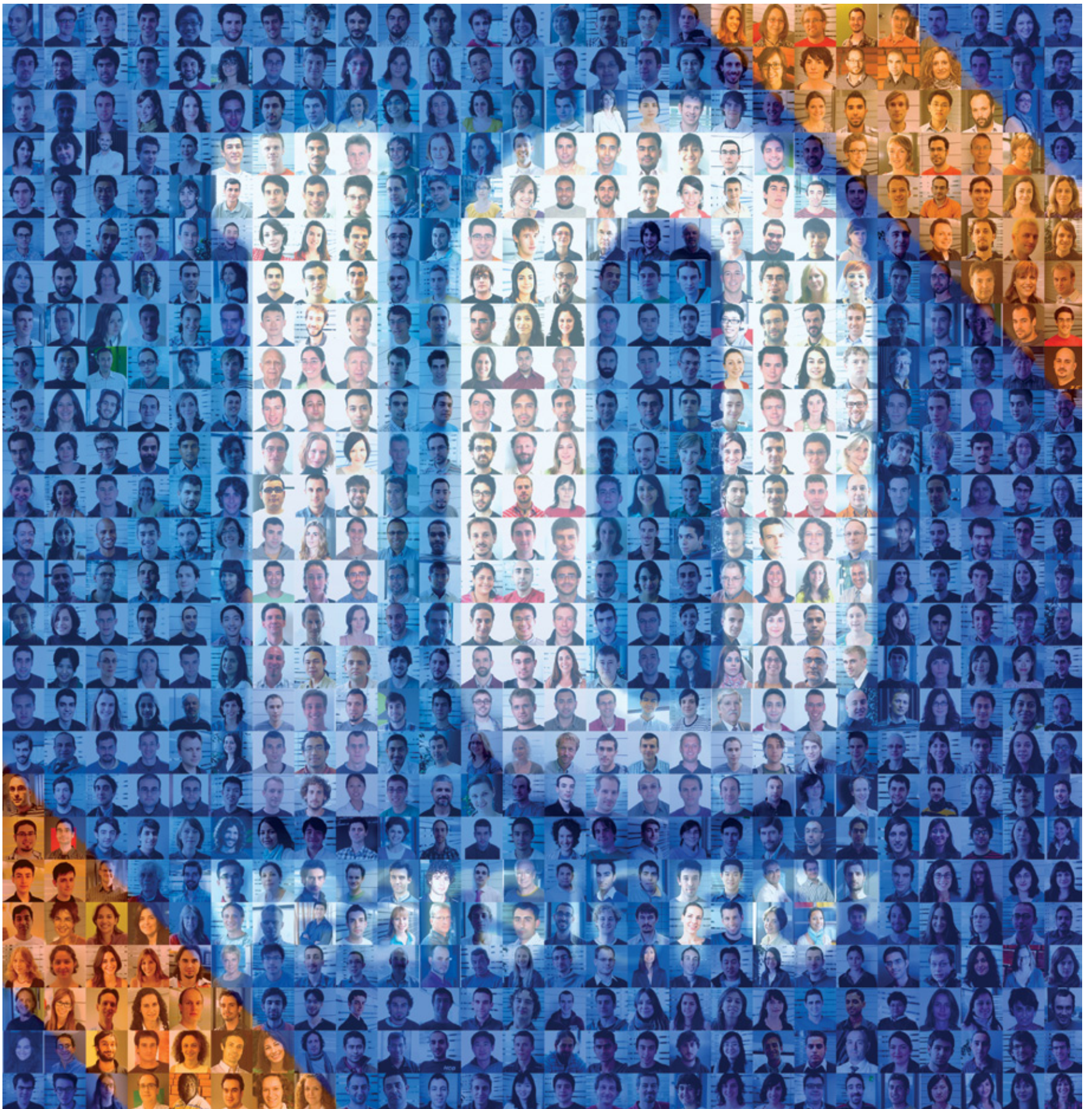


# ICFONians

Community News from the Institut de Ciències Fotòniques  
ANNIVERSARY EDITION





## MESSAGE FROM THE DIRECTOR

### *Planting the Seed*



**LLUÍS TORNER**  
*Founding Director of ICFO*



This year we celebrate our 10<sup>th</sup> anniversary, however ICFO was actually born in 1991, during an unforgettable summer holiday in the Pyrenees.

We loved mountain climbing. There are often easy ways to reach a summit, however none are ever as beautiful and rewarding –not by a long shot - as those that follow the edges. So, we always preferred to take the edges. During that summer of '91 weather and luck were on our side, allowing us to accomplish a few wonderful dreams. We felt happy, strong, unstoppable and on top of the world. So, I kept dreaming.

Why not build a research centre in Barcelona where young women and men from anywhere on the planet could try to climb scientific summits that had never been reached before?

I wrote down the dream on a piece of paper and made a firm commitment to give it a try sometime. The seed was planted and then slowly nurtured. It was elaborated in detail during another summer holiday – fast forward to 1997- and, almost to my own surprise, the idea began to materialize on March 6<sup>th</sup>, 2002, when ICFO was founded as a legal entity with a Board of Governors chaired by Dr Andreu Mas-Colell. At that time Andreu was serving as Minister for Research of the Government of Catalonia after returning from many years in the USA. He is a visionary that has changed forever the way research is done in this part of the world and he also put his weight behind the ICFO dream.

From then on things became a bit easier.

At the end of the day, everything depends on one's companions, and in that regard luck was again on our side. From day one, outstanding ICFOians from around the world joined the project. Today ICFO is a community of unbelievable people, visionary group leaders, ambitious post-doctoral researchers, PhD and Masters students, dedicated and creative engineers and staff, inspiring visitors, great collaborators, generous supporters, and much more. Among our supporters and friends a very especial and grateful recognition happily goes to Dr Pere Mir i Puig and his Cellex Foundation.

Together we are ICFO; people with outstanding talents, skills and ambitions, collaborating and competing with other dedicated professionals who ask original questions, share complementary ideas, and express contrasting opinions. ICFO's spirit links them to a worldwide community of colleagues driven by the passion to ask difficult questions and relentlessly seek out answers that may help to uncover solutions with a global impact, as well as benefits for the local community.

ICFOians have reached many summits during these 10 years, in the form of influential publications, important patents and spin-off companies, awards, excellent career placements in academia and industry building on the ICFO experience, and a long etcetera.

However, this is just the beginning. We know this beyond a shadow of a doubt because we have witnessed in amazement the drive, the ambition, the generosity, and the will to make a difference demonstrated by many ICFOians every day.

As Eleanor Roosevelt said: *"The future belongs to those who believe in the beauty of their dreams."* This is us, ICFOians.

## COVER



Hundreds of ICFOians have added their unique ingredient to the mix that has made ICFO a successful research institution over the past 10 years. This special edition is dedicated to ALL ICFOians and ICFO alumni.

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## ICFO NEWS



## RECOGNITIONS AND AWARDS

ICFO project manager Noelia Cuesta has been awarded the UAM-Telefónica Innovation Prize 2012 for a business idea presented in her Master thesis. This prize is linked to Telefónica's program for capturing ideas and encouraging innovation and entrepreneurship.

