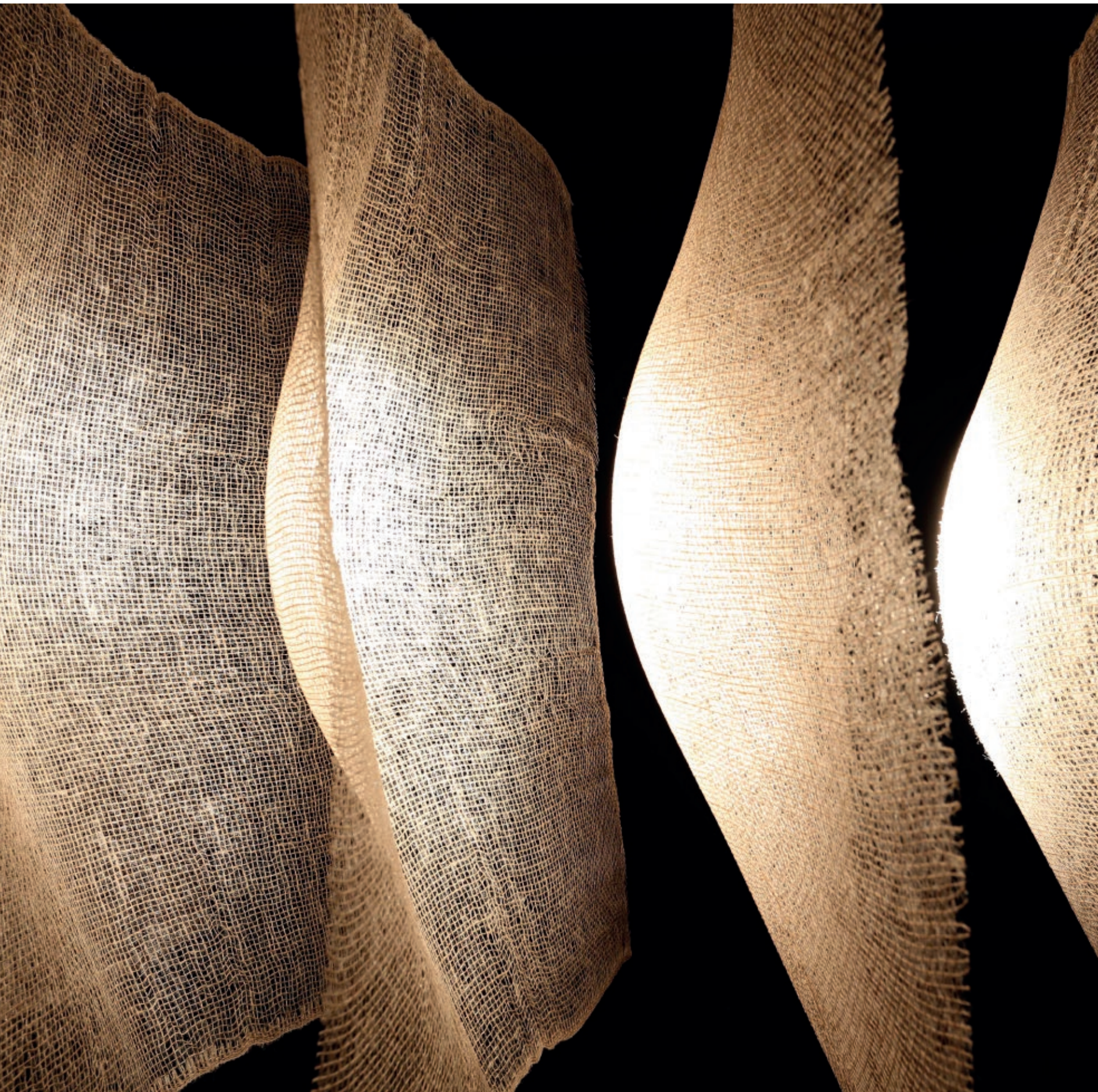
INTERNATIONAL YEAR OF LIGHT 2015

SUMMER 2015

ICFOnians 24

Community News from the Institut de Ciències Fotòniques



EDITOR'S CORNER

Summer Solstice

Brook Hardwick
Coordinating Editor

Around the world and throughout history, the Summer Solstice has been celebrated as the high point of summer- the moment when the sun is at its furthest point from the equator. In the absence of scientific methods for measuring time and planning for survival, our ancestors kept a close eye on the sun, the moon, the stars, the seasons, and patterns of nature. Increased awareness of these patterns gradually gave rise to pagan rituals, many of which, like *Sant Joan,* which is celebrated throughout Catalonia on the 24th June, were eventually incorporated into modern religious traditions, moving away from the original impetuses. In Catalonia we build bonfires and light fireworks, however there is also a strong Celtic and Slavic tradition which entails dancing around bonfires to help increase the sun's energy. In China, they honour Li, the Chinese Goddess of Light. The importance of energy, light and renovation was clear in the minds of all our ancestors who celebrated the Summer Solstice.

