

ICFONians

Community News from the Institut de Ciències Fotòniques



EDITOR'S CORNER

The end of the Anniversary



BROOK HARDWICK
Coordinating Editor



This is the first newsletter of 2013 but the last edition in our 10th Anniversary Celebration year. Over the past 12 months we have put a lot of institutional energy into marking this landmark year with events, invited guests, and conferences in our new NEST building. It has been a yearlong tribute to the science of light and ICFO's first decade "putting light to work". As a final celebratory gesture, we honour ICFO's Group Leaders with this special GL EDITION of ICFOians.

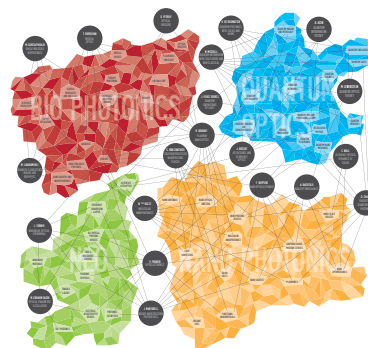
Over these past 10 years, ICFO's groups have grown in number and have propelled ICFO to receive international recognition. ICFO Group Leaders have initiated 50 doctoral students (including the 5 recently graduated PhDs highlighted in this issue) in careers in research, acting as guides, mentors and inspiration. They lead not only from a scientific standpoint, but also by adding their uniquely human attributes to this mix, making ICFO a great place to work, study, learn, investigate and grow. They are an eclectic gathering of some of the brightest and most interesting people I have had the pleasure of meeting and they never cease to amaze with their creative energy and curiosity.

But I must admit that this has not been the easiest issue to pull together. To begin, this is no longer a small group! Twenty-one groups are carrying out research at ICFO in a wide range of areas. Coordinating the inputs of the leaders behind this research, guiding them towards a common destination (i.e. this edition) has been a bit like herding cats. On top of that, our protagonists are busy and do not sit still for long. If they are not traveling, they are working on a deadline, in the lab, meeting with students and collaborators... And surprisingly, they do not all enjoy being protagonists! It is possible that my persistent demands on their attention has pushed the limits of their patients, but I have had no choice- we cannot bring to a close a year full of celebrations for the 10th anniversary without giving credit where credit is due. Thank you for sharing a bit of yourselves in this issue.

For those who fear that after a year of anniversary celebrations, life will be comparatively boring at ICFO in a "normal" year, this issue will highlight some evidence that points to the contrary. The FET Flagship program, and namely the Graphene Flagship that we discuss in depth on page 5, promises exciting graphene based advances aimed at ushering in a wave of disruptive technologies to position Europe on the very forefront of innovations in this area. With ICFO acting as co-leader of the Optoelectronics work package of this flagship, we will no doubt see some of this action. Likewise eight research groups at ICFO have graphene related projects in motion that will give ICFO an increasingly in-depth perspective on potential applications.

I hope you enjoy reading about all this and more in this special edition of ICFOians.

COVER



How does one describe photonic research without playing tribute to the interdisciplinary collaborations that tie it to the breakthroughs that are changing the world of science and technology today? ICFO group leaders cannot be tied to one specific area of Photonic research. While that would make creating illustrations of ICFO research much simpler, it would completely miss the basis of what makes our research so exciting. Photonics converges with other fields of science to provide new profound understanding of our world, opening up previously unimaginable possibilities.

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GO & FLY

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ICFO NEWS



Carlos & Miriam @ CosmoCaixa

PHOTONIC EXPLORERS AT COSMOCAIXA

ICFO participated in CosmoCaixa's conference series "Technology: the permanent revolution". The goal of this series was to reach out to the general public with a talk entitled "Explorers of Light". Miriam Martí and Carlos Florensa, both from ICFO's Outreach Team, mixed an informative talk with some "photonic magic" to communicate key insights about the major program thrusts of ICFO's research "Light for Health" "Light for Energy", and "Light for Information".

ICFO IN THE EUROPEAN ACADEMY OF SCIENCES

The European Academy of Sciences (EURASC) rewards excellence in science and technology by electing to its fellowship and honorary membership the brightest professorial and postdoctoral scientific researchers in Europe, including recently nominated member, ICREA Professor at ICFO, Maciej Lewenstein. The membership of this prestigious group strives to further the reach of cutting edge scientific research by promoting science and technology and their essential roles in fostering social and economic development. The Academy boasts an important number of well-known Nobel Laureates and other distinguished elected members.