Frank Koppens, leader of the Nano-optoelectronics group, has been selected as a finalist of the 2012 World Technology Awards in the category of Materials. The World Technology Network nominated 50 organizations and 100 individuals for the "most innovative work of the greatest likely long-term significance."

Gerasimos Konstantatos, leader of the Solution-processed nanophotonic devices group, was awarded by the MIT's online technology publication in Spain. The TR35 Spain is awarded each year to outstanding researchers under the age of 35 whose work has the potential to transform the world of technology and business in the near future.

Maria Garcia-Parajo is one of the winners of the 2012 ICREA Conference Award, which funds international symposiums in Catalonia. Garcia-Parajo, leader of the Single molecule biophotonics group will organize the "ICREA International Symposium on Visualizing signalling nanoplatforms at a higher spatiotemporal resolution" at ICFO in 2013.

Romain Quidant, leader of the Plasmon nano-optics group, received the ICO (International Commission for Optics) Prize for his contributions to the diffusion of Optics. The prize recognizes Quidant's pioneering studies of the optical and thermal properties of metallic nanostructures and their applications to new functionalities and devices.

Congratulations!!!

## LA CAIXA FOUNDATION SCHOLARSHIPS

ICFO has been included in the new PhD scholarship program of the La Caixa Foundation helping to finance PhDs at leading research institutions in Spain. This program was launched to offer research opportunities to outstanding young graduate students of any nationality to pursue a PhD project in one of eight Spanish research centres accredited with the "Severo Ochoa" seal of excellence.

## ICFO ON TVE

The TV series "The Idea Factory" (*La Fábrica de Ideas*) presents people, companies and centers who conceive of and carry out innovative ideas and projects. The program produced a report about ICFO through interviews with the director, members of the KTT team as well as Professors Maciej Lewenstein and Maria Garcia-Parajo. ICFO's appearance is the result of a collaboration initiated by The Spanish Foundation for Science and Technology (FECYT) and TVE to help draw attention to the excellent work being carried out at leading Spanish research centers. Check it out on youtube! (search: "¿Para qué se puede utilizar la luz láser?").

## UNESCO SUPPORTS 2015 - INTERNATIONAL YEAR OF LIGHT

UNESCO's Executive Board enthusiastically endorses the resolution to name 2015 the International Year of Light (IYoL). A definitive UN approval of IYoL would raise public awareness of the vital role that light-based technologies play in industry, energy, healthcare and all areas of life, demonstrating its importance in addressing critical global social challenges. ICFO fully supports the IYoL resolution as a member of several of the partner entities on the International Steering Committee.

## LATEST ADVANCES



## RAMAN SPECTROSCOPY AGAINST BREAST CANCER

Researchers at IDIBELL and ICFO, led by Angels Sierra and Dmitri Petrov respectively, have collaborated on a diagnostic tool to determine the metastatic ability of breast cancer cells. The results appear in the journal PLoS ONE. The technique is based on the analysis of the lipid component from breast cancer cells, indicative of their malignancy. ICFO's Optical tweezers group collaborated with researchers from IDIBELL by using Raman Spectroscopy, which enables an evaluation of the lipid composition of breast cancer not possible using biological instruments. This technique may be extended to other types of tumours in the future.

## QUANTUM PHYSICS AND RELATIVITY

A team of researchers including Antonio Acín have proposed a test to show that it is impossible to explain quantum correlations as hidden influences propagating continuously and at arbitrary, yet finite, speed in space-time. The collaboration between researchers at Switzerland, Belgium and Singapore led to the paper "Quantum nonlocality based on finite-speed causal influences leads to superluminal signalling" appearing in Nature Physics. As Acín explains, "In our study, we demonstrated that models where non-local correlations between quantum particles spread with an arbitrary finite speed could only reproduce quantum physics if they violated Einstein's theory of relativity".

## COLOURED NANOVIEW IN PHOTONIC CRYSTALS

Former ICFOnian Riccardo Sapienza (now at King's College London) and ICFO researchers Jan Renger, Martin Kuttge and Nick van Hulst, in collaboration with AMOLF researchers led by Albert Polman, have recently reported in Nature Materials on the use of electron-beam-induced luminescence to map with unprecedented detail the photonic modes inside nanostructures. This advance will be of direct use to optimize nanophotonic designs for applications in biosensing, solar energy and quantum information technologies. The photonic crystals and nanocavities were designed and fabricated at ICFO's NanoPhotonics Laboratory and explored with a technique developed and refined at AMOLF.

## NEW ADVANCES IN SOLUTION-PROCESSED OPTOELECTRONICS

The group led by Gerasimos Konstantatos presented in Nature Photonics a novel architectural platform for inorganic solution-processed optoelectronics and solar cells. The paper presents a platform easily implemented by mixing different semiconductor nanocrystals in solution. The device may significantly improve the performance of solar cells and allow for the development of other optoelectronic nanocomposite materials with tailored optoelectronic properties. The authors show that their platform can augment the lifetime of a semiconductor nanomaterial, allowing a more efficient functionality. These devices are fabricated at low temperatures (up to 100°C), which is of great importance for low-cost, large-scale manufacturing based on roll-to-roll processing.



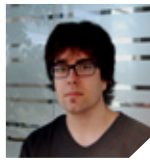
## ICFO NEWCOMERS



**Carlos Abellán Sánchez**  
Undergraduate Student



**Carlos Florensa Campo**  
Undergraduate Student



**Jordi Morales Dalmat**  
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**Pau Buch Cardona**  
Undergraduate Student



**Albert Mundet Bolos**  
Communications Manager



**Simon Wall**  
Group Leader



**Anaïs Brunet Núñez**  
KTT Assistant



**Mussie Beian**  
PhD Student



**Benjamin Wolter**  
PhD Student



**Simon Coop**  
PhD Student



**Wiktor Walasik**  
PhD Student



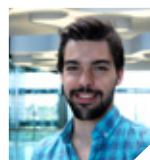
**Martí Perarnau Llobet**  
PhD Student



**Jean Christophe Gomez Lavocat**  
PhD Student



**Petronela Bauer**  
PhD Student



**Mathieu Massicotte**  
PhD Student



**Vahagn Mkhitarian**  
PhD Student



**Alberto Sosa Costa**  
PhD Student



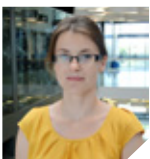
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PhD Student



