial collaboration between ICFO and B.

Braun Surgical, S.A., researchers develop a new technique that could prevent bacterial contamination and infection in medical implants by using light combined with gold nanoparticles. Learn more in Business News on pg. 6.

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Mystery ICFonian
Solution Ed #39

Alba Rosado
Project Portfolio Manager, KTT

Science Quiz
Answers from p.12

CM: A AAG: B
MM: D JK: C

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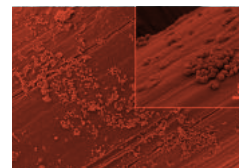
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HAPPENINGS



BUSINESS NEWS
 ICFO and B. Braun
 work together to prevent
 biofilms on medical implants
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ICFO NEWCOMERS

Welcome to ICFO

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



Md Masudur Rahman
Student



Aykut Eken
Postdoctoral Researcher



Natalia Salvat
PhD Student



Izabela Piechocka
Visiting Scientist



Javier Arrés Chillón
Student



Ana Luisa Cartaxo
Visiting PhD Student



Charitra Sree Senthil
Student



Ravindra Chhajlany
Visiting Scientist



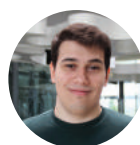
Elisa Tamariz
Visiting Scientist



Adriana González
Postdoctoral Researcher



Manabendra Bera
Visiting Scientist



Arnau Cobes Orteu
Electronics



Jaume Sanchis Batlle
Financial Accountant



Adam Summers
Postdoctoral Researcher



Pei Sheng Lin
Visiting PhD Student



Luciana Vidas
Research Engineer



Jacqueline Martínez
Student



Jan Gieseler
Postdoctoral Researcher



Umüt Karadeniz
Business Developer



Iris Agresti
Visiting PhD Student



Tanja Dragojevic
Research Engineer



Sara Zacchetti
Student



Flavio Baccari
Postdoctoral Researcher



Xavier Cañas Pons
Info & Communication Technologies



Esteban Gerbino
Visiting Scientist



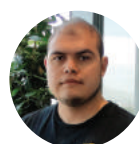
Alessio Celi
Visiting Scientist



Gaurav Kumar
PhD Student



Ying-Hao Chien
PhD Student



Roberto León
Visiting Scientist



Arnau Rosell
Student



Antoine Reserbat
Postdoctoral Researcher



Andrea Konecna
Postdoctoral Researcher



Rachele Catalano
Student



Anna Dawid
Visiting PhD Student



Ayşe Bilgehan Baspınar
Student



Stefan Baumli
Postdoctoral Researcher



Reiko Yamada
Visiting Artist



Valentí Bosch Fontana
Mechanics



Ewelina Wajs
Postdoctoral Researcher



Jaime Redondo
Student



Valentin Kasper
Postdoctoral Researcher



Ernest Pastor
Postdoctoral Researcher



Victor Vysloukh
Visiting Scientist



Nawaphat Malaiwong
PhD Student



Adrian Gómez
Student



Adrià Marín
Student (SRF 2019)



Laura Zarraoa
Student (SRF 2019)



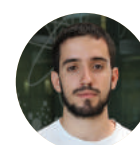
Antoni Latorre
Student (SRF 2019)



Simon Cichy
Student (SRF 2019)



Miguel Saucedo
Student (SRF 2019)



Adrián Pinilla
Student (SRF 2019)

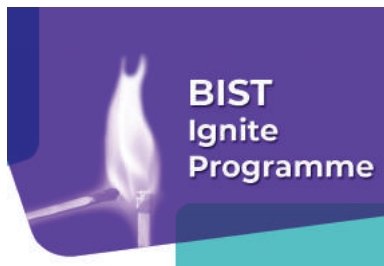


Gerardo Garcia
Student (SRF 2019)

HAPPENINGS

ICFO NEWS

2018 BIST Ignite Awards



The **BIST Ignite Program** aims to promote the initiation of new collaborations among the BIST researchers, facilitating the exchange of knowledge among different scientific fields and exploring new approaches to address complex questions. In the 2018 program, five projects have been awarded grants from within the BIST Community for their multidisciplinary and high level of scientific excellence. The winners will have eight months to develop their projects, at which point they will be eligible to apply for a second round of funding.

ICFO will participate in two of these projects:

BIOSPAD ("A fast monolithic multi-channel ASIC for diffuse optical, non-invasive blood flow measurement"), led by Sebastian Frinsein, IFAE and Turgut Durduran, ICFO.

ORGANSENS ("Dynamic monitoring of pancreas metabolism by combining nano-optical biosensing to organ on-a-chip technology"), led by Romain Quidant, ICFO and Javier Ramon, IBEAC.

Fellow of the Royal Academy of Science and Arts of Barcelona



ICFO's director, **Lluís Torner**, became a full member of the **Royal Academy of Science and Arts of Barcelona (RACAB)** on April 11th. Membership in the Academy is an enormous honor, limited to only 75 numerary members, traditionally representing the most prominent scientists of the region. He is one of nine members of the Physics section. In the induction ceremony, Prof. Torner gave a special talk to his fellow peers entitled "Photons: A key tool to explore the frontiers of the Natural Sciences". Congratulations Lluís on this important honor which not only recognizes an illustrious scientific career to date, but also foretells many future achievements to come.

The Quantum Communications Infrastructure Declaration



Spain was one of seven EU member states to sign a joint declaration pledging to work together to build a **Quantum Communication Infrastructure (QCI)**. The national initiative will focus on working with large industries, specialized in telecommunication, electronics and software sectors both on ground and in space to integrate quantum cryptography and other quantum communication technologies into their products. The QCI will represent the next generation of ultra-secure communications in Europe, allowing information to be transmitted and stored ultra-securely, linking critical data and communication assets all over the continent. It aims to become the backbone of the future Quantum Internet. **ICREA Prof. at ICFO Valerio Pruneri** and Dr. Juan José García Ripoll from CSIC will be Spain's two representatives to the infrastructure.

