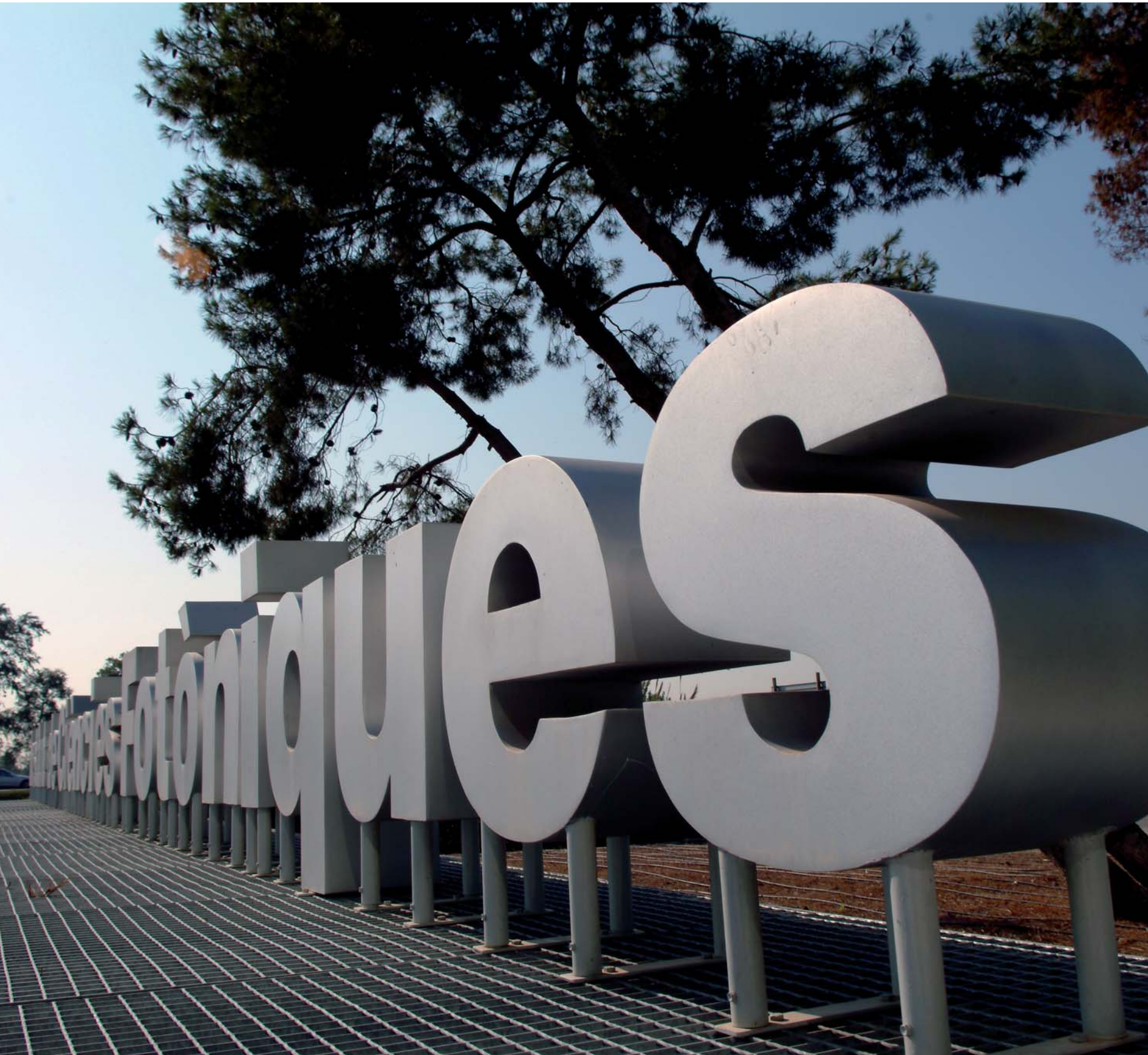


Community News from the Institut de Ciències Fotòniques

# ICFO<sup>R</sup> spotlight

FALL 2008 | 01



## welcome to SPOTLIGHT



**Lluís Torner, ICFO Director**

It is for me a pleasure and privilege to introduce you to the first issue of ICFO Spotlight. ICFO Spotlight, our brand new community newsletter, is one more dream come true.

ICFO is a young institution, full of passion and ambition. We feel passion for what we do, and we also feel passion for why we do it and what we do it for. Our aim at ICFO is to do cutting-edge research in the science of light. Our motivation is to push the boundaries of knowledge in our scientific and technological field for the benefit of Humanity.