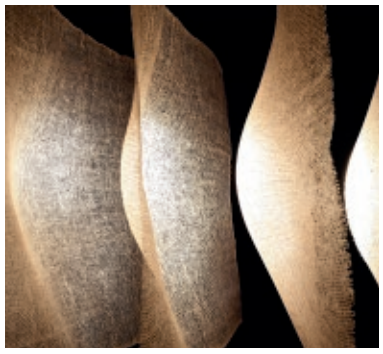
Interestingly, cultures are built on layers of new knowledge and ways of understanding the world. While it was once deemed necessary to sacrifice to the gods for a good harvest, fertilizers, genetic engineering and all kinds of "know-how" now help to assure healthy crops (even if we still enjoy the traditional dancing around the bonfire!) Society in general is advancing thanks to new knowledge. At ICFO, we are also constantly working to uncover new truths with an eye for scientific excellence that will propel society to new heights. We aim to be seen as a reference in our field.

In this edition of ICFOnians, there are several examples of ICFO's push to find better and more productive ways of working. One example is ICFO's participation in the new Barcelona Institute of Science and Technology, an ambitious initiative that brings together six research centres in Catalonia known internationally for scientific excellence. *BIST,* as some are already calling it, aims to "launch more transversal scientific projects and to achieve greater international competitiveness". Individually, all the institutes involved strive for and are achieving recognition for scientific excellence. The progress we will make together by combining forces will be extremely exciting.

Looking around ICFO laboratories or browsing our publications lists, you will find many more examples of our constant push for excellence. (See *Latest Advances* on pg.4). We regularly publish highlights on scientific developments, however we rarely stop to examine the institute behind the science. This edition highlights achievements from the administrative areas of ICFO who strive to ensure that the interaction between the management and research areas is constant and fluid, creating the most positive and productive working environment so that science can flourish. The goal is to not only attract top global talent (the HR Excellence in Research Award) but also to provide the best possible facilities in which they can produce excellent scientific results (OHSAS 18001 certification in the area of Safety).

Read on!! You will find many more examples of ICFOnians hard at work to our own mark on our world!!

COVER



Word from the artist: My "Light Matter" work is about imagination- of what could be. What would happen if the world were different? What if light had the force to move things so much that it affected our everyday lives? For more than a year I have been collaborating with ICFO, visiting labs, talking with scientists and sneaking into seminars on the back row. I have come to realise that my work and that of the scientists has many similarities- the ability to ask the question "What if?" and to be able to keep an open mind to possible answers that at first seem to make no sense.- Andrew Chappel

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Brook Hardwick, Corporate Communications Head

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Dolors Mateu, ICFO Manager
Silvia Carrasco, Knowledge & Technology Transfer Director
Laia Miralles, HR and Education Head
Valerio Pruneri, Group Leader, Optoelectronics
Rob Sewell, Coordinator of Academic Programs
Alina Hirschmann, Communications

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Andrew Chappel, Artist
Laia Miralles, HR and Education Head
Míriam Martí, Outreach, KTT
Rafael Yuste, Neurotechnology Center, Columbia University

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INTERNATIONAL YEAR OF LIGHT 2015

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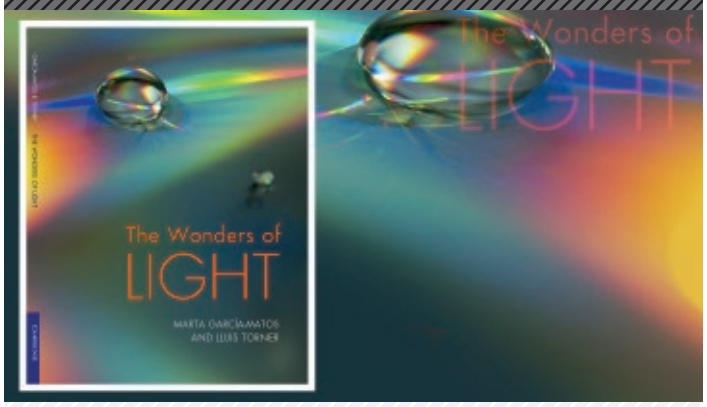
ICFO NEWS



THE WONDERS OF LIGHT

ICFO and Cambridge University Press announce the launch of The Wonders of Light, a book that dives into the realm of photonics enabling the reader to see, learn and discover the amazing things that light is capable of accomplishing. Written by Marta García-Matos from ICFO's KTT team and ICFO's director, Lluís Torner, *The Wonders of Light* aims to show how light-based technologies are ushering in solutions for some of the major challenges faced by humankind. It is a highly visual book with a modern, eye-catching design, and with simple explanations of high-tech, advanced scientific concepts explained in a gentle, literary style.