COFUND PhD Fellowship Program

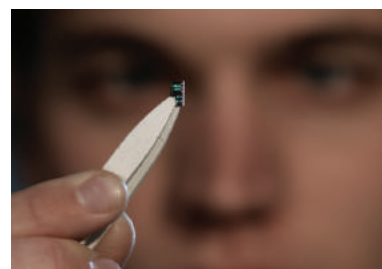


ICFO has been awarded highly competitive funding for a new doctoral fellowship program via the **European Commission's Marie Skłodowska-Curie COFUND action**.

This project, entitled **ENLIGHTEN**, will allow ICFO to offer 20 highly competitive fellowships to PhD candidates of 36-month duration, through four calls.

ICFO currently runs the **ICFO Stepstone** program, encompassing two COFUND-actions, for outstanding doctoral candidates to carry out their PhD at the institute between 2016 and 2022. In addition, the **ICFONest+ CO-FUND-action**, an equivalent program for post-doctoral researchers, ran at the institute from 2014-2018, attracting fellows from leading institutes around the world.

Photonics Incubator in Castelldefels



The **City Hall of Castelldefels** and **ICFO** have formally renewed the agreement originally signed in 2016 for the support of an incubator fostering photonic based companies in the area. This support from the city of Castelldefels is instrumental in allowing ICFO to act as a technological accelerator focused on giving support to entrepreneurs from the inception of their business idea, helping convert projects into successful deep-tech companies that take photonic technologies from the laboratory to the market. One of ICFO's recent spin-off, **QuSide**, was a beneficiary of the program. Today it is a fast growing, high-tech company based in Castelldefels that employs a dozen people. It is a perfect example of the important impact that the program can have in the city.

ICFO Passes 100,000 Citations



ICFO's citations are growing exponentially along with our publications list. Between 2002 and 2018, ICFONIANS authored over **2,600 papers with over 85% in Q1 journals and 40% in D1 journals**. In 2018 alone, there were over 16,000 citations for ICFO papers. Today, total citations for ICFO publications have surpassed 100,000 according to the **Web of Science (WoS)**. This impressive milestone demonstrates that not only are ICFONIANS publishing in the most prestigious topical journals, this work is increasingly being recognized by peers around the world.

QEOD Thesis Prize for Applied Aspects



Since 2007, the **Quantum Electronics and Optics division (QEOD)** of the **European Physical Society (EPS)** awards up to four thesis prizes around the **CLEO Europe Conference to reward excellence in PhD research and scientific communication in the area of quantum electronics and optics**. The prizes take into account related PhD thesis work submitted in the two years prior to the conference. These prizes are awarded for fundamental and applied aspects.

The 2019 QEOD Thesis Prize for applied aspects is awarded to **Dr. Mathieu Massicotte**, whose thesis entitled "Ultrafast optoelectronics in 2D materials and their heterostructures" was supervised by **ICREA Prof. at ICFO Frank Koppens**.

LATEST ADVANCES



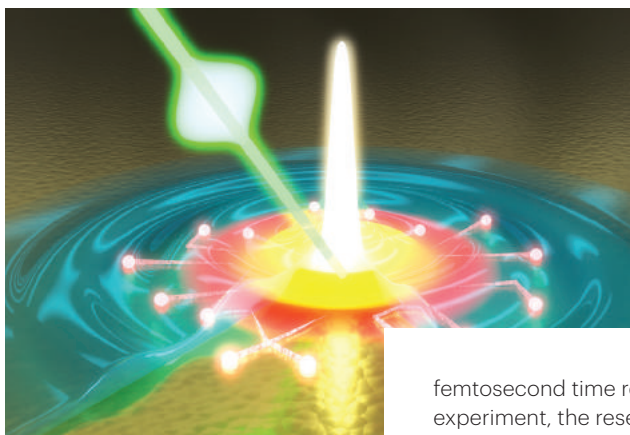
Multicolored Light Twists in New Knotted Ways

Joint collaborations at ICFO result in studies that provide new frameworks and results that advance the study of structured light.

In the first study published in *Nature Photonics*, ICFO researchers Emilio Pisanty, Gerard Jiménez Machado, Veronica Vícuña-Hernández, Antonio Picón and Alessio Celi, led by ICREA Prof. at ICFO Maciej Lewenstein and UPC Prof. at ICFO Juan P. Torres, have designed a beam of light with a polarization state that forms three-lobed trefoils at each point by combining light of different frequencies, and making the trefoils connect to each other in a way such that the light beam, as a whole, has the shape of a knot. These beams also exhibit a new kind of angular momentum associated with the unusual symmetry of the beams, which remain unchanged when they're rotated — but only when the polarization is rotated by a specific portion of the rotation in space. Researchers were able to experimentally confirm the presence of this new quantity called the torus-knot angular momentum.

In another study published in *Physical Review Letters*, ICFO researchers Emilio Pisanty and Antonio Picón, led by ICREA Prof. at ICFO Maciej Lewenstein, in collaboration with researchers from the University of Salamanca and from CU Boulder, show that the new type of angular momentum is conserved in interactions. They show, via theoretical simulations, that at extremely high intensities, many photons of light can be combined into single photons with high energy, and that these new, bigger photons carry the combined torus-knot angular momentum of the original, smaller photons.

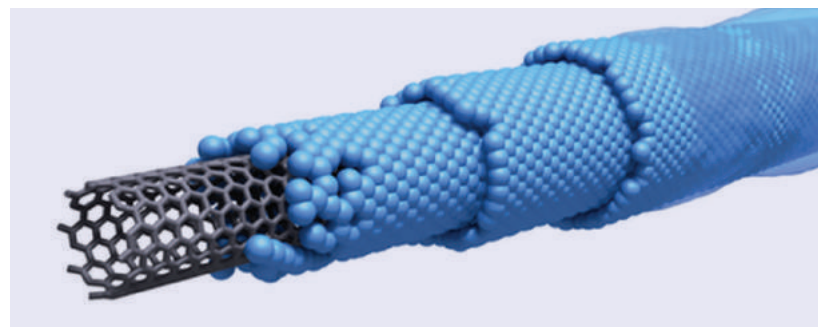
The results of these studies open the possibility of using these new topologies of light for future communication applications, among others.