**Karen Hovhannisyan**  
Postdoctoral Researcher



**James Douglas**  
Postdoctoral Researcher



**Izabela Piechocka**  
Postdoctoral Researcher



**Juan Aguirre Bueno**  
Postdoctoral Researcher



**Emilie Wientjes**  
Postdoctoral Researcher



**Matthew Hoban**  
Postdoctoral Researcher



**Maciej Demianowicz**  
Postdoctoral Researcher



**Tommaso Caneva**  
Postdoctoral Researcher



**Florian Sterl**  
Postgraduate student



**Roland Terborg del Rosal**  
Postgraduate student



**Judith Ibáñez Sánchez**  
Research Engineer



**Waldimar Amaya Ocampo**  
Research Engineer



**Edén Corrales López**  
Research Engineer



**José García Guirado**  
Research Engineer



**Marta Gilaberte Basset**  
Research Engineer



**Laura García Rico**  
Undergraduate Student



**Karen Volke Sepúlveda**  
Visiting Professor

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



**Daniel Cavalcanti**  
Visiting Scientist



**Julia Stasinska**  
Visiting Scientist



**Joonwoo Bae**  
Visiting Scientist



**Adrian Bachtold**  
Group Leader

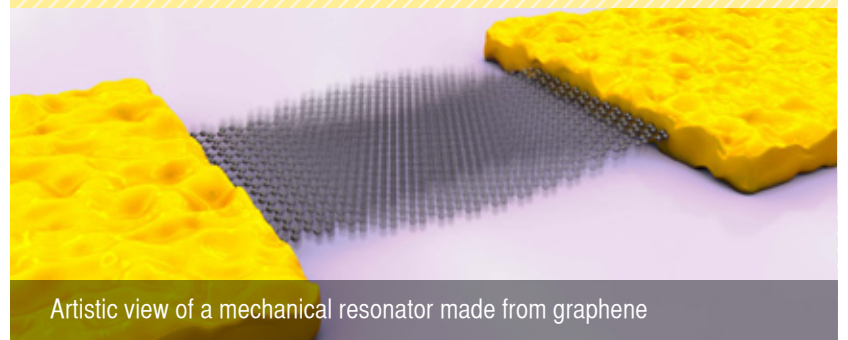
## NEW RESEARCH GROUPS @ ICFO

Research is set to take off in new directions

### NANO OPTOMECHANICS LED BY PROFESSOR ADRIAN BACHTOLD

Most of us can build a castle wall, the blades of a helicopter or a railroad track with the parts of a construction toy. In fact, we are able to build whatever we want, as long as we patiently assemble the small colourful bricks. This is not unlike what the new Nano Optomechanics group at ICFO led by Prof. Adrian Bachtold does, except that they play lego with single nanoscale objects, such as carbon nanotubes and graphene atoms, to build new electronic devices. Their work becomes even more exciting when you consider that their structures are so tiny that quantum effects start to play a dominant role. The energy levels are quantized, just like in atoms and molecules. Due to their small size, nanoscale objects can feature exceptional mechanical, optical, electrical, and structural properties. Interestingly, these structures are large and robust enough to be implemented in a variety of different microfabricated devices, which permit the tuning of their properties. The aim of this research group is to exploit these unique properties for different classes of experiments. For instance, they have shown that a carbon nanotube can resonate as a guitar string, whereas a graphene layer will vibrate more like a drum membrane. They have also succeeded in using a nanotube to demonstrate a thermal nanomotor.

Professor Bachtold comes to ICFO from the Catalan Nanotechnology Institute at Universitat Autònoma de Barcelona where he has carried out his research since 2005 leading the Quantum Electronics Group. He is the recipient of several awards, including the IBM award of the Swiss Physical Society, the CNRS medal, an EURYI award, and the ERC Starting Grant.

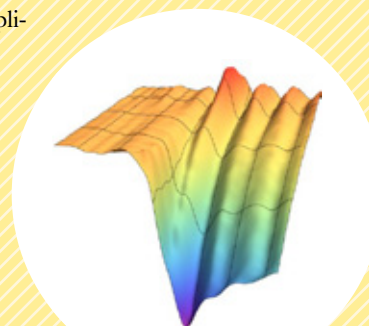


Artistic view of a mechanical resonator made from graphene

### ULTRAFAST OPTICAL DYNAMICS OF SOLIDS LED BY NEST FELLOW, PROFESSOR SIMON WALL

The melting of candle wax before it burns and the condensation of water to make raindrops are common phase transitions that happen in a manageable timescale. They alter the order and structure of a material producing dramatic changes in a material's physical properties, and they play a significant role both in nature and in industrial processes from chip fabrication to steel making. Some materials can undergo ultrafast phase transitions that are difficult for scientist to catch. The new group at ICFO led by Simon Wall, challenges this phenomena. They will use ultrafast "sonograms" and short pulses of light to reveal the dynamic changes in trillionth-of-a-second intervals. Their goal is to manipulate the magnetic, structural and electronic states of matter with ultrafast electric fields to induce new properties when materials are driven out of equilibrium. These properties are measured in the time domain with a combination of linear and non-linear spectroscopic techniques that are performed in the lab, as well as experiments based at larger scale facilities around the world. Their research holds potential applications in faster computer memories, optical shutters, sensors and cameras.

Nest Fellow, Prof. Simon Wall comes to ICFO from the Fritz Haber Institute of the Max Planck Society where he carried out an Alexander von Humboldt fellowship in the Department of Physical Chemistry.



Ultra-fast sonogram of Crystal vibrations

Welcome to ICFO!



## CREATIVE MINDS

## LIGHT ON THE WAVES: Light Propagates as Waves... of Music!

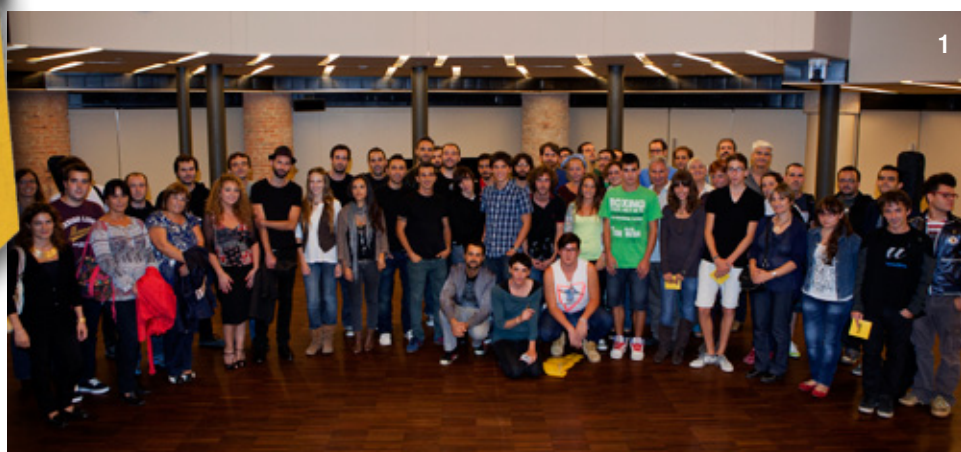
The program exploits the interplay of science, literature and music for the benefit of education.

*Light on the Waves (La Llum a les Ones)* asked students to submit sci-fi poems or short stories based on light. The winning selections were given to musicians to compose a song inspired by these lyrics. On Friday, 28 September, the closure of the program gathered all participants and supporters at the Auditorium La Pedrera for a concert of light-inspired music.

Musicians Joan Colomo, Pulpopop, Miss Q, Exxasens, Megaafonia, Glissando\*, Bläue, Fernando Lagreca, D-Fried i Lucy & the Bossons happily joined the project, which not only involved the writing of the songs, but also included meetings with authors.