BARCELONA INSTITUTE OF SCIENCE AND TECHNOLOGY

Six of the top research centres in Catalonia have taken a step forward in their collaboration by setting up The Barcelona Institute of Science and Technology. The centres involved are: the Centre for Genomic Regulation (CRG); the Institute of Chemical Research of Catalonia (ICIQ); the Catalan Institute for Nanoscience and Nanotechnology (ICN2); the Institute of Photonic Sciences (ICFO); the High Energy Physics Institute (IFAE); and the Institute for Research in Biomedicine (IRB Barcelona). The Barcelona Institute is a scientific initiative that seeks to foster interdisciplinary research, to leverage its scientific impact, and to position itself among the leading European institutions. The Board of Trustees is Chaired by Rolf Tarrach, and is comprised of prestigious members of the scientific community, including Joan Massagué (Sloan Kettering Institute), Ignacio Cirac (Max Planck Institute), Miquel Salmeron (UC Berkeley) and Sergi Verdú (Princeton University) as well as five private foundations which support the institute, including La Caixa Foundation (Jaume Giró- Vice Chair), the Banc Sabadell Foundation (Miquel Molins), the Catalunya-La Pedrera Foundation (Germán Ramón-Cortés), the Cellex Foundation (Jordi Segarra), and the Femcat Foundation (David Nogareda). The Government of Catalonia also belongs to the Board of Trustees, represented by Minister Andreu Mas-Colell. The Institute will promote joint research strategies, transfer of technology, and graduate programs.

ERC ADVANCED GRANT

The European Research Council (ERC) has awarded ICREA Professor at ICFO Niek van Hulst his second Advanced Grant award to pursue his project LightNet ("Tracking the Coherent Light Path in Photosynthetic Networks"). In 2009, Prof. van Hulst was awarded his first ERC Advanced Grant, which made possible the "Nano-Optical Antennas for Tunable Single Photon Super-Emitters" project. This year is the first Advanced Grant competition under the 'excellent science' pillar of Horizon 2020, in which 190 grants were awarded to senior research leaders from 2287 applications received.

FRESNEL PRIZE

The Fresnel Prize, awarded by the QEOD division of the European Physics Society, recognizes the highest level of excellence amongst emerging researchers, under the age of 35, in the field of photonics. At an award ceremony at the CLEO Europe –EQEC conference in Munich, ICFO Alumnus Tim Taminiau was awarded the Fresnel Prize for fundamental advances for his fundamental contributions to nano-optics and quantum information science through the control of solid-state quantum emitters and spins.