In both the short and long-term, our research programs aim at providing **new understanding, new solutions, and new tools** to help industry and the society at large tackle some of the greatest challenges we face today. Our greatest reward at ICFO is to step into new territories and know that the discoveries we make are useful to society.

Our research focuses on both **novelty and relevance**, and to tackle this dual challenge we have been partnering with academic colleagues, research institutions, funding agencies, and companies all over the world. Over the years we have created an extensive network of people and institutions whom we share projects and aspirations with. The main objective of ICFO Spotlight is to foster new, strong links between all the different members of this network.

Spotlight is the fruit of the vision and efforts of many ICFOians. The list is too long for me to name here every one of you who has contributed to making this project a reality. I would like to give my special thanks to our brand new and brilliant editor Elisabeth Pain for her leadership, as well as to all the ICFOians who have offered their enthusiastic participation already. I am convinced that, from now on, we are all going to look forward to the next issue of ICFO Spotlight with great anticipation.

Spotlight is for every one of us ICFOians. Spotlight is dedicated to all the ICFOians who work in the building today and to all those who have now left for new professional horizons. Spotlight also belongs to all of you who collaborate with us, propose new scientific challenges, and also support research with funding.

Please do all contact Elisabeth for any suggestions or contributions you may have for the upcoming newsletters.

Enjoy your Spotlight, and thank you for your attention.



**Elisabeth Pain, ICFO Spotlight Coordinating Editor**

When I first came to ICFO last April I was struck by how young, multicultural, and dynamic the Institute is. As I got to know ICFO a little better over the months that followed, I saw a great number of you join the Institute, many new research findings get published in prestigious journals and national newspapers, and ICFO expand with brand new labs and offices.

These developments--and the many others that took place during these last few months--are of course all important. But I knew I would never be short of ideas for this newsletter when back in May I saw an email calling upon all ICFOians to take part in this year's International Food Festival. This, I realized, was one of many other personal initiatives, and a tale-tell sign of the great sense of community that reigns here at ICFO.

As Lluís says beautifully above, ICFO Spotlight is for and about all ICFOians. You all are the ones who will make this newsletter a reality, term after term. I would like to thank all of you who have taken part in this first issue already and look forward to receiving your comments and suggestions for future content.

Meanwhile, it is with great pleasure that I will keep watching ICFO grow and that, with the precious help of every one of my colleagues in the editorial committee, I will continue to celebrate the achievements--professional and personal--of all the ICFOians.

## index

<b>Welcome</b>	<b>2</b>
<b>Happenings</b>	<b>3</b>
ICFO News	
ICFO Newcomers	
ICFO Events	
<b>Latest Advances</b>	<b>4</b>
Research Highlights	
Business News	
<b>People</b>	<b>5</b>
Junior Researchers	
Community Picture	
<b>People</b>	<b>6</b>
In Focus	
In the Frame	
<b>Perspectives</b>	<b>7</b>
Beyond ICFO	
Culture Spot	
<b>The Last Word</b>	<b>8</b>
High Profile	
Sudoku	
Get in touch!	






## cover

The *Institut de Ciències Fotòniques* (ICFO) is an independent, non-profit research center with the mission to advance the science of light through cutting-edge research and education. ICFO was established in March 2002 by the *Generalitat de Catalunya* (Government of Catalonia, Spain) and the *Universitat Politècnica de Catalunya* in Barcelona, Spain.

# ICFO<sup>R</sup>

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# HAPPENINGS

## ICFO news

by Michele Catanzaro

### ERC Grants for Two ICFO Researchers

Last July, ICFO group leader Antonio Acín was awarded a Starting Independent Researcher Grant from the European Research Council (ERC) for his Percolating Entanglement and Quantum Information Resources through Quantum Networks (PERCENT) project. The ERC Starting Grants aim to support young researchers with up to €2 million over 5 years while they establish themselves as independent group leaders in Europe.

In August, ICFO group leader Maciej Lewenstein also received an Advanced Investigator Grant from the ERC for his Quantum Gauge Theories and Ultra-cold Atoms (QUAGATUA) project. The Advanced Grants, which offer up to €3.5 million over 5 years, promote pioneering research carried out by top-level scientists in Europe.

### Optics & Photonics Focus Takes Off

A group of researchers at ICFO and at the Massachusetts Institute of Technology (MIT) in the United States have recently launched a new online magazine called Optics & Photonics Focus (OPFocus). The aim of OPFocus is to review recent developments in optics and photonics research and make them accessible to scientists, journalists, and the public alike. You can find OPFocus at [www.opfocus.org](http://www.opfocus.org).