Watching Nanoscale Heat Transport

In a study published in *Science Advances*, ICFO researchers Alexander Block, Dr. Matz Liebel, Renwen Yu, led by ICREA Professors at ICFO Niek van Hulst and Javier García de Abajo, in collaboration with researchers from Ben-Gurion University of the Negev, have been able to measure and track the evolution of locally induced hot electrons on a gold thin film, and observe how they distribute and cool down within the metal on the nanometer length scale and with

femtosecond time resolution. In their experiment, the researchers took a 50 nm thin film of gold and illuminated it with an optical pump pulse. They resolved changes in the sample with a 20 nm spatial precision and 0.25 ps temporal resolution using ultrafast thermo-modulation microscopy, to identify two regimes of heat diffusion and understand how metals at such scales are capable of managing heat dissipation. These discoveries pave a way to fully understanding heat management in metals at the nanoscale, which has proven to be essential for the design and development of efficiently operational optoelectronic devices, having implications in applications that range from thermoelectric devices, broadband detectors, to efficient solar cells and even plasmon-enhanced photochemistry.



Controlling Superfluid Helium with Carbon Nanotubes

A study led by ICFO researchers shows how superfluid helium grows on a carbon nanotube as a series of first-order layering transitions.

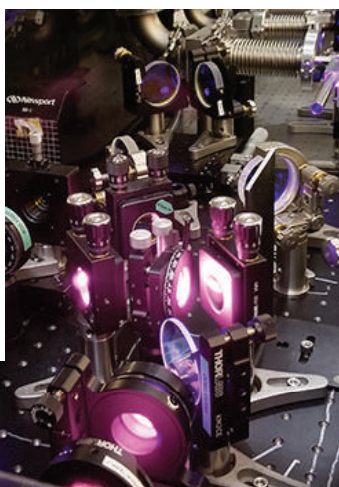
In a study published in *Physics Review Letters* and highlighted in *APS Physics Magazine*, ICFO

researchers Adrien Noury and Jorge Vergara-Cruz led by ICFO Prof. Adrian Bachtold, in collaboration with researchers from Ecole Normale Supérieure, Universidad Pablo de Olavide, and the UPC, report on a controlled layer-by-layer growth process of superfluid helium onto the surface of carbon nanotubes.

The team was able to build helium superfluid films with a number of atomic layers in a perfectly controlled manner, and demonstrate that these helium multilayers adsorbed on a nanotube are of unprecedented quality compared to previous works. Such findings could open a new pathway into the field of topological phase transitions, aiming to carry out novel research of quantum fluids and solids in reduced geometry.

Dynamic Beams of Light

An international team of researchers is able to generate time-varying OAM beams of light.



In a study published in *Science*, researchers from the University of Salamanca, the University of Colorado Boulder and NIST, together with ICFO researchers Emilio Pisanty and ICREA Prof. at ICFO Maciej Lewenstein, have presented and experimentally confirmed the creation of dynamical pulses of light whose OAM changes over the duration of the pulse (varying its frequency with time). This gives these pulses of light a new property, known as the self-torque of light.

Even though self-torques can be found in several other physical systems (e.g., electrodynamics and general relativity), this is the first time that this dynamic property has been shown to exist in light. This is made possible by the highly nonlinear processes that occur when light of very high intensities interacts with matter.

The results of this study give rise to a completely new form of light. They open a new field of applications in optical communications, microscopy, quantum optics, and microparticle manipulation. This new class of dynamic-OAM beams might be useful for manipulating the fastest magnetic, topological, molecular, and quantum excitations on attosecond time and nanometer spatial scales.

HAPPENINGS

BUSINESS NEWS

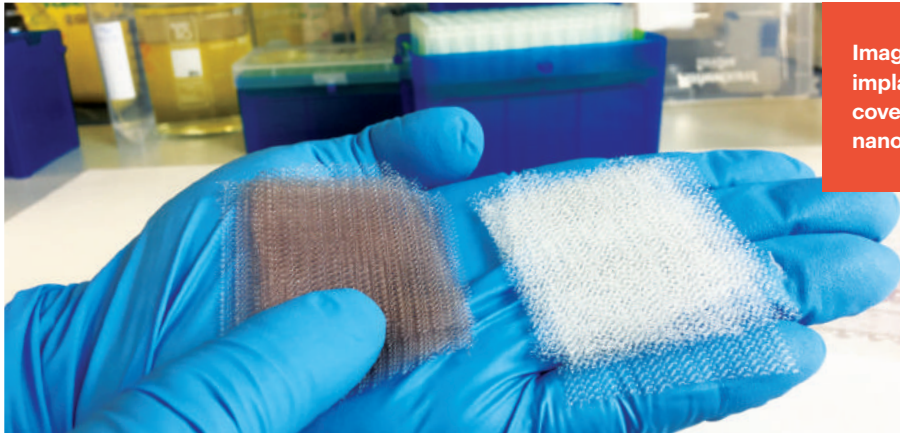


Image of the surgical implants. Mesh covered with gold nanoparticles on left.

ICFO and B. Braun work together to prevent biofilms on medical implants

Collaborative research yields a new technique that could prevent bacterial contamination and infection

In a recent study published in *Nano Letters* and highlighted in *Nature Photonics*, ICFO researchers Dr. Ignacio de Miguel, and Arantxa Alborno, led by ICREA Prof. at ICFO Romain Quidant, in collaboration with researchers Irene Prieto, Dr. Vanesa Sanz, and Dr. Christine Weis led by Dr. Pau Turon from the major medical device and pharmaceutical device company B. Braun, have devised a novel technique that uses nanotechnology and photonics to improve the performance of medical meshes for surgical implants.

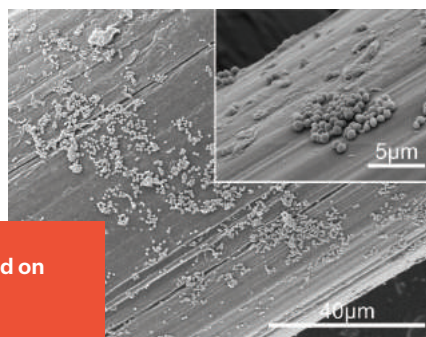
Through an ongoing collaboration since 2012, the team of researchers at ICFO and B. Braun Surgical, S.A., developed a surgical mesh where its surface was chemically modified to anchor millions of gold nanoparticles. Gold nanoparticles have been proven to very efficiently convert light into heat at very localized regions.