ICFO NEWCOMERS

Nicola Palombo
PhD Student

María A. Padrón
PhD Student

Emanuele Tirrito
PhD Student

Diana Rueda Delgado
EMJD PhD Student

Simon Hurand
Postdoc Researcher

Josep Canet Ferrer
Postdoc Researcher

Andreas Lenhard
Postdoc Researcher

Francesca Cella
Postdoc Researcher

Óscar Vázquez Mena
Postdoc Researcher

Manabendra Nath Bera
Postdoc Researcher

Luis Miguel Fidalgo
Research Engineer

Philipp del Hougne
Research Engineer

Emilio J. Gualda
Postdoc Researcher

Esther Gellings
PhD Student

Juan Rombaut Segarra
Undergraduate Student

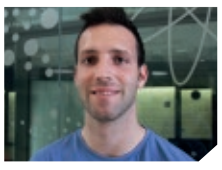
Ugaitz Elu Etxano
Postgraduate Student

Mohamed Hamed
Postgraduate Student

Niklas Gerdes
Postgraduate Student

Vincent Turgeon
Undergraduate Student

Irene Alda Ferrero
Postgraduate Student



Joaquín Guimbao
Postgraduate Student

Klaudia Golos
Undergraduate Student

Eric Dilcher
Undergraduate Student

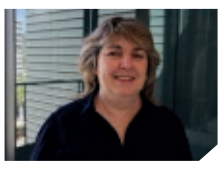
Anil Rizaoglu
Undergraduate Student

Christine Payne
Visiting Scientist

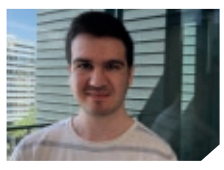
Victoire Neguembor
Visiting Scientist

Sara Bottes
Visiting Scientist

Leszek Kaczmarek
Visiting Scientist



Sabina Semeraro
Research Administration Support

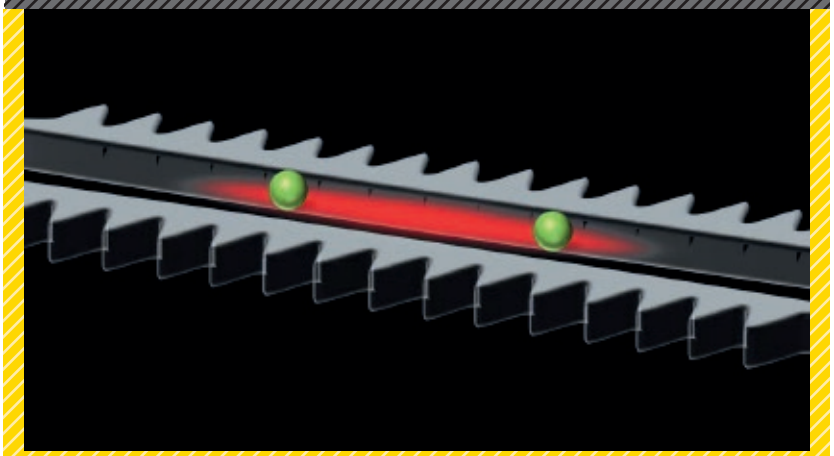


Albert Aloy López
Undergraduate Student

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

Welcome to ICFO!

LATEST ADVANCES



A NEW QUANTUM MATERIAL

ICFO researchers in the group led by Prof. Darrick Chang, in collaboration with scientists at Caltech and the Max Planck Institute for Quantum Optics, have proposed a novel way to realize strong long-range interactions between atomic spins, motion, and photons. This rich interplay between many degrees of freedom is made possible by coupling cold atoms to photonic crystals, and taking advantage of the ability to significantly alter the way that light propagates in these structures. Their work appears in two back-to-back papers in *Nature Photonics*. In one paper, the researchers propose the existence of this unique quantum material in already-existing one-dimensional waveguide systems. A second paper investigates the possibility of realizing this physics in two-dimensional photonic crystal membranes. The ability to achieve simultaneous strong and long-range coupling between spins, phonons, and photons is unprecedented. It is expected that this system should lead to many exciting and unexpected phenomena in the next few years, also providing novel routes toward the exploration of many-body physics and quantum information processing with atomic systems.

GRAPHENE SPEEDS UP LIGHT-TO-ELECTRICITY CONVERSION

Researchers in the groups led by ICFO Professors Niek van Hulst and Frank Koppens, in collaboration with scientists from MIT and UC Riverside, have demonstrated a graphene-based photodetector that converts absorbed light into an electrical voltage at extremely high speeds. The new device is capable of converting light into electricity in less than 50 femtoseconds (a twentieth of a millionth of a millionth of a second). To demonstrate this, researchers used a combination of ultrafast pulse-shaped laser excitation and highly sensitive electrical readout. This work, which has been partially funded by the EC Graphene Flagship, opens a new pathway towards ultra-fast optoelectronic conversion. The study was published in *Nature Nanotechnology*.

STRONG-FIELD PHYSICS WITH MID-IR FIELDS

In a paper published in *PRX* and highlighted in *APS Physics*, researchers in the group led by ICFO Prof. Jens Biegert investigate atomic and molecular structure using a unique combination of a mid-infrared laser source with a 3D detector. The authors study ionization in the strong-field regime, in which the laser pulse distorts the electric field of the atom, allowing an electron to tunnel into the vacuum. The emitted electron accelerates within the strong electric field of the laser before recolliding with its parent ion and either recombining or scattering. Compared to shorter-wavelength pulses, mid-infrared pulses lead to unambiguous conditions in which electrons tunnel at much lower intensities. The electric fields of longer-wavelength lasers also accelerate the electrons for more time, which results in a quadratic increase in the electron energy. This provides the ability to probe nuclear rather than electronic structure at unprecedented resolutions.