EU-ITN INDEX AT ICFO

The Marie Curie Training Network *INDEX* (standing for Indirect Excitons) is an initial training network for training and career development of young researchers, funded by the European Commission under the 7th Framework programme. The program, which was started in November 2011, will run for four years with an impressive network of 13 academic and industrial partners. In December, ICFO hosted *INDEX*'s European Workshop which emphasized the formation of collective quantum phenomena with indirect excitons confined in bilayer heterostructures, and more generally with ultra-cold dipolar gases.

ICFO LAUNCHES NEW WEBSITE

After 10 years of service, the original ICFO website was retired and replaced with a brand new look. This improvement in our "window to the world" is easier to navigate than its predecessor and contains new content which aims to paint a clearer picture of the work that is carried out at ICFO. The website is a work in progress and will continuously strive to offer improved content and navigability to meet the needs of our growing institution. Coming soon: outreach.icfo.eu

EUROPEAN FET- ENERGY PROJECT

NANOMATCELL (Novel Environmentally Friendly Solution Processed Nanomaterials for Panchromatic Solar Cells) is a new Future Emerging Technologies (FET) Project funded by the European Commission within FP7. It has summoned leading groups in the fields of nanomaterials and solar cells to develop the next generation of DSSCs (Dye Sensitised Solar Cells) to boost current performance limits, with emphasis on low-cost fabrication techniques and the use of novel environmentally friendly and Earth abundant materials. The project unites research institutions from the Netherlands, the UK, Switzerland, and Spain, all coordinated by ICFO Group Leader and Nest Fellow, Prof. Gerasimos Konstantatos.

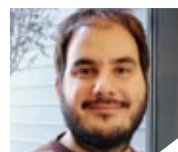
ICFO NEWCOMERS



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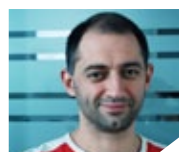
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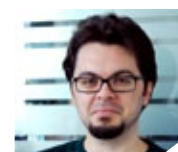
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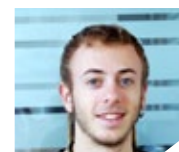
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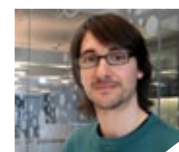
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Many of us joined ICFO or took a new position at the Institute between November 2012 and mid February 2013.



LATEST ADVANCES

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PNAS

Proceedings of the National Academy of Sciences of the United States of America

www.pnas.org

Intracellular transport dynamics

NEW ALL-OPTICAL IMAGING METHOD

The February issue of *PNAS* featured a novel all-optical imaging method that combines two cutting-edge techniques: super-resolution microscopy with single particle tracking. This powerful technique presented by researchers in the group led by Prof. Melike Lakadamyali holds great promise for studying biological phenomena with high spatiotemporal resolution and will allow biologists to interpret their data in a new light by putting highly dynamic processes into the context of subcellular ultrastructure.

CATCHING AND TWISTING A SINGLE SPIN WITH LIGHT

In a paper published in *Nature Nanotech* and highlighted by *Nature*, researchers in the group led by ICFO Prof. Romain Quidant, in collaboration with Prof. Frank Koppens (ICFO), Prof. García de Abajo (CSIC) and Macquarie University, describe a new technique, similar to the MRI but with a much higher resolution and sensitivity, which has the ability to scan individual cells. Using artificial atoms, diamond nanoparticles doped with nitrogen impurity, they were able to probe very weak magnetic fields such as those generated in some biological molecules. Researchers used optical tweezers to trap and manipulate the artificial atoms, leading them above the surface of the object to study and extract information from its tiny magnetic fields. The emergence of this new technique could strongly benefit the field of medical imaging, providing a new class of information that could contribute to early detection of diseases, and thus a higher probability for successful treatment.

ULTRA-GENTLE MEASUREMENT USING QUANTUM ENTANGLEMENT

A new way to observe very delicate bodies based on quantum physics was presented in *Nature Photonics* by the group led by Prof. Morgan Mitchell. This technique consists of groups of photons organized in a “Schrödinger cat” state that can gently explore the properties of objects in non-invasive way. They were able to deduce the number of atoms in the cloud and the magnetic field of their surroundings. At the same time, they were able to assess the damage, i.e. the number of photons absorbed by the cloud.

The results have shown that photons prepared in this quantum state can provide more information causing less damage. They overcome for the first time the so-called “standard quantum limit”, and permit the observation of unknown properties of ultra-sensitive objects such as individual atoms or living cells.