In an *in-vitro* experiment, they exposed the modified mesh to *S.aureus* bacteria for 24 hours until a biofilm was formed on the surface. After irradiating the mesh with a series of short intense pulses of near infrared light (800 nm), the researchers induced surface plasmon resonances in the nanoparticles—a mode that results in the efficient conversion of light into heat, burning the bacteria at the surface. By using a fluorescence confocal microscope, they detected the amount of bacteria that had been killed, and were able to observe that the remaining live biofilm bacteria became planktonic cells, recovering their sensitivity to antibiotic therapy and to immune system response. They also saw that, by increasing the amount of light delivered to the surface of the mesh, the dead bacteria lost their adherence and peeled off the surface. Researchers confirmed that operating at near infrared light ranges was completely compatible with *in-vivo* settings, avoiding possible damage of surrounding healthy tissue. Through repetition of the treatment, they verified that recurrent heating of the mesh had not affected its conversion

efficiency capabilities.

ICREA Prof. at ICFO Romain Quidant comments, *“the results of this study are promising and pave the way towards using nanoplasmonics to prevent the formation of bacterial biofilms at the surface of surgical implants. There are still several challenges that need to be addressed and current steps are focussing on implementing our approach in an in-vivo setting.”*

Dr. Pau Turon, Director of Research and Development at B. Braun Surgical, S.A. explains, *“our commitment to help healthcare professionals to avoid hospital related infections pushes us to develop new strategies to fight bacteria and biofilms. Additionally, the research team is exploring to extend such technology to other sectors where biofilms must be avoided.”*



SEM micrographs of the *S. aureus* biofilm formed on the surgical mesh surface.

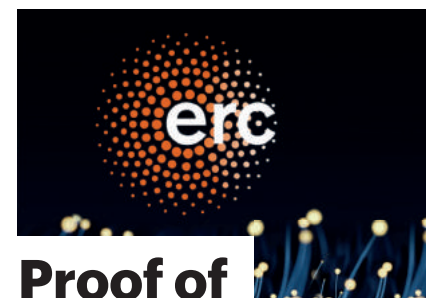


City of Castelldefels Award

KTT Director Silvia Carrasco awarded for innovation and promotion of the economy of the city

The City of Castelldefels celebrated the thirteenth edition of the City of Castelldefels Awards, recognizing the people or entities that have contributed to disseminate the “values of liberty, equality, solidarity, progress and civic commitment or that personify exemplary trajectories in these areas.”

The director of Knowledge and Technology Transfer (KTT) at ICFO, Dr. Silvia Carrasco, was awarded the City of Castelldefels Award for Economy and Innovation. This prize specifically cites her extraordinary work in promoting activities of great economic and social importance for the city of Castelldefels. This is an important recognition for the entire KTT team.



Proof of Concept Grant

ERC Funding to develop MRI with single-atom resolution

The European Research Council, in its efforts to help ERC grant-holders to bridge the gap between their research and the earliest stage of a marketable innovation, created the Proof of Concept (PoC) funding scheme for researchers who have already been awarded an ERC grant. Not only does this program help ERC grantees to explore the innovation potential of their research and/or commercialize the results of their ERC-funded research, the program complements the efforts of ICFO's Knowledge and Technology Transfer Unit (KTT), which proactively searches for ways to translate newly generated knowledge into new technologies.

ICREA Prof. at ICFO Dr. Adrian Bachtold has been awarded a PoC, the eleventh award of this kind for ICFO in the past seven years, for the project titled **Room Temperature Magnetic Resonance Force Microscopy (RTMRFM)**. The main goal of this project is to use ultra-sensitive nanotube hybrid cantilevers to carry out magnetic resonance force microscopy at room temperature.

COLLABORATION



CONFERENCE
IONS BCN'19
at ICFO

p. 8

RESEARCH

Gordon and Betty Moore Foundation awards ICFO's frontier research on Quantum Science

New grant for Prof. Hugues de Riedmatten underscores ICFO's international leadership in the field of quantum science

In 2018, a representative of the Gordon and Betty Moore Foundation visited ICFO in search of frontier research with potential global impact in the area of quantum science. The Moore Foundation, founded by Gordon Moore, well known for his role in the foundation of Intel Corporation and also for authoring Moore's Law, seeks to help understand how the world works while paving the way to far-reaching benefits for society. Following this visit to the institute, the foundation announced the award of a \$1.1 million research grant to **ICREA Professor at ICFO Dr. Hugues de Riedmatten**, based on his

whitepaper outlining an ambitious project to link quantum nodes for the quantum internet.

The project that de Riedmatten and the team he leads will carry out aims to experimentally demonstrate fundamental purely quantum effects such as entanglement, between different quantum physical platforms or nodes, made with different materials (solid crystals or ultra-cold atoms). The idea is to create a hybrid network of quantum systems, with each particular platform running a specific task according to its capabilities. The hybrid entanglement between these many-particle quantum systems based on different physical platforms would then be followed by the experimental demonstration of teleportation of quantum information between these systems. The ultimate goal would be to obtain an efficient and reliable distribution of quantum information over quantum networks. *"It is very important that fundamental and applied research go hand in hand", comments Prof. de Riedmatten. "This kind of grant supporting fundamental, curiosity driven and risky projects allows us to explore new directions that may one day lead to new technology."*

To date, the Moore Foundation has awarded over 800 research grants to support basic research and discovery science in the life and physical sciences, adding up to over a \$1 billion USD in funding. The majority of these grants have gone to US based institutions, however their mission



to "foster path-breaking scientific discovery" extends beyond the US borders and fosters international collaboration that is conducive to major breakthroughs. Likewise, it is highly flexible and complementary to any other national or international funding that the scientist may receive.

ICFO Director Lluís Torner emphasizes, *"We are extremely proud to receive this grant from the Gordon and Betty Moore Foundation. That they came across the Atlantic to pick up one of our best research projects is an indication of the exceptional vision of the program managers of the Foundation and a further sign of the global quality and impact of the research conducted at ICFO"*.

ICFO has to date benefitted tremendously from the generous support of philanthropic organizations, namely the Cellex and Mir-Puig Foundations which have played a decisive role in helping researchers like Prof. de Riedmatten to build ambitious research projects at the institute. This new support from the Moore Foundation will help to advance ICFO's international leadership in the field of quantum science.