THOUSANDS OF NANOANTENNAS TO ENLIGHTEN LIVING CELLS

A recent collaboration between ICFO researchers led by Prof. Maria García-Parajo with researchers at EPFL has succeeded in fabricating hundreds of thousands of photonic antennas to measure for the first time the nanoscale dynamics of individual molecules in living cells. The work, supported by EU project NanoVista, was published in *Nano Letters* and establishes that thru-stencil etching of metal nanostructures represents a cost-effective and scalable alternative for the fabrication of large arrays of photonic antennas fully compatible with life science applications. Researchers foresee that these engineered substrates could become inexpensive, powerful tools to investigate the plasma membrane of living cells with nanoscale resolution at endogenous expression levels.

BUSINESS NEWS

Bringing technological innovations to market

The Generalitat de Catalunya has announced the results of a call to provide seed funding for innovative projects with market potential in the early stages of technological maturity. The two ICFO proposals that received funding were:

- Professor Jens Biegert: Table-top Synchrotron Laser Driver
- Professors Valerio Pruneri & Morgan Mitchell: Quantum Random Number Generator for the Consumer Market

Clearly aiming to help ensure that new knowledge and technologies produced in research centres in Catalonia are translated into economic growth for society, this financing will assist scientists in the early stages of commercialization of new technologies, generating business models, conducting commercial and technological feasibility analysis, designing concept testing, etc. The aid includes a training program hosted by UC Berkeley for the development of innovative projects, aiming to strengthen the process of teamwork and provide entrepreneurial insights. In parallel, there will be a local training program including a business mentor that will assure that each team makes qualitative steps forward in their ability to make strategic evaluations of new technologies, acquiring new skills applicable to future developments and opportunities. The *LLAVOR* (Seed) program is partially funded by the Regional European Development Fund administered by GenCat.

Both projects, along with five other initiatives, are currently under incubation in ICFO's KTT LaunchPad, a space and support structure which allows innovative ideas to develop into new technology spin-offs.

Join us in celebrating the 10th bright anniversary of ICFO's spin-off Radiantis. Happy birthday!

THE FOUNDERS OF RADIANTIS: ICREA Professor at ICFO Dr. **Majid Ebrahim-Zadeh** (President and Chief Scientist) and Dr. **Sara Otero** (Chief Executive Officer).

+ INFO ▸ www.radiantis.com

INSTITUTIONAL EXCELLENCE

PHOTO:
Human Resources and Education team *(left to right)* **Manuela Furkert, Cristina García, Anne Gstöttner, Mireia Vilamala, Laia Miralles** *(missing Mery Gil).*

Distinctions for ICFO Management

Behind ICFO's frontier research is a support structure dedicated to achieving world-class working conditions and attracting top global talent.

From its earliest days, ICFO has sought to operate as one of the top research institutes in the world, acting as a resource for science, technology and talent and providing its researchers with unique skills to become successful and independent future leaders, both in the academic and industrial worlds. In building the institute, the founders purposefully established a structure which offered researchers extended administrative support and a working environment that encouraged the focus on landmark research.

Today, ICFO Administrative Units continuously work to achieve an objective of excellence in all areas of institutional management, thus playing a central role in the scientific achievements of ICFO.

MANAGING HUMAN RESOURCES

The European Commission, in an effort to enhance the attractiveness of European research careers, launched the EURAXESS Rights initiative aiming at better employment and working conditions for researchers throughout Europe. One of the cornerstones of EURAXESS Rights is the implementation of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. The Human Resources Strategy for Researchers (HRS4R) supports the implementation of the "Charter & Code" principles and provides for the award of the '**HR Excellence in Research'** *logo to give public recognition to research institutions that have made progress in aligning their human resource policies with these principles.*

ICFO officially endorsed the Charter and Code in January 2014, creating a Core Committee to perform an internal analysis, involving key-players. This Committee established a framework and a detailed action plan for the implementation of the HRS4R @ ICFO, which was approved by the EC in April 2015.

With this approval, the institute has been granted the "HR Excellence in Research" award, to help promote itself as a provider of a stimulating and favorable work environment, as well as to highlight its commitment to implement fair and transparent recruitment and appraisal procedures for researchers.

As part of implementation of the HRS4R at ICFO, the Human Resources and Education Unit is carrying out the established action plan addressing the following strategic objectives:

- Continuous enhancement of the **Recruiting & Hiring Life-Cycle** to increasing the number of outstanding candidates for research positions, as well as to improve their hiring/onboarding experience.
- Continuous enhancement of the **Career Development Plan**, offering the best opportunities for personal and professional growth and boosting future careers both in the industrial and academic worlds.
- Continuous enhancement of **Best Practices in Research** at all levels, thereby assuring established ethical principles for each discipline and focusing research for the good of humankind and the expansion of the frontiers of scientific knowledge.
- Continuous enhancement of the **Research Environment** with the aim of providing the healthiest, safest, most supportive, respectful, equitable, inclusive, stable, competitive and stimulating environment, thus providing the best possible conditions for top world-renowned research.
- Continuous improvement of the **Information Channels and Admin Work-flows** with the aim of ensuring that researcher's access to information is reliable, professional, and user-friendly, with optimized admin procedures making them time-, cost- and environmentally efficient.