### Charting the Future of European Photonics

In an initiative promoted by Photonics21—the Technology Platform for Photonics in Europe—a high-level group of 15 experts from all over Europe gathered in Cork, Ireland in October last year to identify the areas of photonics research with most potential for European economy. The group—which included ICFO Director Lluís Torner—produced a roadmap for photonics research that may be downloaded from [www.photonics21.org](http://www.photonics21.org).

### ICFO Joins Photonics4life

ICFO is among the 13 European institutions that have joined the new European Network of Excellence for biophotonics, Photonics4life. Launched in May at the Institute of Photonic Technology (IPHT) in Jena, Germany, Photonics4life aims to provide a common platform for biophotonics researchers and bridge the gap between disciplines as diverse as physics, engineering, chemistry, biology, and medicine.

Together with their teams ICFO group leaders Niek van Hulst, Dmitri Petrov, Romain Quidant, and Pablo Loza-Alvarez will all contribute their expertise to the network. In particular the ICFO researchers will focus on developing new photonic technologies capable of bridging the nano-micro-macro gap as well as novel tools for minimally invasive diagnosis.

### ICFO Featured in Nature

ICFO was referred to as one of the driving forces in today's Spanish science in a feature article published in Nature last July. The article, which focused on major research efforts made in the Barcelona area in the recent years, noted how rapidly ICFO has grown since its creation in 2003. Nature also highlighted the internationality of ICFO, the diversity of its research lines, and the launch of spin-off company Radiantis.

### ICFO wins the Castelldefels City Prize

In May ICFO was invited to the ancient castle of Castelldefels—the seaside town where the Institute is located—to receive an award from the city council. ICFO won the Castelldefels City Prize in recognition of its vital role in putting the city on the map as an innovative pole for new industries and frontier science.

## ICFO newcomers

Here are the ICFOians who have joined us between 15 July and the end of September this year... our warmest welcome to you all!



## ICFO events

by Michele Catanzaro

**ICFO at ESOF 2008.** ICFO group leaders Jürgen Eschner and Maciej Lewenstein represented ICFO this July at the EuroScience Open Forum (ESOF) in Barcelona. During the Forum, which showcased the latest trends in European research, Eschner and Lewenstein discussed the properties of matter near the absolute zero temperature in a session entitled 'The amazing quantum world of ultra-cold matter.' Eschner and Lewenstein acted as chair and speaker, respectively, and were joined by Christophe Salomon of the *Ecole Normale Supérieure* in Paris, France and Christopher Foot of the University of Oxford in the United Kingdom. The session was moderated by Spanish journalist and writer Eduardo Punset.

**ICFO Helps Foster European Photonics Projects.** On 18 and 19 September, ICFO hosted a meeting to present the 27 research projects funded by the European Commission under the second Information and Communication Technologies (ICT) call of the 7th Framework Program. The meeting, which in particular aimed at fostering information exchange on FP7 projects and debate on management issues, drew around 90 participants.

**Next IONS Meeting.** The young researchers at ICFO who are also members of the Optical Society of America (OSA) are in charge of organizing the next meeting of the International OSA Network of Students (IONS). The meeting will take place at ICFO in February next year.

# LATEST ADVANCES

## research highlights

by Michele Catanzaro

### Attosecond Watches

A new approach to achieving attosecond time resolution was presented in the July issue of *Nature Physics* by co-author and recently appointed ICFO group leader Jens Biegert. The research, done in Biegert's previous lab, used an intense circularly polarized pulse for measuring and controlling the movement of electrons at the attosecond scale.

### Treat Them Gently

ICFO researchers Dmitri Petrov, Giovanni Volpe, and Sandro Perrone have shown that, in science, common sense isn't always the answer. When trapping particles with optical tweezers in a noisy environment, using lower trapping power actually means holding particles more firmly, the team reported in the May issue of *Physical Review E*.

### A Nanoantenna Able to Redirect Visible Light

When brought down to the nanoscale, antennas are able to redirect electromagnetic waves in the visible spectrum pretty much the same way larger antennas operate when you make a phone call from your mobile.

ICFO researchers Tim Taminiou, Fernando Stefani, and Niek van Hulst, together with collaborators at the University of Twente in the Netherlands, used an 80nm-long antenna to capture the visible light of a nearby molecule and usher it into a new, controlled direction. Potential applications include more effective light sources and ultrasensitive biological sensors. The research finding made the cover of the April issue of *Nature Photonics*.

### Tuning Laser Blue Light

Together with researchers at the Catalan Institution for Research and Advanced Studies, ICFO group leader Majid Ebrahim-Zadeh and his team have developed the first practical solid-state laser technology to provide tunable blue radiation.