ICFO is grateful for the collaboration and support of the Fundació CatalunyaCaixa, for making possible the concert in La Pedrera; poets and scientists David Jou and Joan Duran for their expertise as jurors; radio station iCat FM (specially Montserrat Virgili) for their enthusiasm, and their assistance in promoting the initiative; and all the people who listen to the songs, which help the propagation of light and creativity on these waves!

The "Photonic Music" selections can all be found on the contest website: [www.lallumalesones.icfo.es](http://www.lallumalesones.icfo.es)



1. All program contributors: authors of the lyrics, the teachers who supported the authors, and the musicians who turned the lyrics into songs.
2. Glissando\* composed a beautiful theme on Thomas Young's seminal experiment demonstrating the quantum nature of light.
3. Winners came from cities, towns and villages all around Catalonia.
4. Texts could be submitted in Catalan, Spanish or English. Exxasens played the only theme composed in English, Light of the day.

## THE WINNERS

- **Jesús Badenas**, Aula Escola Europea, Barcelona.
- **Karen Cortés**, Institut La Bisbal, La Bisbal de l'Empordà.
- **Aitor Gil Flores**, Institut Ramon Coll i Rodés, Lloret de Mar.
- **Alba Hernández**, Institut Forat del Vent, Cerdanyola de Vallès.
- **Simon Immerzel**, Aula Escola Europea, Barcelona.
- **Eva Marín**, Institut Ramon Coll i Rodés, Lloret de Mar.
- **Laura Núñez Bañuls**, Escola Virolai, Barcelona.
- **Guillem Ramírez Santos**, Institut Josep Lluís Sert, Castelldefels.
- **Maite Gutiérrez Soler**, Institut Baix Penedès, El Vendrell.
- **Nil Santané Nadal**, Institut Tossa de Mar, Tossa de Mar.



## YOUNG MINDS

## ICONS Science Workshop

The ICONS, (ICFO Organization and Network of Students) Student Chapter organized a high impact four day science workshop for high-school students with the goal to increase awareness for optics and photonics. This outreach event was made possible in large part by an Educational Outreach Grant from SPIE (the International Society of Optics and Photonics), and also by the support of OSA (Optical Society of America), EPS (European Physical Society) and the ICFO-KTT unit.

The lead organizer of the workshop, PhD student Yannick de Icaza Astiz, assisted by volunteers from the ICONS chapter, put together an ambitious program aimed at transferring a large amount of information on Optics and Photonics from a motivated PhD community at ICFO to 30 high-school students from Catalonia. "Our main objective during the workshop was to communicate the idea that science is fun and challenging, but also that through science you can understand more about nature itself. All this focused on light, our

favourite tool, here at ICFO", explained de Icaza Astiz. The workshop began with talks given by ICFO PhDs as well as Group Leaders, offering an overview of a variety of subjects related to the science and technology of light. Social activities as well as some Photonic Magic were built into the intense agenda.

The high-school students, all of whom began the workshop with a strong interest in science, achieved a solid foundation in photonics spanning the basics of optics, geometrical optics, interference and diffraction, polarization, and quantum measurements. They were later given the opportunity to put this knowledge to practical use with a hands-on experiment led by PhD students in ICFO's laboratories.





## BUSINESS

## 2012 ICFO-Corporate Liaison Day

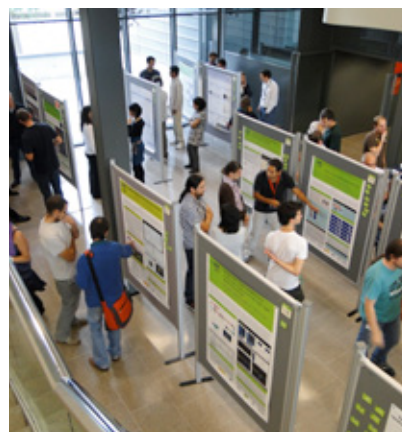
ICFO celebrated the fourth edition of the Corporate Liaison Day on Friday, 14 October. The ICFO-Corporate Liaison Day is a one-day program of networking events open to ICFO industrial partners and other collaborators. The goal of CLP Day is to provide industries with insights into new advances that in the short to medium term may provide interesting innovations for industrial processes or products. The day is also an excellent opportunity for ICFO researchers to mingle with representatives from industry to stay abreast of the challenges and needs of businesses. The event fosters future collaborations through the exchange of ideas and perspectives.

The focus theme of the 2012 ICFO-Corporate Liaison Day was *Graphene Photonics for Industry*. In a morning series of talks, Professor at the University of Cambridge Andrea Ferrari, leading the European Flagship initiative in Graphene Photonics, overviewed the properties and potential of this material and shared his vision on the opportunities in Europe for such a booming field. ICFO Group Leader and ERC Prof. Frank Koppens covered the latest scientific developments on this area. The session was completed with talks by Dr. Fengnina Xia (IBM

Thomas J. Watson research centre in Yorktown Heights, USA ) and Dr. Jani Kivioja (Nokia Research Center, Cambridge UK) both contributing with their views on the potential of graphene based technologies from an industrial perspective.

The program also featured ICFO's Ph.D. Student Thesis Award Ceremony, the Annual Student Poster Session, tours of the research labs, a variety of project meetings, and a workshop by Dr. Rebeca Santamaría Fernandez on funding opportunities for photonics in the FP7 framework programme and beyond.

Now in its fourth year, the 2012 ICFO-Corporate Liaison Day welcomed around 125 attendees, including industry representatives from more than 20 companies. To date, ICFO has more than 30 members in its CLP Program. The ICFO CLP program is dedicated to generating shared knowledge, mutual trust, and common benefits with corporations of all kinds.



At the top: Jan Gieseler awarded Best Poster by jury of distinguished CLP Day invited guests from Industry: Fengnian Xia (IBM TJ Watson Research Center, USA) Javi Kivioja (Nokia Research Center in Cambridge, UK); and Cynthia Giroux (Optical and Surface Technologies, Science&Technology at Corning Inc., USA).

Bottom Left: Lab Tours and a visit to ICFO's prototype room formed part of the CLP Day agenda.

## CROSS FERTILIZATION

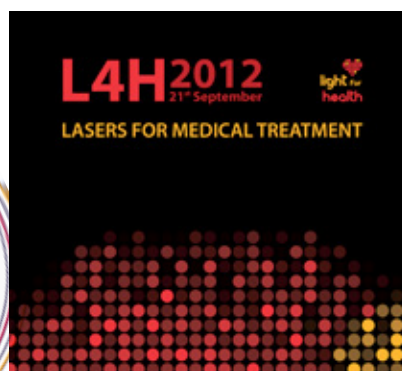
## Light for Health 2012

One of the main goals of the Light for Health Focus Program at ICFO is to draw attention to the wide range of potential applications for photonics in life sciences, thus providing a platform for exchange of know-how between the many different research focuses that are making advances in this area today. Now in its 3<sup>rd</sup> edition, the Light for Health 2012 event entitled "Lasers for Medical Treatment", gathered more than 200 participants from hospitals, healthcare centres, medical research centres, as well as universities and industry, all with the common objective of expanding the applications of lasers for medical innovation and technologies.