SAFETY AT ICFO

With the aim of providing the healthiest and safest possible environment and thus the best possible conditions for top world-renowned research, a new unit dedicate to Occupational Safety and Biosafety (OS&B) has been established at ICFO, led Sergi Beltrán.

The first order of business for this unit is the implementation of the ambitious Occupational Health and Safety Management Systems (officially *BS OHSAS 18001*). Very few research centers in the world are OHSAS certified and ICFO's progress in this area marks an important distinction for the institute.

This system, which goes far beyond the standards set by the EU Directives in establishing the legal obligations on safety, is based on a continuous improvement process. To begin, ICFO has undergone a meticulous internal assessment by which ICFO has set goals, defined a policy of health and safety as well as an internal organization adequate to our needs. OS&B has created a management manual in which the roles and functions of all ICFOnians have been defined within the system, as well as rights and obligations in relation to occupational health. There are now set procedures governing the safety requirements to be applied in different phases of daily operations (works with laser, chemical, maternity protection, biohazard protection, training, etc.)

All of these steps are part of the process of demonstrating OHSAS compliance, which, with the cooperation and involvement of all ICFOnians, will eventually lead to OHSAS certification and a constant improvement of working conditions.

OUTREACH

Light Activities for All

The International Year of Light continues to provide the Knowledge and Technology Unit at ICFO with new forums and opportunities for spreading the message of the ubiquity and importance of light and light based technologies. Through collaborations with museums, artists, cultural centers, universities, as well as the Town Hall of Barcelona, to name a few, ICFO continues to deliver creative explanations and demonstrations of the enabling power of light to new audiences. Here is a recap of the most recent activities.

ART+SCIENCE= NEW PERSPECTIVES

MARCH 2015

ICFO participated in the 2nd edition of the Kosmopolis festival at CCCB (Centre de Cultura Contemporània de Barcelona), with a unique quantum cryptography workshop for all audiences.

TOUCH THE LIGHT

APRIL 2015

Cosmocaixa, the Science Museum of Barcelona, launched *Toca la Llum!* (Touch the Light!), a photonics workshop created and developed by ICFO, which will now be included in the museum's regular weekly program.

LIVE RESEARCH FOR HIGH SCHOOLERS

APRIL 2015

Members of the Quantum Information Theory and Optoelectronics research groups at ICFO explained their research on ultra-secure communications to high school students at the *"Fira Recerca en Directe"* (Live Research Fair") at Cosmocaixa.

LIGHTTALK: CAREERS IN PHOTONICS

APRIL 2015

As part of the GoPhoton! project, ICFO organized a special event at the Universitat Politècnica de Catalunya · Barcelona Tech in which over 120 university students gathered to learn what it would be like to work in the field of Photonics.

PULL&PUSH: A WORLD MOVED BY LIGHT

APRIL-JULY 2015

In the Espai Cultura Fundació Sabadell, the artist Andrew Chappel and ICFO inaugurated an exhibition featuring five different artworks which is scheduled to run from April 16 to July 26, 2015. The art represents possible scenarios in our world that are consequences of the interaction of light with matter.

SCIENCE, TECHNOLOGY AND INNOVATION

APRIL 2015

NOVUM is Barcelona's city-wide Festival of Science, Technology and Innovation in which ICFO participated with a Light Painting activity offered by ICFO's Student Association, ICONS. Other activities dedicated to the topic of Outreach in Light took place in Mataró, where ICFO took part in the XII Mataró Scientific Fair, and in Girona, Ciència entre tots ("Science for Everyone") in which Pol Via, Hiroki Mamine, Albert Pumarola and Mrityunjaya Nebhwani, the creators of "Bob", presented "Bob the Photonic Robot".

MAY THE FORCE BE WITH YOU

APRIL 2015

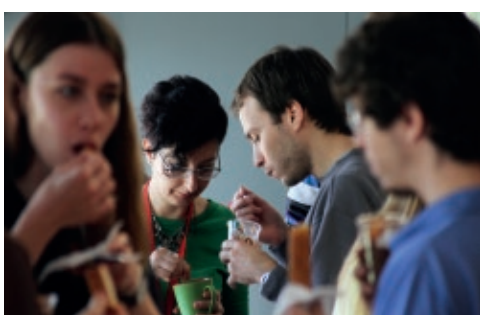
Andrew Chappel and ICFO's Dr Marta García-Matos participate in *Lates*, a free night for Adults at London's Science Museum, with a joint talk about the force of light, combining a presentation of Andrew's art with Marta's insights into the physical properties of light.