PHOTONS TO ELECTRONS WITH GRAPHENE

In their paper appearing in *Nature Physics*, researchers in the group led by Prof. Frank Koppens in collaboration with researchers from MIT, Max Planck Institute for Polymer Research, and Graphenea S.L. demonstrates that graphene is able to convert a single photon that it absorbs into multiple hot electrons, and that the higher the photon’s energy, the larger the number of hot electrons created. Since these light-induced electrons can drive currents, hot-electron multiplication is an essential ingredient for light harvesting with very low energy loss. Moreover, the combination of broadband absorption and hot-carrier multiplication enables graphene to efficiently convert light energy from the full solar spectrum into electricity.

BUSINESS NEWS by Silvia Carrasco

ICFO launches a new spin-off, ProCareLight, in the field of laser security

ProCareLight, ICFO’s fourth spin-off company, was founded with the aim of helping to improve the laser security of the companies and the people who use lasers in processes such as production, manufacturing, medicine or aesthetics. ProCareLight offers its support to organisations to guarantee operator safety, compliance with legislation and to improve customer trust. It brings vast experience to audits and security laser trainings, a wide variety of services such as custom-made trainings to maximize lasers’ potential, assessment in the application of laser products and improvements that could be made to guarantee a safer use of laser, periodic audits and follow-up. These services are designed to benefit employees as well as external users, patients and customers.

The company sets up house in ICFO’s incubator.

Josep Maria Silvestre, CEO of the new company, has a Telecommunications Engineering degree from the Universitat Politècnica de Catalunya-Barcelona Tech and an MBA from EAE Business School.

“ICFO has developed a unique expertise and a purpose built database to manage efficiently all safety related information including operators, laser systems, protection equipment, and documents (laser risk analysis, procedures, etc.). This can now be offered to our customers to optimize the management of their laser safety and quality procedures.” says Josep Maria Silvestre.

[L*] ProCareLight
Light and Laser Safety Solutions

*La Caixa and fitalent invest in SIGNADYNE*

SIGNADYNE, founded by ICFO PhD graduate Marc Almendros, is an ICFO spin-off company which develops technology to test, measure and control electronic equipment using cutting edge technology. Thanks to the highest speed and channel density per module in the market, SIGNADYNE offers benefits over competitors offering similar services including substantial cost savings, the capacity to operate with reduced space requirements, and increased instrumental flexibility which make this technology applicable in a multitude of sectors.

The private equity branch of “la Caixa”, Caixa Capital Risc, and the venture capital fund of everis, fitalent, are investing €300,000 in this start-up which has already closed agreements to distribute its instrumentation in Germany, France, Austria, Switzerland, Korea, Singapore, Australia and New Zealand.

According to Dr. Almendros, “the development of this type of cutting edge technology requires a mix of talent, hard work and enthusiasm, and would not be possible without the support of fitalent, Caixa Capital Risc and ICFO.”

 **Signadyne**

EU FLAGSHIPS PROGRAM

Graphene: a Future Emerging Technology Flagship

ICFO will co-lead a work package in this large band pan European R&D Movement.

On 28 January, the European Commission announced the winners of the multi-billion euro competition of Future Emerging Technologies (FETs) billed as “science beyond fiction”. The flagship winners, *Graphene* and *The Human Brain*, were chosen from six pilot programs that were evaluated in terms of scientific, technical and financial feasibility by a panel of experts including leading scientists, professors, Nobel Prize winners, and industrialists. Each will become large band European projects, with researchers from at least 15 EU Member States in each initiative and nearly 200 research institutes involved.

The Flagship program represents a definitive action on the part of the European Commission at the crossroads of science and technology, arming Europe with serious funding to innovate in areas of key strategic importance for European competitiveness. As EC Vice-President Neelie Kroes stated in her presentation address, the flagship program aims to give European R&D a major push “back into the driver’s seat” in order to “fertilize the green shoots of economic growth”. To accomplish this, the European Commission has awarded Flagship winners €1.000 million each, the largest award for research in European History.