CONFERENCE

EPIC World Industrial Quantum Photonics Technology Summit

ICFO hosts summit bringing together future supply chain for new quantum technologies

On June 5 and 6, ICFO hosted the **EPIC Industrial Quantum Photonics Technology Summit**, bringing together companies that will constitute the supply chain for the commercialization of new products that are the result of R&D initiatives of the second quantum revolution.

According to the EU Quantum Technologies



Flagship, as well as many other initiatives worldwide in Quantum technologies, today's second quantum revolution is expected to introduce paradigm shifts in the fields of quantum communication, quantum simulation, quantum computing and quantum sensing and metrology. In line with these areas, the **EPIC Industrial Quantum Photonics Technology Summit** aimed to prepare

the supply chain for related product ranges.

The strong focus on quantum activities at ICFO, with fourteen of the center's groups participating in research related to quantum technologies, created the impetus for ICFO to host this event. Likewise, ICFO is playing a leadership role in several projects within the Quantum Flagship. The theories, experiments and discoveries of groups at the center often represent essential technological elements in today's cutting-edge applications and are also setting the foundations of future quantum solutions.

ICREA Prof. at ICFO Dr. Valerio Pruneri, leader of the Optoelectronics research group, offered a talk within the summit about the Quantum Flagship project he leads entitled "CiViQ- Bringing continuous-variable QKD technology into emerging optical telecommunication networks". In addition, Domenico Tulli, CTO of QuSide, an ICFO spin-off company that develops quantum technologies for the cyber-security and super-computation worlds, also offered a keynote talk during the summit.

COLLABORATION

CONFERENCE



IONS BCN'19 at ICFO

ICONS hosts students from OSA Chapters around the world

From June 26-29, ICONS welcomed students from around the world to ICFO to participate in IONS BCN'19 - the conference in Optics for, of and by students. IONS (the International OSA Network of Students) is a program backed by the Optical Society of America (OSA) that encourages student chapters to organize and manage regional meetings which are focused on technical and professional development as well as on networking with peers and luminaries. The IONS conference ran for the first time at ICFO in 2007, came back to ICFO in 2009 and with IONS BCN'19 has returned once again after 10 years.

In addition to the keynotes by well-known leaders in the field and student talks, the program included an engaging panel with Carlos Abellán, co-founder and CEO of ICFO spin-off Quside, Luis José Salazar, Optics Payload & Operation Specialist at Aistech Space (both ICFO alumni), María Viñas, post-doc at the IO-CSIC in Madrid and OSA Ambassador 2019 and Simon Wall, ICFO Group Leader, all of whom shared insights into career opportunities after the PhD. Attendees also had the opportunity to visit the Barcelona Supercomputing Center as well as ESADE Business School for discussion on what an MBA after a PhD could do to leverage your career. On the final day, ICFO alumnus Danny Krautz offered encouraging insights into Zeiss' R+D policies and ventures.

With a majority of participants being students, questions and discussions flowed with a special freedom both inside and outside the auditorium. Not only was it stimulating to see the participation of students in the scientific discussions, it was also fantastic to see invited speakers joining the social events, where these renowned researchers were willing to interact with students and give advice both on science and professional careers, providing a forum to unwind and network.

IONS BCN '19 extended over four amazing days resulting in unforgettable memories.

It was a great experience for the ICONS organizing team, and we express our deep thank you to ICFO and everyone who made it happen.



"IONS BCN '19 has been a very refreshing event. I could present my work with ease, in front of people who are just like me. That was the best part of the conference, of course other than the social events! The punchline is that I got to make some wonderful new friends. Wonderfully organized. Thank you ICFO and OSA."

Surya Abhishek Singaraju
PhD student at the Karlsruhe
Institute of Technology

IONS BCN'19

- 80+ enthusiastic attendees (masters students to professors)
- Participants from over 15 countries
- 4 distinguished keynote speakers kicked off sessions
 - Lukas Novotny**
Nanophotonics
 - Eleni Diamanti**
Quantum Optics
 - Jenny Nelson**
Optical Devices
 - Viola Vogel**
Biophotonics
- 28 student talks
- Lively poster session

ICONS organizing team:

Pamina Winkler
Sarah Keary
Sandra de Vega
María Sanz Paz
Lisa Saemisch
Carlotta Ciancico
Natalia Alves
Vindhiya Prakash
Samyo Mukherjee
Robin Camphausen
Pili Pujol
Sukeert
Jana Ockova
Álvaro Rodríguez Echarri
Roland Terborg

"We are very happy to have The Optical Society's IONS conference hosted back at ICFO. This program provided nearly 100 student attendees from around the globe with the ability to share their research, build cross-collaboration relationships, and hone professional and technical skills needed to enhance their careers. The student organizers at ICFO have done a fantastic job shaping a program that cultivates the next generation of scientists!"

Terence Rooney
Manager of Students and Early
Career Professionals, OSA.

"Having been a PhD student for two years, it's easy to lose track of the broader photonics community. IONS was the perfect remedy - with diverse and high quality talks, food and sunshine, the atmosphere was ripe for open sharing of ideas and experimental techniques that transcend the different laboratories."

Jayadev Vijayan
PhD student at the Max Planck
Institute of Quantum Optics, Munich.

"IONS BCN '19 was a unique opportunity to try your talk and connect with amazing people all around the world, both students and professors. I would love to go once more and the biggest thanks to the organizers."

Kristýna Holanová
PhD student at the Institute of
Photonics and Electronics of the
Czech Academy of Sciences, Prague.

+INFO
ionsbcn19.osahost.org

TRAINING

Skills Training for ICFOnians at all Career Levels

Seminars and workshops aim to help ICFOnians make the most of their research careers and to prepare for a wide range of career options beyond ICFO.

#1

New ICFO Alumni Seminar series

The ICFO Alumni Network allows alumni to maintain and strengthen the personal and professional ties created while at ICFO, that will help all ICFOnians to “go and fly”, without losing common roots.