IMPERIAL FEST

MAY 2015

ICFO participated in the GoPhoton! Splash at Imperial College in London leading the light painting activity at the "Imperial Fest".

COMMUNITY PICTURES Sant Jordi



BEYOND ICFO

Igor Blanco & Taisuke Minagawa

Igor and Taisuke coincided as researchers in the Medical Optics group at ICFO led by Prof. Turgut Durduran. They are now both working as Data Scientists at Accenture. They share their "beyond ICFO" experience with ICFOnians.

Was it difficult to transition from ICFO to industry?

IGOR: Before starting my PhD I was working as a risk analyst. I decided to come to ICFO because I concluded that by getting a PhD I was doing something I liked that also could be thought as a tactical movement to gain long term competitiveness.
I wanted to get the best education, covering my field of interest (Medical Optics) but also gaining awareness of the progress in other areas of Photonics and Physics in general. I knew I would not follow an academic career so my transition back to industry was quite normal and I'm very happy with the choices I have made. In relation to this point I must admit that Taisuke gave me excellent feedback of the work in Analytics.

TAI: My postdoctoral work in medical optics at ICFO had nothing to do with my Ph.D. work in condensed matter physics. Having already made one big transition to a new environment with a completely new area of work, the transition from academia to industry was not so difficult for me.

So- what's it like at Accenture?

IGOR: I was pleasantly surprised that all my new colleagues have strong scientific background: engineers, mathematicians, physicists… Furthermore, a considerable number of them hold PhD degrees and have worked for years in academia as postdocs or research fellows. In other words, although I was no longer working in academia I found myself quite comfortable with my new colleagues.

TAI: I had been in science for so long, I was concerned that I would have a hard time contributing "outside", but working in industry is more or less the same for me as working in academia. It is also quite result oriented, and the deadline is still the day of judgement. There are some differences, for example, in consultancy, we must talk to clients, make last minutes trips to Africa and have awkward dinner with strangers. I never did any of these things in academia, but I kind of like to do them!

Any recommendations for ICFOnians interested in consultancy?

IGOR: I am sure that all ICFOnians have developed top algorithms and/or fantastic programming skills. Nevertheless, for those who haven't used this language yet I humbly recommend that you learn R since is probably the most popular language for statistics used in industry (Data Science) nowadays. I got this suggestion while at ICFO and it turned out to be very good advice. Thanks Turgut!

Would I make a good consultant?

TAI: If you like a fast working environment where you don't have time to get bored, consultancy might be a good place to start. People who hesitate to talk to strangers or hate coding may not do so well there. From day one, you will talk talk talk and code code code. (I knew Igor would be successful in our office, since he is a good speaker/talker/coder)!
The PhD program trains you to be a consultant: You are trained to explain very complex studies in a simple way, and this is very useful here. You are very motivated to learn new things. You are a logical thinker. You always work in a group and know how to take part in a big project. Another plus- you won't work on the weekend, although you will probably feel guilty about it sometimes.

> *"... Although I was no longer working in academia I found myself quite comfortable with my new colleagues."*
> *Igor Blanco*

> *"The PhD program trains you to be a consultant: You are trained to explain very complex studies in a simple way, and this is very useful here."*
> *Taisuke Minagawa*

GO & FLY

98 women and men have successfully defended their theses at ICFO since its founding in 2002 and have helped us to measure what we have learned, how far we have come, and how much we have yet to learn. These ICFOnians have recently succeeded in defending their PhD Theses. Honoring ICFO's tradition, ICFOnians gather together 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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NAEIMEH BEHBOOD

Generation of Macroscopic Spin Singlets in Cold Atomic Ensembles
TD: ICREA Prof. at ICFO Dr. **Morgan Mitchell**

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May 18 2015

NADIA FORMICA

Mechanically Flexible Transparent Conductors based on Ultrathin Metallic Layers
TD: ICREA Prof. at ICFO Dr. **Valerio Pruneri** and Prof. **Uli Lemmer**

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May 22 2015

CARMELO ROSALES

Photonic applications based on the use of structured light
TD: Prof. Dr. **Juan P.Torres**

HIGH PROFILE

Rafael Yuste:

"Trying to understand the brain by probing it one neuron at a time is like trying to watch a movie one pixel at a time"

RAFAEL YUSTE moved from practicing medicine to pioneering new optical methods which are helping scientists to uncover some of the mysteries of the functioning of the brain.