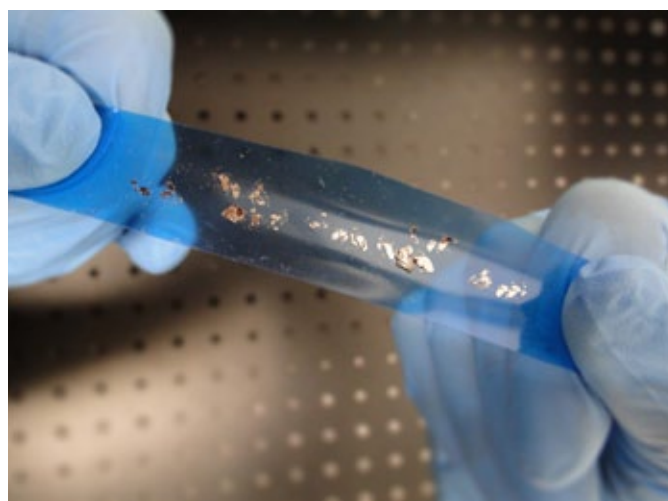
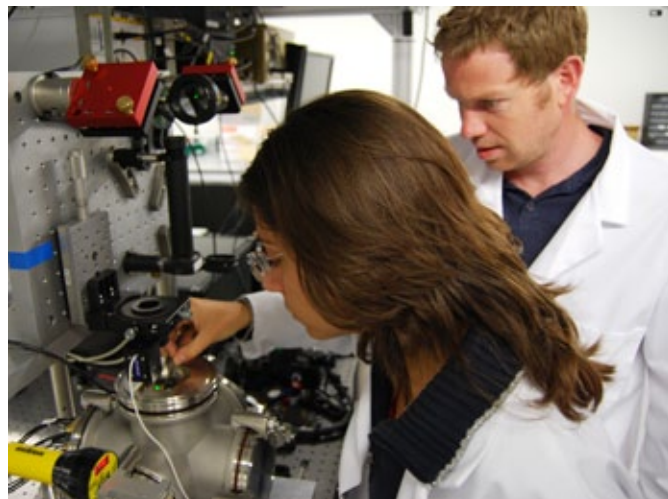
The Graphene Flagship brings together the most recognized figures in graphene research in Europe as well as industrial partners including large companies such as Nokia, Airbus, Philips and ST Microelectronics as well as SME’s such as Graphenea. The goal of all partners is to capitalize on graphene’s unique and superior properties to create a credible starting point for new disruptive technologies in a wide range of fields.

Research work is divided into 11 scientific and technological work packages. ICFO Professor and Nest Fellow Frank Koppens will have a special leadership role in the Optoelectronics work package, in collaboration with Prof. Andrea Ferrari (Cambridge, UK).

This opto-electronics work package aims at implementing an “all-in-one” solution to the challenges of future opto-electronic technologies, banking on its tuneable optical properties, broadband absorption (from UV to THz frequencies), high electrical mobility for ultrafast operation, and novel gate-tuneable plasmonic properties. In addition, active graphene optoelectronic devices will be integrated monolithically, or as hybrids with silicon platforms, or flexible and stretchable substrates. The efforts are focussed towards the development of novel graphene-based photonic components such as lasers, optical switches and waveguides, optical frequency converters, amplifiers, cavities, modulators, photodetectors for visible, infrared and THz frequencies, nano-photonics components, metamaterials and solar cells.

During the 30 month ramp-up phase of the project, the Graphene Flagship will focus on the area of communications, concentrating on ICT and on the physical transport sector and supporting applications in the fields of energy technology and sensors. In addition to the leadership role of Prof. Koppens in the Optoelectronics work package, seven other ICFO research groups led by Professors Bachtold, Biegert, Chang, Konstantatos, Lewenstein, Martorell and Pruneri will contribute expertise to the Flagship with projects in graphene photonics.

Since 2010 when the Nobel Prize was awarded to Andre Geim and Konstantin Novoselov for their revolutionary insights into graphene, scientists, engineers and industry have been urgently looking for the key to convert this wonder material into paradigm shifting applications. There is widespread optimism that the injection of financial support and brain power which this Flagship promises will lead to innovations that researchers and industry have yet to fathom.



At the top: Prof. Frank Koppens, group leader at ICFO of the Nano-Optoelectronics group and Co-leader of the Flagship Optoelectronics Work Package.

Bottom: Graphene



FULL LISTING OF WORK PACKAGES WITHIN THE GRAPHENE FLAGSHIP

- **Work Package 1: Materials**
- **Work Package 2: Health and Environment**
- **Work Package 3: Fundamental science of graphene and 2d materials beyond graphene**
- **Work Package 4: High frequency electronics**
- **Work Package 5: Optoelectronics**
- **Work Package 6: Spintronics**
- **Work Package 7: Sensors**
- **Work Package 8: Flexible electronics**
- **Work Package 9: Energy applications**
- **Work Package 10: Nanocomposites**

WHAT IS GRAPHENE?