The event program offered a range of talks by renowned experts in the field addressing the subject of photonics applied to a variety of areas of medical treatments, including clinical and translational research and development. From the distinguished group of experts who actively participated in this event, we would like to highlight Dr. Hans-Peter Berlien from the *Elisabeth Klinik*

*Berlin* in Germany who offered his insights into the state-of-the-art lasers applied to medicine in an inspirational talk entitled "Let there be light - Biophotonics literally taken". In addition, Dr. Tayyaba Hasan, from the *Massachusetts General Hospital* in USA, gave a far reaching presentation on Photodynamic Therapy and the bridging of Medicine and Technology.

The Light for Health 2012 event was co-located with the "24th International Conference of the Society for Medical Innovation and Technology" (SMIT 2012) in the frame of the "Catalonia: Working in Health Forum". L4H program activities continue with preparations already underway for Light for Health 2013. The event will take place in May at ICFO's facilities with a focus on Super Resolution Imaging.





**GOLDEN JUBILEE**

*NLO 50 Celebrates 50 Years of Nonlinear Optics*

The three day conference attracted participants from 30 countries. Nobel Prize winning pioneers, Dr. Charles Townes and Dr. Nicolaas Bloembergen participated at the Symposium.

As part of the yearlong celebration of ICFO's 10<sup>th</sup> anniversary, there has been a wave of conference activity at ICFO focusing on a wide range of fields within the science and technology of light. A central pillar of photonics research, Nonlinear Optics, also this year celebrates the 50th anniversary of the seminal paper by Nicolaas Bloembergen and co-workers, which had a profound impact on the field and paved the way for a new era in science and technology.

The discovery, understanding and manipulation of nonlinear optical phenomena have led to numerous scientific and technological breakthroughs, not only in photonics, but also in the broader fields of knowledge in physics, chemistry, biology, and medicine. Many areas of research and innovation, from laser technology to high-intensity physics, photochemistry, frequency metrology, and quantum information science would not have been possible without the exploitation of nonlinear optical ef-

fects. It is no exaggeration to state that these advances have changed the world.

In recognition of the importance of this landmark anniversary and the happy coincidence of a shared anniversary year, ICFO organized NLO 50 - a Golden Jubilee International Symposium. The three day conference attracted participants from 30 countries around the world to take part and benefit from keynote presentations by contemporary leaders in the field of nonlinear optics and closely related topics, as well as plenary talks given by Nobel Prize winning pioneers, Dr. Charles Townes and Dr. Nicolaas Bloembergen. In addition to the scientific program involving the spectacular line-up of invited and plenary speakers, the Symposium provided the opportunity for younger researchers to share their research findings in oral presentations and poster sessions, as well as for a number of companies in photonics to exhibit their latest products.



PLENARY SPEAKERS



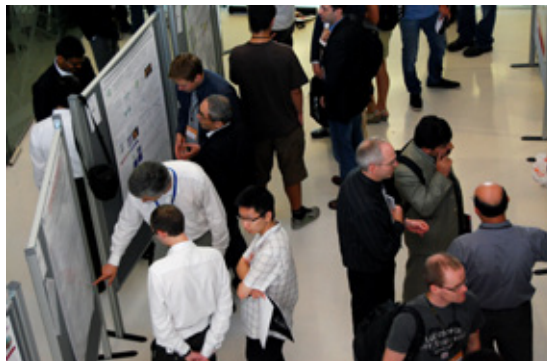
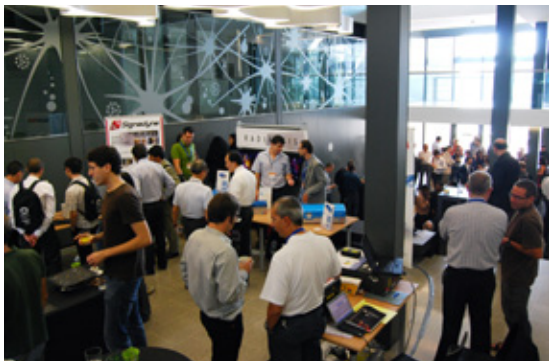
**Nicolaas Bloembergen**  
Nobel Laureate (1981)  
*Sharing the award with Drs. Schawlow and Siegbahn "for their contribution to the development of laser spectroscopy"*



**Charles H. Townes**  
Nobel Laureate (1964)  
*Sharing the award with Drs. Prokhorov and Basov "for fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser principle".*

INVITED SPEAKERS

- R. W. Boyd, *University of Rochester (USA)*
- R. L. Byer, *Stanford University (USA)*
- F. Krausz, *Max Planck Institute (Germany)*
- P. F. Moulton, *Q-Peak, Inc. (USA)*
- A. P. Piskarskas, *University of Vilnius (Lithuania)*
- K. J. Vahala, *Caltech (USA)*
- E. W. Van Stryland, *CREOL (USA)*
- X. Xie, *Harvard University (USA)*



Top Left: Exhibitors taking part in this event included Cosingo, Hamamatsu, Innova, Radiantis, Signadyne, and Time-Bandwidth.

Top Middle: Posters Sessions were held on two days, displaying sixty posters in total.

Top Right: ICFO Prof. Majid Ebrahim-Zadeh: Symposium Chair.

Bottom Left: ICFOnian Carlos Florensa offered the conference attendees some photonic magic between sessions.

Bottom Middle: Nobel Prize winning pioneers, Dr. Charles Townes and Dr. Nicolaas Bloembergen, with ICFO Director, Professor Lluís Torner and ICREA Professor at ICFO, Majid Ebrahim-Zadeh

Bottom Right: Front row only (from left to right): Torner (ICFO), Van Stryland (CREOL), Ito (Univ Tohoku and RIKEN), Mas-Collé (Catalonian Gov't), Bloembergen, Moulton (Q-Peak), Byer (Stanford), Soileau (CREOL), Boyd (Rochester), Ebrahim-Zadeh (ICFO), Sorokina, (NTNU-Trondheim), Xie (Harvard), Vahala (CalTech)



## CROSSING BORDERS

### Consular Visit with Presidential Support

On 17<sup>th</sup> October, ICFO invited consulates and honorary consulates from over twenty countries to the institute as part of 10<sup>th</sup> Anniversary celebration. ICFO's Director, Prof. Lluís Torner, explained the rationale behind the visit; "ICFO has decided to celebrate its birthday by working harder than ever to achieve its goals. We are seeking even more allies and new friends with whom we can collaborate." The visit was organized with the support of the Office of Consular Affairs in Barcelona as well as the office of External Affairs of

the Government of Catalonia. Lending additional force to this visit were the President of Catalonia, Hble. Artur Mas and the Mayor of Castelldefels, Manuel Reyes, as well as members of their administrations and representatives of ICFO's Board of Trustees.

ICFO collaborates with the public and private sector, both in Spain and abroad, to find innovative solutions for issues facing the world today. In order for these essential relationships to thrive, information must flow freely between the institute, industry

and all areas of society. The goal of this visit was to give the consular community an indication as to the importance of the research being conducted at ICFO as well as the quality of our results.

After a formal presentation in the auditorium, the Consuls toured the centre, stopping in laboratories as well as ICFO's prototype room. Afterwards, they were given the opportunity to meet with researchers from their countries to gain a well-rounded vision of ICFO's activities.