Apart from the social connections and the professional networking that facilitates growth for Alumni as they move into new or advanced careers, the Alumni Network also has established a platform that allows ICFOnians to continue to have a positive effect on the institute even after they have left. In this regard, one of the new programs initiated by the Alumni Network is a series of Alumni Seminars, in which remarkable alumni are invited to give a seminar about their work and to discuss their career path, sharing opportunities in their field, and offering advice about career development.

The first session of this series was held in April with ICFO alumna Roser Juanola-Parramon, researcher at NASA Goddard Space Flight Center and newly elected ICFO Alumni Representative, who talked about the next generation of space telescopes which will allow us to characterize new exoplanets. This was followed by a talk by entrepreneur alum Jon Donner about his company Nanofabrica, which brings the possibilities of 3D printing to precision manufacturing of components. The most recent instalment of this series was a talk by Roberto León, professor at the National Autonomous University of Mexico, who talked about his research on entangled photon spectroscopy, and shared his experience outside ICFO.



#2

Empowering Women in Science

On May 23-24, ICFO launched the first edition of a new training workshop: **Empowering women in science**: A workshop for women and men which was developed as part of an ongoing series of actions designed to support the research careers of outstanding talented young women at ICFO, such as the regular Women in Science lunches, and the María Yzuel Fellowship Awards.

Developed in partnership with Dr. Gavin Lucas, director of ThePaperMill, and Alicia Marín Muniesa, a consultant, coach and trainer with 18 years of experience, the workshop was designed to develop self-awareness, confidence and leadership skills, and explore themes of unconscious biases and self-limiting beliefs.

The workshop was attended by 10 women and 2 men, including PhD students, postdoctoral researchers and research engineers.



#3

BIST Science to Business Course:

Immersing researchers in the new venture creation process

The **From Science to Business** course created through a partnership between ICFO and ESADE Business School, has long been at the heart of the ICFO+ training and development program. Throughout its first five editions, the program evolved yearly to assure that the contents were suited to the needs of today's researchers in an ever-changing business landscape. Based on the success of the program, in 2016 the program moved under the BIST umbrella in order to expand its frontiers to incorporate researchers from the seven different research centers that comprise BIST.

The program, with its strong emphasis on entrepreneurship, is aimed at BIST researchers including senior researchers, postdoctoral fellows and last year doctoral students. It focuses on helping professionals in academia get acquainted with the business world, increasing their understanding of how companies work and create value in a competitive environment. Through this six day program, BIST scientists become familiar with the new venture creation process and the roles that science and technology play in it.

ICFO postdoctoral researcher Yu Bi was one of five ICFOnians to take part in the 2019 edition. She enthusiastically recommended the course, reflecting, *“As a researcher in academia, business used to be kind of the mysterious black box to me. This course gave me a great introduction to the business world. Within three intensive days, we got to learn how a company runs, survives and succeeds by employing innovation and strategy in its management and implementing a suitable business and financial plan. This course also tried to show us how to turn an idea into a start-up. I really liked the group project part, where we created a business plan to pitch our idea to an investor; we got to practice all the things we learned about business from the course.”*



#4

Resilience and Wellbeing for Researchers

On May 21 ICFO launched a new **Resilience & Well-being program** developed in partnership with OnBalance and designed to help researchers strengthening their capacity to face the different challenges involved in a competitive research career on a personal as well as intellectual level. The program was launched with a kick-off symposium on May 21st with Victoria Conesa, Director of OnBalance, who presented the results of a voluntary survey of the individual habits of ICFO researchers, followed by a briefing for the ICFO Group Leaders.

The program includes regular workshops designed to offer tools to help researchers improve their ability to respond to change and uncertainty, understand and practice techniques to improve emotional well-being, and develop healthy habits to minimize the consequences of stress, improve well-being, health and effectiveness. It also includes access to an individual coaching and counselling service for all ICFO researchers.



Save the date

Beyond ICFO 2019 Data Science

September 20

Data Science is offering business-oriented careers for professionals with scientific backgrounds. The field has attracted many ICFO Alumni. **Is it for you?**

Come hear from ICFO Alumni who will share their experience with a panel discussion which will be of interest to both current ICFOnians and Alumni.

Keynote Address:

Ángel Sánchez

Executive Vice President, Space Division, EVERIS

Alumni Panel Discussion with Q&A:

Igor Blanco, Tommaso Caneva,

Anna Kubasiak and Armand Niederberger

COLLABORATION

OUTREACH

International Day of Light

May 16th is the global recognition day for the central role that light and light-based technologies play in our lives



UNESCO declared May 16th the *International Day of Light*, an annual observance promoting the importance of light and light-based technologies in science, education and culture. To commemorate this event, partners around the world conduct a series of outreach and education activities on this day and throughout the month, with special focus on students, young people and the public at large.

The **Illuminating Education** conference, the flagship event for the International Day of Light, took place this year at the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, with presentations covering a wide range of topics, from inspiring science to practical career advice. ICFO's Dr. Federica Beduini from the Knowledge and Technology Transfer team, offered a talk on participatory science and the Big Bell Test, a worldwide citizen science experiment that led to over 100,000 people world-wide participating in state-of-the-art tests on quantum physics.



International Day of Light

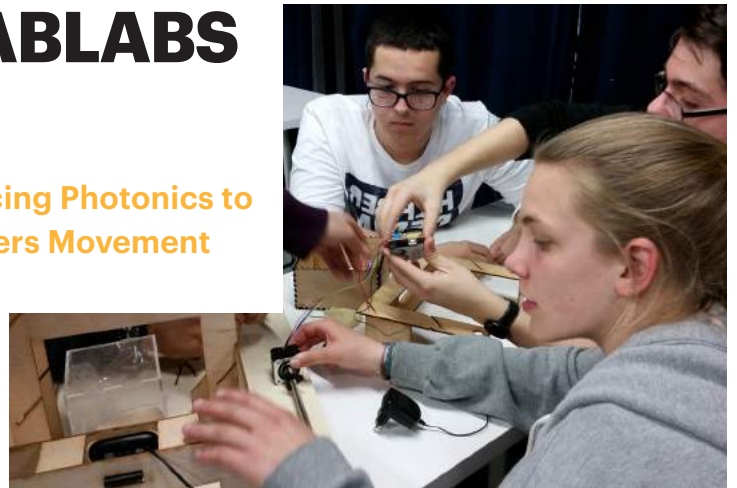
16 May

Back in Castelldefels, ICFO welcomed visitors to the institute to commemorate International Day of Light 2019, including a visit from INS Joan Puig i Ferrer from La Selva del Camp (Tarragona) on May 14th, where students toured the facilities and spoke with researchers. There was also an Open Day for the general public on May 17th.