Graphene is a two-dimensional (2D) atomically thin crystal in which carbon atoms are arranged in a honeycomb lattice. Due to its unique structure, it is the strongest and stiffest material in the world, exhibits the highest electrical conductivity at room temperature, and is ultra-thin, transparent and extremely flexible. It promises a wide range of novel applications that are being pursued by researchers worldwide, in industry and academia.

With this combination of superior properties, graphene has great potential to be the next disruptive technology which can truly revolutionize many technologies:

- ICT: ultra-fast electronics, data storage, optoelectronics,...
- Materials: ultra-light and strong composites for e.g. aerospace and cars. Conductive inks for printable electronics, ...
- Energy: advanced batteries and super capacitors
- Health: sensors, DNA sequencing,...

Graphene photonics is a vibrant, rapidly developing and exciting research area which has already led to some commercial applications. This is due to the key properties of graphene, such as its excellent transport characteristics, high optical transparency combined with extremely high quantum efficiency for light-matter interactions as well as the highest degree of light compression available to date.

Rather than being just another new photonic material, it combines a wide palette of unique aspects which promise breakthroughs in several outstanding problems of nanophotonics and optoelectronics, including ultrasensitive photodetection and sensing, on-chip plasmon generation and detection, low-power information processing, and quantum information processing on a single photon level.

****COMING SOON:** graphene activities at ICFO at graphene.icfo.eu

IN FOCUS

ICFO's GLs- Inside and Out

A closer look at who is leading research at ICFO.

Central to ICFO's mission is to make world-leading research discoveries and innovations. To ensure that we meet this goal, ICFO focuses on the training of the next generation of scientists and technicians through courses, seminars, access to cutting-edge experimental infrastructures, and mentoring by researchers that are among the best in the world in their field. These Group Leaders deserve the

limelight of this Special Edition of ICFOnians. ICFO's GLs have built research groups that are searching for answers to unique and challenging questions. They have been a driving force behind ICFO's growth to date and are setting the stage for great things to come in the future. Inside and outside the lab, they are exceptionally curious, highly ambitious, and distinctive individuals.