Top: ICFOians pictured with consulates, honorary consulates, and dignitaries.

Left: Over 20 different countries participated in the visit which ended with a networking opportunity.

Middle & Right: A visit to the prototype room and a research laboratory stressed the connection between frontier research and society.



### Secretary of State for Research Visits ICFO

While in Barcelona to attend a conference addressing strategies for the recruitment of top international talent for research institutions, Spain's Secretary of State for Research, Carmen Vela, made a detour to ICFO to visit the facility. In reference to ICFO's 10th Anniversary, she congratulated ICFOians on the progress made to date.

Ms. Carmen Vela's visit included an introduction to the institute's faculty and management staff, giving

an overview of the wide range of research thrusts at ICFO. She later toured the prototype room to highlight industrially oriented research, followed by brief project presentations covering "Onco-plasmonics", "NanoLight.es" and "EuroBioImaging". In this encounter with the Ministry of the Economy and Competitiveness (MINECO), ICFO aimed to highlight our reliance on world class scientific talent as part of the commitment to research excellence.



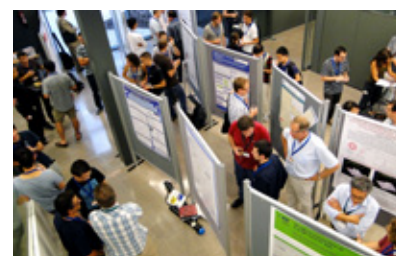
A tour of the prototype room highlighted industrially oriented results and collaborations.

## BRIDGING FIELDS

### The Future Directions of Quantum Nano-Optics

Quantum information brings a new paradigm in the processing of data that could radically revolutionize our way of communicating and enables us to handle tasks that are currently not achievable with conventional computers. This is a promising area of research where a variety of photonic disciplines tend to naturally converge despite their different roots. In particular, the now relatively mature field of Nano-Optics offers different strategies to control light fields on the nanometer scale; that could dramatically benefit to Quantum Optics by improving the light interaction with tiny quantities of matter down to the single atom level.

The Quantum Nano-Optics (QNO) Workshop held at ICFO on September 10-11th aimed at bringing together these two communities of researchers to focus on the interplay between them. This two-day meeting brought together leaders from around the world who are actively working on the frontiers between both fields. The invited speakers provided an overview of the most recent advances and stimulated open discussions on the future directions of Quantum Nano-Optics.



1. Prominent speakers from around the world shared their research with a full auditorium throughout the two day workshop.
2. Attendees had the opportunity to visit ICFO labs.
3. Lively discussions took place around posters.



## PHD THESIS AWARD

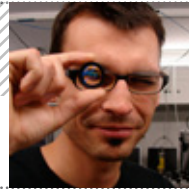
*Special Recognition for two Distinguished PhD Thesis*

Dr. Tim Taminiau and Dr. Marco Koschorreck receive the 2012 ICFO PhD Award.

DR. TIM  
TAMINIAU

The field which fascinates Dr. Tim Taminiau, recipient of ICFO's Phd Award, is communication at the nanoscale. His PhD thesis is focused on controlling quantum emitters, such as single molecules and quantum dots, with metallic nanostructures. "During the writing of my thesis, there were nights where it seemed like a hard and almost futile exercise. Therefore, it was very satisfying that the committee found the thesis worthy of distinction, particularly in an institute like ICFO which is bustling with so many excellent PhD students." Tim says.

Today, he is involved in the Quantum Transport group at the Kavli Institute of Nanoscience, at the Delft University. The group's research led by Prof. Ronald Hanson, centres on solid-state quantum systems. Tim focuses on quantum information with spins in diamonds, in particular on the remarkable properties of the nitrogen-vacancy centre. Although applications of that field are extremely challenging to carry out, they have the potential to revolutionize the way we process information. When Tim looks to the future of his career, he can't help but remember what he has gone through to date. "I have been lucky to have worked with great groups of smart people all over the world, such as Niek van Hulst and his group at ICFO, and now the Quantum Transport group in Delft. For the next few years, and in fact for the rest of my research career, I can only hope to continue to find such remarkable co-workers from whom I can keep learning more about physics and science." reflects Taminiau.

DR. MARCO  
KOSCHORRECK

"It is a big honour to receive the award and it felt nice to get some recognition for the hard work during my doctorate". These were the first words spoken by Dr. Marco Koschorreck after receiving the ICFO PhD Award. In his doctoral dissertation, he worked in the field of quantum metrology with cold atomic ensembles. He developed techniques to manipulate atomic quantum states which allow precision metrology beyond the standard quantum limit.

Currently, he is working in the group led by Professor Michael Köhl at Cambridge University on simulating the physics of complex solid state systems with the help of ultra-cold atomic gases. This might find application in many fields which range from magnetic resonance imaging of the human body to improvement of receivers in mobile communications base stations. The group's research is driven by the desire to overcome practical limitations of current quantum technology and to study qualitatively new effects arising from novel interactions and geometries. Marco agrees with this aspiration. "My prospective for the coming years is to contribute many interesting results to the fascinating field of quantum simulations with cold atoms" he concludes.



1. Prof. Niek van Hulst, thesis advisor for Dr. Tim Taminiau and Prof. Morgan Mitchell, thesis advisors for Dr. Marco Koschorreck, commended the PhDs on their work.
2. Prof. Romain Quidant presented the awards during the 2012 CLP Day.

## ICFO AWARD

*Dr. MJ Soileau Recognized for Valuable Contributions in the Development of ICFO*

Special events planned throughout this 10th Anniversary landmark year have focused on the celebration of learning and discovery, the building blocks of a frontier research institution. But for an institute to arrive at a point where learning and discovery come together at a level of scientific excellence, it must have a support structure in place. ICFO has had the good fortune over the past ten years to be able to count on generous friends and colleagues who have offered guidance and inspiration.

In this regard, ICFO's Board of Trustees formally recognized the outstanding dedication of Dr. MJ Soileau toward the development of the institute by awarding him ICFO's first **Distinguished Service Appreciation Medal**. The Board sited Soileau's exceptional commitment to the institution through "outstanding service in ICFO's Scientific Advisory Board at large and especially for continuous and generous advice in the design of the Institute and in matters related to technology transfer".

Dr. Soileau formative influence at ICFO stems from his experience as the first director of the University of Central Florida's internationally recognized *Center for Research and Education in Optics and Lasers (CREOL)*. Since, 1999, he has served as vice president for the Office of Research and Commercialization at CREOL, where he dedicates his efforts toward moving research from the labs into industry. He is also a distinguished Professor of Optics, ECE, and Physics.

Soileau's research interests include the nonlinear optical properties of materials and laser-induced damage. It was thus especially fitting that ICFO's Board should grant this award during the Nonlinear Optics Golden Jubilee at ICFO, in the framework of ICFO's 10th Anniversary celebration. Dr. Andreu Mas-Colell, Chairman of ICFO's Board of Trustees and Minister of Economy and Knowledge in the Government of Catalonia, presented the award to Soileau who was surrounded by colleagues from the field of nonlinear optics who also know and respect his work.



## 2002-2012: 10 YEARS @ ICFO

## Snapshots of a Growing Research Institute

An inside look at ICFO's building plan outlines the institute's first 10 years of growth.