OUTREACH

PHABLABS 4.0

Introducing Photonics to the Makers Movement



ICFO is a work package leader of PHABLABS 4.0, a EU Horizon 2020 project that has been carried out with 10 other research and technology centers and 14 Fab Lab organization for the last 30 months.

The project aimed to integrate photonics in European Fab Labs in order to engage, excite and educate young minds, students, technicians and young professionals about the fascination of working and innovating with light, thus building a trained workforce and giving them 21st century skills.

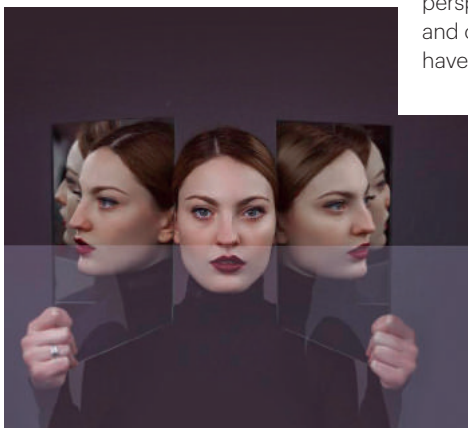
PHABLABS 4.0 has combined two major trends; on the one hand, the growing awareness of photonics as an important innovation driver and a key enabling technology for improvements in many areas of society, and on the other hand, the exploding network of vibrant Fab Labs where next-generation practical skills-based learning using KETs is core, but where photonics was lacking. PHABLABS 4.0 has brought together experts in partner photonics centers and Fab Labs, to develop, test and roll out "Photonics Workshops", "Photonics Challenger Projects" and "Toolkits for Photonics Enhanced Fab Labs" that stimulate hands-on design, fabrication, experiments, and building of innovative systems.

These efforts have resulted in 33 workshops and 11 photonics challenger projects that have been created and implemented with the participation of 3.104 participants at the EU level. Special efforts have been made on the gender equality front. The PHABLABS 4.0 consortium has worked with experts in the field from the WISE (Women in Science and Engineering) organisation to ensure a gender balanced approach, resulting in a guide directed to outreach activities organisers to gain the interest of girls and young women in science and technology, as well as the attendance of over 1,200 girls and women at the PHABLABS 4.0 activities.

www.phablabs.eu

OUTREACH

ICFO Participation in Exhibitions in Barcelona



Espejos

CosmoCaixa through January 31, 2020

Espejos is an imaginative way of showing that reality can be observed from different perspectives. Shifting perspectives favors a scientific mindset and can also change the perception we have of our environment. In this exhibit, visitors can discover the important role that mirrors play in different spheres of science, culture and life in general.

Two of the modules you will find in the exhibit, the Schlieren camera and the Michelson interferometer, are the result of the collaboration between CosmoCaixa and ICFO.

www.cosmocaixa.es

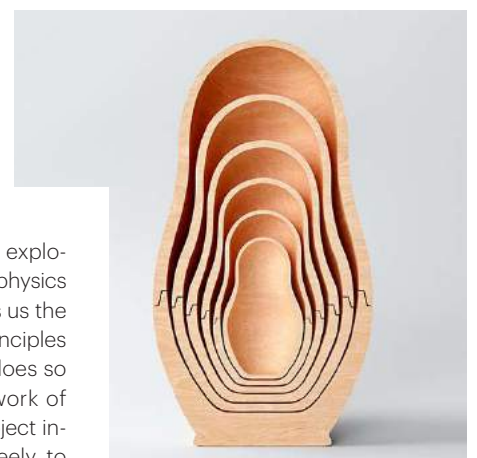
Quantum

CCCB- Centre de Cultura Contemporània de Barcelona through September 24, 2019

Quantum - an exhibition that explores the influence of quantum physics on our everyday lives. It gives us the keys to understanding the principles of quantum physics, and it does so through the joint creative work of scientists and artists. The project invites the public to browse freely, to awaken their curiosity, and to critically evaluate the new paradigms of modern science.

In the section dedicated to randomness, you can find the quantum random number generator developed by QuSide, one of the latest ICFO spin-off companies. Moreover, many ICFOians have participated in the activities related to the exhibit, such as scientific debates, talk and activities for families.

www.cccb.org/en/exhibitions/file/quantum



GO & FLY

192 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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April 12, 2019

SENAIDA HERNANDEZ SANTANA

"Local Temperature and correlations in Quantum Many-Body Systems"

TD: ICREA Prof. Dr. Antonio Acin



185

April 15, 2019

DAVID RAVENTÓS RIBERA

"Exact Diagonalization Studies of Quantum Simulators"

TD: ICREA Prof. Dr. Maciej Lewenstein and Dr. Bruno Julia



186

April 16, 2019

PETER SCHMIDT

"Exploring Intersubbands in 2D Materials"

TD: ICREA Prof. Dr. Frank Koppens



187

April 29, 2019

CALLUM O'DONNELL

"Novel Femtosecond Optical Parametric Oscillators in the Infrared"

TD: ICREA Prof. Dr. Majid Ebrahim Zadeh and Dr. Chaitanya K. Suddapalli



188

May 2, 2019

LUCIANA VIDAS

"The Insulator-Metal Phase Transition in VO₂ Measured at Nanometer Length Scales and Femtosecond Time Scales"

TD: Prof. Dr. Simon Wall



189

May 3, 2019

HANYU YE

"Novel Pulsed Optical Parametric Sources in the Mid-Infrared and the Application Towards High-Resolution Molecular Spectroscopy"

TD: ICREA Prof. Dr. Majid Ebrahim Zadeh and Dr. Chaitanya K. Suddapalli



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May 10, 2019

TANJA DRAGOJEVIC

"Translation Of Speckle Contrast Optical Techniques From Bench-Top To In Vivo Applications"