GROUP LEADERS

CAREER

OUTSIDE ICFO

LLUIS TORNER Nonlinear optical phenomena		Studies the nonlinear interaction of light with matter to design new ways for controlling light beams and signals.	<ul style="list-style-type: none"> • ICFO Founder and Director • Fellow OSA, EPS, EOS, GenCat Award 2000 • Monturiol Medal 2010 	<ul style="list-style-type: none"> • Optoel Prize 2011 • EPS Service Appreciation Award 2011 • OSA Leadership Award 2011 	I love all types of outdoor sports. These days my favourite is mountain biking.
ANTONIO ACÍN Quantum information theory		Studies how to harness quantum physics for the design of information processing technologies.	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Joined ICFO from U. Geneva, CH • ERC Starting Grant • Le Prix La Recherche 2010 		I'm not a great player, but I am a big football fan. I can give you results of all the World Cup finals... especially the last one!
DAVID ARTIGAS Academic Affairs		Studies the interaction of light in surfaces and biological samples.	<ul style="list-style-type: none"> • UPC Professor • Head of ICFO Academic Affairs 		Time to dedicate to science is important, but it is also necessary to dedicate time for a coffee with friends.
ADRIAN BACHTOLD NanoOptoMechanics		Studies devices based on single nanoscale objects, such as carbon nanotubes and graphene.	<ul style="list-style-type: none"> • ICFO Professor • Joined ICFO from the Catalan Nanotechnology Institute at UAB 	<ul style="list-style-type: none"> • IBM Award of the Swiss Physical Society • CNRS Medal • EURYI Award • ERC Starting Grant 	My favorite recent book was "Berliner Alexanderplatz" translated in French.
GONÇAL BADENES NPL		Develops the nanofabrication infrastructure at ICFO to provide the best tools and techniques for research and development.	<ul style="list-style-type: none"> • Head of ICFO's Nanophotonics Lab (NPL) • Joined ICFO from IMEC, Belgium 		When I am not at ICFO, you can find me playing with my daughters Laura and Nuria or hacking on ICFO's servers.
JENS BIEGERT Attoscience and ultrafast optics		Focuses on generating attosecond light pulses and on harnessing their applications to ultrafast processes.	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Joined ICFO from ETH Zurich, CH • OSA Allen Award 2004 		You will find me a lot in the mountains and one of my favorite hobbies is downhill skiing. Since living in the US, flying airplanes has become another passion.
DARRICK CHANG Theoretical quantum-nano photonics		Aims at merging quantum optics and nanophotonics.	<ul style="list-style-type: none"> • ICFO Professor • Nest Fellow • Joined ICFO from Caltech, USA 		If I wasn't a physicist, I would want to be a chef.
TURGUT DURDURAN Medical optics		Develops new optical imaging and monitoring techniques for the non-invasive measurements of the tissue well-being and function for clinical and biomedical applications.	<ul style="list-style-type: none"> • ICFO Professor • Joined ICFO from U. Pennsylvania, USA 		These days I am watching Gaia grow, am still involved in Cypriot activism, hunting food, hoping to pick up photography again, and figuring ways to avoid personal statements.
MAJID EBRAHIM-ZADEH Optical parametric oscillators		Focuses on the development of novel light sources in spectral regions inaccessible to lasers.	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Resigned his tenure at U. St Andrews, UK, to join ICFO • Innova Award 2005 	<ul style="list-style-type: none"> • Berthold Leibinger Innovationspreis 2010 • Fellow OSA • Fellow SPIE 	When not at ICFO, you may find me travelling, improving my golf swing, experimenting with exotic cooking (haggis to humus), or on a treadmill listening to my favourite tracks.
MARIA GARCIA-PARAJO Single molecule biophotonics		Develops advanced nanoimaging techniques to study biological processes at the molecular level.	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Joined ICFO from IBEC • Formerly at U. Twente, NL • HFSP Advanced Grant 2012 	<ul style="list-style-type: none"> • Academy Research Fellow award from the Royal Dutch Academy of Sciences (KNAW): 1998-2002 	I love to psychoanalyze people's daily behaviours. I am a true believer of Freud's theories.
NIK VAN HULST Molecular nanophotonics		Studies light-matter interactions at the nanometer scale, focusing on nano-antennas, femtosecond dynamics and molecular nanophotonics.	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Resigned his tenure at U. Twente, NL to join ICFO • ERC Adv. Grant • Fellow OSA 	<ul style="list-style-type: none"> • City of Barcelona Award 2010 • Koerber EU Science Award 2003 • Royal Dutch Shell 	As an Astronomy student I spent nights taking photos of Pluto during its May 1980 opposition.
GERASIMOS KONSTANTATOS Solution-processed nanophotonic devices		Studies a number of nanomaterials and solution-processed quantum dots for optoelectronics.	<ul style="list-style-type: none"> • ICFO Professor • Nest Fellow • Joined ICFO from U. Toronto, CA 		When I am not at ICFO, I enjoy the Catalan nature and the medieval villages.
FRANK KOPPENS Nano-optoelectronics		Aims to integrate nano-optoelectronic devices with plasmonics and quantum emitters.	<ul style="list-style-type: none"> • ICFO Professor • Nest Fellow • Joined ICFO from Harvard U., USA 	<ul style="list-style-type: none"> • Christian Huygens Science Prize 2011 • ERC Starting Grant 	Outside ICFO, you can find me either playing with my son, climbing in the mountains or both.
MELIKE LAKADAMYALI Advanced fluorescence imaging and biophysics		Develops imaging techniques to study questions in cell biology and neuroscience.	<ul style="list-style-type: none"> • ICFO Professor • Nest Fellow • Joined ICFO from Harvard U., USA 		When I am not at ICFO you can find me reading a book while enjoying a glass of wine at home.