## MARCH 2002

When the Government of Catalonia and the UPC formalized the creation of a centre for research in photonics that would be known as ICFO, a small but inspired group, which included Ramon Alcubilla, Emilià Pola and other early supporters, was working hard within the UPC and GenCat towards the creation of the institute. Within weeks of signing the charter, Dolors Mateu joined as ICFO Manager and by summer a group of new ICFO-nians moved into rented space in the Nexus and Omega buildings on the UPC campus. Scientists and staff worked together and in spite of the inconveniences related to the start-up, scientific results were promising and there was a general excitement for being part of something new with amazing potential.

Even before signing the charter, ICFO had embarked on the construction of an independent, purpose built facility. At the end of 2002, construction began at the site of ICFO's permanent home, on land donated by the Government of Catalonia in the Mediterranean Technology Park in Castelldefels. The laying of the founding stone was a momentous event in January 2003.

As a cork bursts from a bottle of cava, soon ICFO's energy burst into the scientific community with publications, new PhD projects, European project participations, visits, and even the launch of ICFO's first High Tech spin off company.

## OCTOBER 2005

On 7<sup>th</sup> October 2005, ICFO's leading web highlight read "WE HAVE MOVED". The new ICFO headquarters in Castelldefels occupied 3,500m<sup>2</sup>, built to house one hundred people, twenty research laboratories, and a nanofabrication lab. As researchers and staff began to fill the new state-of-the-art facility, plans were underway for the construction of Phase II of ICFO's home. ICFO continued to grow in number of researchers, projects,

publications, awards, patents, PhDs, and collaborations of all kinds.

## DECEMBER 2008

The Phase II building project gave ICFO-nians 5000 m<sup>2</sup> of new space, including 40 new offices, 24 laboratories, chemistry, biology and post-processing nanophotonics labs, an auditorium, and additional leisure and discussion space.

ICFO was not only publishing in the highest impact journals, it was on the cover! As research areas grew, so did efforts to take research out of the lab and into society, with outreach and KTT activities on the rise. ICFO was making its mark.

Dr. Pere Mir i Puig and his Cellex Foundation took notice and starting in 2007, began supporting many visionary research projects at ICFO. In addition, in October 2010, he made a historic €16 million donation to finance the CELLEX NEST program which supports the creation of new research groups exploring the role of photonics in new areas of science and technology. The CELLEX Foundation's generosity put in motion ICFO's final building project.

2012: 10<sup>TH</sup> ANNIVERSARY OF ICFO

Throughout 2012, celebrations of learning and discovery have taken place at ICFO, starting with the inauguration of the CELLEX NEST Building (June 2012), providing space to grow and expand to meet ambitious goals.

In these first 10 years, ICFO has built from scratch a world-class research facility, manned it with inspired and dedicated scientists and support staff, and marked the path for a successful future.

With the continued support and collaboration of friends and colleagues, ICFO will continue this important journey, expanding the frontiers of the science and technology of light.

*"It was one phone for eight people in the office, ten minutes to go from the office to the lab in the Omega building, three groups in a small lab space - but they were the happiest years of my life, full of illusions and hopes."*

*ICREA Professor Dmitri Petrov - ICFO-nian since 9 October 2002*

*"Looking back over these first 10 years what most stands out in my mind is the terrific team of ICFO-nians that have made EVERYTHING happen."*

*Dolors Mateu - ICFO Manager since 2002*

## SNAPSHOT ICFO JANUARY 2003



## Founding stone for permanent facility in Castelldefels

- Founding stone for permanent facility in Castelldefels
- 16 ICFO-nians in total including researchers and staff
- 4 Research Groups

## SNAPSHOT ICFO OCTOBER 2005

Facilities: 3500 m<sup>2</sup>

- 85 ICFO-nians in total including researchers and staff
- 12 Research Groups
- 3 PhDs Defended

## SNAPSHOT ICFO DECEMBER 2008

Facilities: 9000m<sup>2</sup>

- 192 ICFO-nians in total including researchers and staff
- 15 Research Groups
- 12 PhDs Defended
- 300 publications in leading high impact journals

## SNAPSHOT OF ICFO NOVEMBER 2012

Facilities: 14000m<sup>2</sup>

- 300 ICFO-nians including researchers and staff of 50 nationalities
- 22 Research Groups
- 44 PhDs Defended
- 1000 publications in leading high impact journals

*"Research is what allows a country to advance. Scientific careers in general, and physics in particular, are beneficial for companies and the healthy functioning of the economy."*

*Dr. Pere Mir - President of the Cellex Foundation (La Vanguardia, 26 October 2010)*



The best way to predict the future is to build it



2002-2012: 10 YEARS @ ICFO

ICFO's Internal Clock:  
The measure of success of a research institute in large part comes from its PhD students

Forty-five women and men have 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. They have asked important questions that we will continue to contemplate far into the future. They are bright and ambitious young scientists with a talent for discovery and strong values, who aim to achieve difficult but important goals. We proudly recognize the contribution of all our PhDs towards the successful first decade of scientific discovery at ICFO.