TD: ICREA Prof. Dr. Turgut Durduran and Dr. Joseph Lee Hollmann



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May 17, 2019

FLAVIO BACCARI

"Certification of Many-Body Systems"

TD: ICREA Prof. Dr. Antonio Acin



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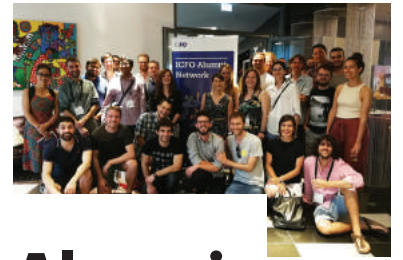
June 4, 2019

MARTINA GIOVANNELLA

"Hybrid Diffuse Optical Neuromonitoring of Cerebral Haemodynamics: From the Smallest Premature born Infants to Adults"

TD: ICREA Prof. Dr. Turgut Durduran and Dr. Udo Weigel

BEYOND ICFO



Alumni Networking at CLEO Europe

Industry conference unites ICFONIANS from around the world

The ICFO Alumni Network aims to provide a platform that allows ICFONIANS to continue to network both socially and professionally even after their careers have taken them away from the institute. By maintaining the relationships built at ICFO, both alumni and the institute are able to strengthen the reach of their work by drawing on the resources of the network.

Taking advantage of major industry conferences that typically attract both current and former ICFO researchers, the Alumni Network organizes Alumni Drinks events, the most recent of which took place on June 26th in **Munich in the framework of CLEO Europe**. This event brought together over thirty conference attendees, both current ICFONIANS and Alumni, as well as Alumni currently living and working both in industry and academia in Germany.

ICFONIANS live, work and travel to all corners of the globe, and notably attend conferences for experts in the field. The Alumni Network is actively reaching out to all Alumni to ensure that all are aware of these opportunities to stay in touch. If you are an alum and you are not receiving information about the Network and its activities, please contact us at contact@alumni.icfo.eu. Likewise, if you know of events where many ICFONIANS will gather, let us know so that we can create a new opportunity to get together!

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 obtained his private pilot's license before his driver's license.
2. He likes to make videos with drones.
3. He is a member of a professional racing team in the eSports division.

4. He is the current Acrobatic Aeromodelling Champion in Spain, and in the European TOP10.

THE LAST WORD

HIGH PROFILE

Dusan Pejakovic

Science Program Director at the Gordon and Betty Moore Foundation

Dr. Pejakovic leads the Moore Foundation's Emergent Phenomena in Quantum Systems Initiative, which seeks to advance knowledge of the fundamental organizing principles of complex quantum matter in solid materials. In addition, he develops and manages grant projects in physics, astronomy, earth science and sustainability science.

Directing a grantmaking program for a major institution in scientific philanthropy sounds fascinating. What motivated you to take this path?

Indeed, a career in science philanthropy is incredibly exciting! Prior to joining the Moore Foundation, I had spent about fifteen years doing basic research. While research had many rewards, I had to focus on a narrow range of problems within my fields of expertise, which is the case with every practicing scientist. But my scientific interests have always been very broad, and I saw a position in science philanthropy as a unique opportunity to satisfy my curiosity while making an impact across diverse scientific disciplines.

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

The foundation strives to create truly significant and lasting positive outcomes within its programmatic areas of interest. Not only are these programmatic themes well chosen, but the foundation's funding approach makes so much sense to me. Our founders stipulate that, to achieve our mission, we should make strategic funding plans through a systematic, almost scientific approach, based on thorough research of programmatic and funding landscapes. This style of



"Focus on curiosity-driven research is a good niche for our Science Program because this research is often underappreciated by other funders. We also know that curiosity-driven research actually has a great track record in producing new technologies."

Why does the Moore Foundation invest in basic discovery driven research versus new technologies that may potentially have a more immediate effect on society?

Naturally, we appreciate the societal importance of new technologies and try to be well informed about developments on that front. Focus on curiosity-driven research is a good niche for our Science Program because this research is often underappreciated by other funders. We also know that curiosity-driven research actually has a great track record in producing new technologies! In the physics of materials, famous examples of completely serendipitous discoveries that eventually led to transformative technologies are superconductors, liquid crystals and conducting polymers. At the time these materials were discovered, it was hard to predict that they would have such a tremendous technological impact.

What criteria does the Moore Foundation use for selecting the basic science projects they support?

First, we select projects of high importance. Projects that we fund are typically very ambitious and, if successful, may change entire fields of research or even open new fields. Second, and equally important, we want to assure that our funding is making a significant and measurable difference for the projects and research teams that we support. Thus, we often fund projects at a very early stage or fill key funding gaps in large projects. We can greatly accelerate the pace of research by taking risks, acting quickly, and allowing creative scientists considerable freedom in their investigations.

grantmaking allows us to design innovative and highly effective funding programs. The foundation's inspiring goals and the opportunity to express my creativity through strategic grantmaking present a perfect combination for me.

What type of societal impact does the Moore Foundation seek to have through the Emergent Phenomena in Quantum Systems Initiative?

In solid materials, many billions of interacting quantum particles conspire to create an entire universe of complexity. The discovery and investigation of materials are a great intellectual adventure that deepens our understanding of how the universe works. The history of physics teaches us that new knowledge about the organizing principles of matter in solids often impacts other fields, such as high-energy physics, astrophysics, and quantum information science. In addition to supporting the pure joy of learning about the hidden quantum world, we hope that new materials and better understanding of what goes on in materials will lead to the development of devices and technologies that have great practical value.

Science Quiz

Go, fly, and lead the quantum revolution!



Christine Muschik
Institute for Quantum Computing, University of Waterloo



Ana Asenjo-García
Columbia University



Margherita Mazzera
Heriot-Watt University



Jia Kong
Hangzhou Dianzi University

Recently these ICFOnians were ICFO post-docs, now they are assistant professors. Who published which article?

- A) 'Real-time dynamics of lattice gauge theories with a few-qubit quantum computer'
- B) 'Cavity quantum electrodynamics with atom-like mirrors'
- C) 'Measurement-induced nonlocal entanglement in a hot, strongly-interacting atomic system'
- D) 'Laser-written integrated platform for quantum storage of heralded single photons'

* Find answers on pg. 2

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