GROUP LEADERS

CAREER

OUTSIDE ICFO

<p>MACIEJ LEWENSTEIN Quantum optics theory</p> 	<p>Studies problems from standard quantum optics to physics of matter in ultra-intense and ultra-short laser pulses.</p>	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Resigned his tenure at U. Hanover, DE to join ICFO • ERC Adv. Grant • Humboldt Research Award 2007 	<ul style="list-style-type: none"> • Joachim Hertz Found. Prize of U. Hamburg 2010 • Science Prize Polish Science Foundation 2011 	<p>Probably everybody knows that my first passion is not quantum physics, but jazz. I have ~ 5000 CD and vinyls and have written a book on "Polish Jazz Recordings and Beyond" - just submitted to a publisher...</p>
<p>JORDI MARTORELL Organic nanostructured photovoltaics</p> 	<p>Studies nanostructured materials to enhance the performance of organic photovoltaic cells.</p>	<ul style="list-style-type: none"> • UPC Professor • GenCat Award 2001 		<p>If I am not at ICFO and you happen to be in Collserola you might find me on my bicycle.</p>
<p>PABLO LOZA-ALVAREZ SLN</p> 	<p>Aims to identify bimolecular structural changes in living cells and tissues.</p>	<ul style="list-style-type: none"> • Head of ICFO's SLN lab • Joined ICFO from U. St. Andrews, UK 		<p>I dedicate every sunday morning to one of my passions: mountain biking... and a big breakfast afterwards!</p>
<p>MORGAN MITCHELL Quantum information with cold atoms and non-classical light</p> 	<p>Studies quantum effects at the interface between light and matter.</p>	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Joined ICFO from U. Toronto, CA • ERC Starting Grant 		<p>I have mapped caves, sequenced DNA, audited a nuclear reactor, taught inmates at San Quentin prison and portrayed a physicist on Austrian TV. I'm a certified white water rafting guide and keep a 2 billion-year-old rock, and also a pitufo, on my desk.</p>
<p>JUAN P. TORRES Quantum engineering of light</p> 	<p>Studies the fundamental properties of light beams and the generation of quantum light states with engineered characteristics.</p>	<ul style="list-style-type: none"> • UPC Professor • GenCat Award 2003 		<p>I am always looking for different perspectives to better understand how the world really is. Maybe that's why I like to read almost everything from science to history, cinema, politics and everything in between!</p>
<p>DMITRI PETROV Optical tweezers</p> 	<p>Raman spectroscopy and photonic force microscopy to study biochemical and biophysical processes with single living cells.</p>	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Resigned his tenure at U. Recife, BR, to join ICFO • Coblentz Prize 2006 awarded to group member G. Pratap 		<p>I enjoy walking on the Castelldefels beach or driving during weekends to visit small Catalan cities.</p>
<p>VALERIO PRUNERI Optoelectronics</p> 	<p>Studies and develops new advanced materials and devices for the photonics industry.</p>	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Pirelli Research Fellow • Philip Morris Prize for Scientific and Technological Research • IBM Faculty Award 2010 	<ul style="list-style-type: none"> • Photonics21 EU Student Innovation Award 2011 to group member, D.S. Ghosh • Duran Farell Prize for Technological Research 2012 • Corning Inc. Chair 2013 	<p>I love the Alps in winter, the beach in the early morning and dreaming of Senna in a Ferrari at Spa or Monaco.</p>
<p>ROMAIN QUIDANT Plasmon nano-optics</p> 	<p>Studies the optical and thermal properties of metallic nanostructures and their applications to new optical functionalities and devices.</p>	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Joined ICFO from U. Dijon, FR • ERC Starting Grant • EU Fresnel Prize 2009 	<ul style="list-style-type: none"> • City of Barcelona Award 2010 • Principe de Girona Impulsa Award 2011 • ICO prize 2012 	<p>When I am not at ICFO, you may find me in the mountains, either skiing or trekking or at the beach with my surfboard waiting for the wave of the century...</p>
<p>HUGHES DE RIEDMATTEN Quantum photonics with solids and atoms</p> 	<p>Studies quantum light matter interfaces with solid state devices and cold atomic gases.</p>	<ul style="list-style-type: none"> • ICREA@ ICFO Professor • Joined ICFO from U. Geneva, CH • ERC Starting Grant 		<p>Outside work I enjoy, among other things, mountain hiking, snowboarding and playing guitar.</p>
<p>SIMON WALL Ultrafast optical dynamics of solids</p> 	<p>Uses ultrashort pulses of laser light to manipulate and study the properties of materials.</p>	<ul style="list-style-type: none"> • ICFO Professor • Nest Fellow • Joined ICFO from Fritz Haber Inst., Max Planck Society, DE 		<p>Outside of ICFO I enjoy visiting the various restaurants and tapas bars of Barcelona.</p>

GO & FLY

50 women and men have successfully defended their thesis 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 Thesis. Honouring 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.



46 | SAURABH RAJ
Graduated on November 5. Thesis: 'Mechanochemical Study of Single Living Cells and Biomolecules Combining Optical Tweezers and Raman Spectroscopy'. Supervised by ICFO Group Leader and ICREA Prof. Dmitri Petrov.



47 | BRICE DUBOST
Graduated on November 27. Thesis: 'Light-Matter Interaction with Atomic Ensembles'. Supervised by ICFO Group leader and ICREA Prof. Morgan Mitchell and by Prof. Samuel Guibal.