What moved you away from clinical medicine and into an interdisciplinary research role?

I was always interested in research, even before medical school. The Hospital Fundación Jiménez Díaz in Madrid where I worked while studying medicine is a bright point in the map for scientific and clinical research and I received a lot of support and encouragement there. It was while treating neurological and psychiatry patients there that I decided to switch to basic neuroscience research to try to understand how the brain works so that one day someone else could use that knowledge to better treat their diseases. Just a few weeks after graduating from medical school in Madrid, I started my PhD in the US.

How are advancements of optical methods coupled to the understanding of brain activity?

Trying to understand the brain by probing it one neuron at a time is like trying to watch a movie one pixel at a time. Just as an image depends on interaction between many pixels, the brain likely is building functional states that depend on the interaction of many neurons. If neurons are properly labelled or stained, you can noninvasively take images of all the activities of neurons in a particular field of view using optical methods. As a graduate student I developed the calcium imaging method using fluorescent calcium indicators to measure neuronal activity. Now we do this in-vivo in animals like mice by taking pictures as a function of time of the fluorescence of labelled neurons with tools like 2 photon microscopes. We can actually see neurons change their fluorescence as they fire, letting us visualize the activity of entire neuronal circuits.

Can you tell us about the birth of your involvement in the Brain Activity Map Project?

As a post-doc with Denk, we introduced two- photon microscopy into neuroscience as a tool to better image neuronal activity deep in brain tissue. Later in my own lab at Columbia we expanded these types of approaches incorporating holographic microscopy methods, optochemistry and optogenetics to activate or inactivate neurons using light.

Now we are building a whole platform of optical techniques to not just capture the activity of neuronal circuits, but to alter and manipulate them. This was at the heart of our Brain Activity Map proposal which was incorporated by the Whitehouse into the Brain Initiative. It is aimed at developing methods to capture every activity of every neuron of an animal or a piece of a brain of a human patient.

Is there room for European participation in the Brain Initiative?

Many assumed that the Brain Initiative was going to be funding for research "made in America" but from the beginning the scope of the Brain Activity map was much wider in scope. I am proud to tell you that I introduced the motion at the NIH BRAIN initiative's first council meeting that laboratories outside of the US should be allowed to apply for this funding and the motion was approved unanimously. I think that the US and the Brain Initiative have shown true leadership because they acknowledged that the problem of understanding how the brain works is for the benefit of mankind and not for the benefit of any particular country.

Any advice for ICFOnians?

I think that there are some spectacular opportunities for ICFOnians to get involved in neuroscience in general. Your institute is one of the strongest I have seen in photonics with a lot of breadth and depth. There are many overlaps between the types of methods you are developing at ICFO and the needs for the future of neuroscience. I would encourage you all to think seriously about what you could contribute to neuroscience. I would be happy to serve as a bridge.

STAY TUNED...

ACADEMIC PROGRAMS

- Jul-Aug | **Summer Fellows**, **CIM Cellex, E2C3**.
- 16 Aug | **Deadline CELLEX-ICFO-MPQ** Fellowship Program.
- 15 Oct | **Deadline Travel Grants** for **PhD Open Day** at ICFO.
- 25 Oct | **Deadline Registration PhD Open Day** at ICFO.

OUTREACH

- 15 Jul | **BCN Moments PAU 2015** top students visit ICFO.
- Mid Sep | **iSPEX Community Experiment:** Don't miss it!
- 25 Sep | **Researchers' Night** | ICFO will participate with different activities at the CCCB. More info at: http://nitdelarecerca.com
- End Sep | **Launch** of **Illuminating Curiosity**
- 9 Oct | **Concert** of **Llum a les Ones 2015** | CCCB. More info at: http://lallumalesones.icfo.eu

CONFERENCE

- 24-25 Sep | **Conference** *"ESF - Plasmon-BioNanoSense"*. Chair: Niek van Hulst.

SCIENTIFIC EVENTS

- Jul-Sep | **Summer Lectures** by ICFO Group Leaders.
- 4 Sep | **Colloquium**: David Reitze *"Listening for the Faint Traces of the Most Violent Events in the Universe Using the Laser Gravitational-wave Observatory"*.

INTERNATIONAL YEAR OF LIGHT 2015

KEEP YOUR EYE on the events section of the web. There is always something interesting happening at ICFO.

SUDOKU

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