 <b>Gabriel Molina Terriza</b> <i>Optical vortices: Fundamentals and applications</i> TD: Lluís Torner March, 2002	 <b>Silvia Carrasco</b> <i>Quadratic Solitons: Existence versus Excitation</i> TD: Lluís Torner July, 2003	 <b>Emilio Gualda Manzano</b> <i>Optimización de las prestaciones de enlaces ópticos...</i> TD: Juan P. Torres December, 2005	 <b>Gajendra Pratap Singh</b> <i>Raman microspectroscopy of optically trapped cells</i> TD: Dmitri Petrov July, 2006	 <b>Herbert Crepaz</b> <i>Trapping and cooling rubidium atoms for quantum information</i> TD: Juergen Eschner March, 2007	 <b>Joonwoo Bae</b> <i>Entanglement and quantum cryptography</i> TD: Antonio Acín April, 2007	 <b>Zhiyong Xu</b> <i>All-optical soliton control in photonic lattices</i> TD: Lluís Torner November, 2007
 <b>Marc Maymó</b> <i>Interacció paramètrica no-lineal en materials amb nano-estructuració...</i> TD: Jordi Martorell November, 2007	 <b>Miguel Navascués</b> <i>Quantum information in infinite dimensional hilbert spaces</i> TD: Antonio Acín December, 2007	 <b>Xavier Vidal</b> <i>Generación de Segundo Armónico en Estructuras Desordenadas...</i> TD: Antonio Acín February, 2008	 <b>Daniel Cavalcant</b> <i>Entanglement: from its mathematical description...</i> TD: Antonio Acín October, 2008	 <b>Giovanni Volpe</b> <i>Probing the Near-Field Optical Response of Plasmon...</i> TD: Dmitri Petrov October, 2008	 <b>Petru Ghenuche</b> <i>Trapping and cooling rubidium atoms for quantum information</i> TD: G. Badenes / R. Quidant April, 2009	 <b>Marcin Kubasik</b> <i>Towards spin squeezing in cold atomic ensembles</i> TD: Morgan Mitchell May, 2009
 <b>Ana Predojevic</b> <i>Rubidium Resonant Squeezed Light from a Diode-Pumped...</i> TD: Morgan Mitchell June, 2009	 <b>Simó Graells</b> <i>Creixement de nanoestructures plasmòniques...</i> TD: G. Badenes / R. Quidant May, 2009	 <b>Goutam Kumar Samanta</b> <i>High power, continuous-wave optical parametric oscillators...</i> TD: Majid Ebrahim-Zadeh July, 2009	 <b>Felix Rohde</b> <i>Remotion traps for quantum networking: two-photon...</i> TD: Jürgen Eschner October, 2009	 <b>Anisha Thayill</b> <i>Applications of two-photon fluorescence in biology...</i> TD: PLoza-Alvarez / S. Soria October, 2009	 <b>Manoj Mathew</b> <i>Neuron guidance and nano-surgery using optical tools</i> TD: Pablo Loza-Alvarez November, 2009	 <b>Carsten Schuck</b> <i>Interfacing single ions and single photons for quantum networks</i> TD: Jürgen Eschner January, 2010
 <b>Noelia González</b> <i>Measurement of the spatial shape of photons</i> TD: Juan Pérez Torres January, 2010	 <b>Xiaojuan Shi</b> <i>Spectrum shaping of paired photons</i> TD: Juan Pérez Torres March, 2010	 <b>Clara Inés Osorio</b> <i>Spatial characterization of two-photon states</i> TD: Juan Pérez Torres March, 2010	 <b>Christian Tretzger</b> <i>Ultracold dipolar gases in optical lattices</i> TD: Maciej Lewenstein April, 2010	 <b>Artur Garcia</b> <i>Entanglement and classical correlations in many-body systems</i> TD: Antonio Acín May, 2010	 <b>Mafalda Almeida</b> <i>Quantification of classical resources for quantum information</i> TD: Antonio Acín July, 2010	 <b>Marc Almendros</b> <i>Towards long-distance quantum communication</i> TD: Juergen Eschner September, 2010
 <b>Maurizio Righini</b> <i>Plasmon-based optical trapping</i> TD: Romain Quidant October, 2010	 <b>Nicolás Piro</b> <i>Controlled absorption of heralded single photons by a single atom</i> TD: Juergen Eschner October, 2010	 <b>Armand Niederberger</b> <i>Disorder-induced order with ultracold atoms</i> TD: Maciej Lewenstein December, 2010	 <b>Marco Koschorreck</b> <i>Generation of spin squeezing in an ensemble of cold rubidium 87</i> TD: Morgan Mitchell January, 2011	 <b>Sibylle Braungardt</b> <i>Complex systems for quantum technologies</i> TD: M. Lewenstein / M. Rodríguez July, 2011	 <b>Anna Kubasiak</b> <i>Ultracold gases in non-abelian synthetic gauge fields</i> TD: M. Lewenstein / M. Rodríguez October, 2011	 <b>Tim Taminiau</b> <i>Optical antennas for single emitters</i> TD: Niek van Hulst November, 2011
 <b>Osamu Takayama</b> <i>First experimental observation of dyakonov surface waves</i> TD: Lluís Torner/David Artigas November, 2011	 <b>Chaitanya K. Suddapalli</b> <i>High-Power, fiber-laser-pumped optical parametric oscillators...</i> TD: Majid Ebrahim-Zadeh January, 2012	 <b>Domenico Tulli</b> <i>Micro-nano Structured Electro-Optic Devices in LiNbO3...</i> TD: V.Pruneri/D. Janner February, 2012	 <b>Didit Yudistira</b> <i>Micro-structured Ferroelectric Superlattice for efficient...</i> TD: V.Pruneri/D. Janner February, 2012	 <b>Lars Neumann</b> <i>Control of Optical Fields and Single Photon Emitters...</i> TD: Niek van Hulst April, 2012	 <b>Giorgio Volpe</b> <i>Nanoscale Spatial Control of Light in Optical Antennas</i> TD: Romain Quidant May, 2012	 <b>Florian Wolfgramm</b> <i>Atomic Quantum Metrology with Narrowband Entangled...</i> TD: Morgan Mitchell June, 2012

GO & FLY

These ICFOnians have successfully defended 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.

 <b>Dhriti Ghosh</b> <i>Ultrathin metal transparent electrodes for...</i> TD: Valerio Pruneri October, 2012	 <b>Daan Brinks</b> <i>Nanoscale Coherent Control</i> TD: Niek van Hulst October, 2012	 <b>Srdjan Acimovic</b> <i>Localized surface plasmon resonance for biosensing lab-on-chip applications</i> TD: R.Quidant/Mark Kreuzer October, 2012
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 1 2002	 3 2008
 1 2003	 8 2009
 1 2005	 11 2010
 1 2006	 5 2011
 5 2007	 10 2012



## HIGH PROFILE



**Andreu Mas-Colell:**  
*“The quality of a country is in good part measured by its strength in research and innovation.”*

Honorable Andreu Mas-Colell: Minister of Economy and Knowledge in the Government of Catalonia and first and current Chairman of ICFO’s Board of Trustees. His visionary impulse as Minister of Universities and Research (2000-2003) launched ICFO and its sister institutes.



**You have not always been in government but rather started in academia. Can you tell us how you evolved from Harvard Professor to Minister?**

I suppose it is not an entirely natural evolution, but in my case it was. While still an academic I returned to Catalonia in 1995 because it was exciting for me to do things at home. Incursions into politics have been simply part of this “doing things”. I believe in the power and the need of politics.

**What has driven you to act as a champion for research and innovation?**

I am of the opinion that the quality of a country is in good part measured by its strength in research and innovation. Besides, this is an area I had some expertise and could contribute.

**How has research in Catalonia changed since you began your public service career?**

A lot and for the better. But let me note that it started to change before me and continued after me.

This has been a collective, and basically political, decision to which I had, and now have again, the privilege and the satisfaction to participate.

**You served as ERC Secretary General in a key transition period. How do you see ERC evolving in the upcoming years?**

The ERC has been a fantastic initiative of the EU. It started well and become an instant success. The EU is proud of it and I’m certain that every effort will be made to consolidate and expand it in the perspective of Horizon 2020. It is important, however, that the Member States do also push in that direction.

**What has been the key to the success of the CERCA research institutions?**

In a nutshell: governance. Each institution has legal standing, a Board that guarantees its autonomy, and an organization squarely placed outside the framework of the civil service. Location at university campuses is also important.

**Lluís Torner always quotes you as saying “If you believe excellence is expensive try mediocrity”. Can you please elaborate?**

I have repeated the sentence. It is a good one. But it is not mine. It was coined, to my knowledge, by Derek Bok when he was Harvard’s President. At any rate, the catalan experience, with Icrea, Cerca, and other initiatives at the universities, confirms that excellence is cheap.\*

**ICFO has turned 10! What is your advice for our next 10 years?**

Keep up the good work!

\* Bok, following Benjamin Franklin and possibly others, is known to have coined the now famous phrase “If you believe education is expensive try mediocrity”.

## SUDOKU by [www.sudoku-puzzles.com](http://www.sudoku-puzzles.com)

EASY

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