48 | SUKANYA RANDHAWA
Graduated on December 4. Thesis: 'Active control of surface plasmons in hybrid nanostructures'. Supervised by ICFO Group Leader and ICREA Prof. Romain Quidant and co-supervised by Dr. Jan Renger.



49 | SOTIRIS PSILODIMITRAKOPOULOS
Graduated on December 14. Thesis: 'Polarization Second Harmonic Imaging of Biological Samples'. Supervised by Prof. Pablo Loza-Alvarez and co-supervised by Prof. David Artigas.



50 | GIUSEPPE PRETTICO
Graduated on January 18. Thesis: 'Entanglement and non-local correlations: Quantum resources for information processing'. Supervised by ICFO Group Leader and ICREA Professor Antonio Acin.

HIGH PROFILE



ICFO's GLS: A few words from the resident experts...



ICFO Group Leaders are a fascinating group of individuals who, in honour of this special edition, have given us some insights that help to shed light on the eclectic mix of personalities that are leading the scientific output of our institution.

What is the motivation behind your research work?

The most common underlying motivation behind work in research at ICFO seems to be a drive to uncover new fundamental knowledge and understandings. From this point, the personal motivations become more specific in line with the types of research being carried out. From the desire to improve medical treatment, make the world a safer, cleaner, better place, find new energy solutions, explore new materials, turn science to technology, and in general do something useful.

“Me- I’m in it for the fundamental curiosity- if there is no God, then what?” M. Lewenstein

Today it may seem like science fiction, but I believe photonics research will lead to...

GLs have their own reasons to be optimistic about some pretty amazing advances on the horizon:

- Visualization and understanding of the full human body, down to the single molecule level.
- New devices by every patient in Intensive Care Units to reduce brain damage in patients at risk.
- Solving the mysteries of the human brain leading to new diagnosis and treatment of neurological disorders.

“... a quantum version of the internet, where quantum information can be teleported between the different nodes of the network.” H. de Riedmatten

- An energy revolution with new ways to harvest and convert solar energy, putting PVs on the map of large scale power generation.
- New customized medicine and therapies.
- A revolutionized understanding of the microcosmos.

- GPS with resolution up to a fraction of a mm.
- ... things we have yet to imagine but which will surprise even the most well informed among us.

What is the biggest challenge or obstacle facing research in optics and photonics?

To keep the pace with the potential of Photonics, GLs see challenges on all sides:

- Human Resources: Keeping complacency at bay in order to ensure that researchers stay on the cutting edge. This also requires a steady flow of new, talented and curious young researchers to continue the search for radical new discoveries.
- Technical Limitations: There are physical limits on the development of materials and structures that that will allow for the implementation of designs that, based on the physics of light, could allow tremendous advances with respect to other fields' approaches.
- Funding: Trends in research funding are moving away from basic research which increases fundamental understanding, and increasingly toward applied or translational work. Both are necessary to advance. As the complexity of experiments grows, new technologies and ideas must be incorporated, and this requires funding.
- Societal: Society must be convinced that we are doing work that will help make their lives better.

“Many research fields seem to be increasingly averse to risk, driven by short-term advances. Unless everyone in the scientific community takes part in addressing this issue, I fear we will see far fewer truly spectacular advances in the future.” D. Chang

- Organization: Photonics research is multi-disciplinary, requiring dialogues between fields and a “work space” that facilitates collaborations often with fields that are not directly connected or obvious.

To date, what is the most important advance for society that was made possible by Photonics?

There is widespread agreement that optical fibers and the laser have had an enormous impact on every single aspect of modern life. The industrial development stemming from photonic advances has created employment and wealth and had a tremendous impact on society and the quality of life.

“When Galileo Galilei turned his telescope toward Jupiter and saw that it had moons, his observation confirmed the Copernican hypothesis, displaced the Earth from the centre of the universe, disproved centuries of ecclesiastical dogma and freed Europe from medieval philosophy. It’s hard to top that one.” M. Mitchell

What skills and learning do you hope students and postdocs will take away from their time at ICFO?

Confidence in themselves and their own abilities to change the frontiers of science; the ability to lead; work in an international environment stimulated by brilliant people; a drive to work at the highest levels of excellence; dedication and self-motivation; work under pressure; experience in tackling specific problems with unconventional multidisciplinary approaches; the belief that no problem is impossible to solve...

“I hope they will take with them an open mind, a critical attitude, self-esteem, and the ability to build their own future.” N. van Hulst

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