"The single-mode and high output power, possibility of power scaling and expansion of the wavelength range makes our approach exceptionally promising," ICFO Ph.D. student Goutam Kumar Samanta said to [optics.org](http://optics.org), which in September reported on the finding.

The work was also highlighted in *Laser Focus World*.

### Publishing Matters

The 'Raman Spectroscopy of Optically Trapped Particles' review published in August 2007 by group leader Dmitri Petrov was one year later the paper the most often downloaded from the *Journal of Optics*.

The potential of using surface plasmons to optically manipulate small objects down to the nanometer scale is the subject of a review co-authored by ICFO group leader Roman Quidant that made the cover of the April issue of *Laser & Photonics Reviews*.

Last but not least, ICFO researcher Majid Ebrahim-Zadeh is the co-editor of a book on the development of 'Mid-Infrared Coherent Sources and Applications' recently published by Springer.

## business news

by Silvia Carrasco

### Celebrating the ICFO Corporate Liaison Program's First Anniversary

The ICFO Corporate Liaison Program (CLP) was launched in August 2007 with a simple but challenging mission: To create fruitful and long-lasting relationships with local and international industry partners.

Among ICFO's endeavors is to support the optics and photonics industry by providing cutting-edge science, advanced technology, and talented people. The CLP is an ideal instrument for ICFO and all kinds of companies to establish a first connection. For each of its industry partners, ICFO sets a customized action plan to fulfill specific business needs and maximize mutual benefits.

In this first year of the program the Fundació Cellex, Caixa Catalunya, and Caixa Manresa all got onboard as sponsors, with "la Caixa" also providing some venture capital and other investments. Today the CLP also counts several large corporations as partners, namely Ferrer Internacional, Ficoso, SEAT, and BASF Construction Chemicals, Nikon, and IBM. The spinoff and small and medium enterprises Radiantis, Imagine Optic, On-Laser, Monocrom, AD Telecom, Telstar Instrumat, and WIS@key all joined the CLP too this year.

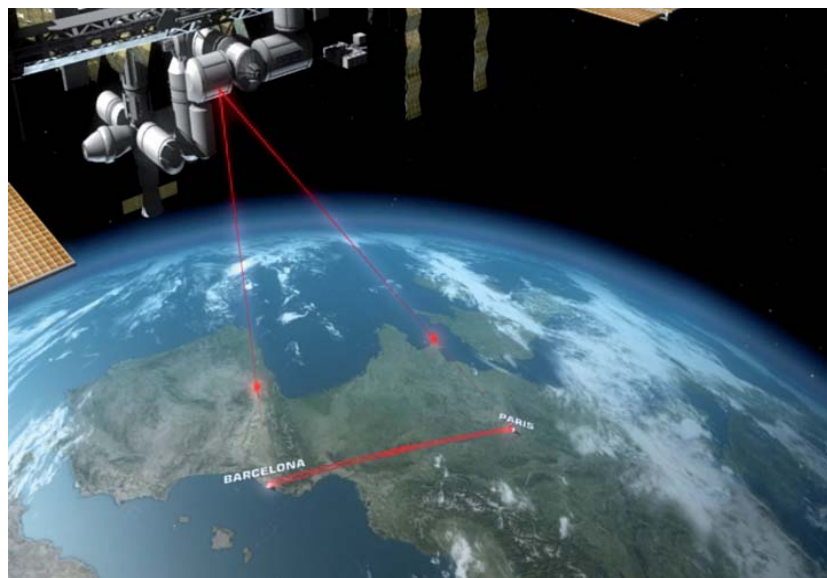


### Leading Ultra-Secure Communication in Space

The potential of sending sensitive information in complete confidence during space missions has led the European Space Agency (ESA) to recently challenge companies and the academic quantum research community to develop the necessary technology. ICFO is part of the consortium of Spanish companies and research centers that were chosen by ESA to help with this particular mission.

ICFO group leaders Valerio Pruneri, Juan Pérez, and Morgan Mitchell together with their teams will all help design and manufacture a quantum transceiver for space applications, a key step in the implementation of secure quantum cryptography in space. The ICFO researchers will work closely with other academic groups in Valencia, Madrid, and Vienna, as well as with space giant Thales Alenia Space and the Spanish companies Alter Technology Group, Emxys, and Lidax. The prototype is to be ready by June 2010, and Alter Technology Group will be acting as the industrial coordinator.

"Meeting the strong requirements of the project is a fascinating challenge and a great integration and optimization effort," says Pruneri, who is in charge of leading the scientific side of the project. "The space challenge will also provide a more portable technology for terrestrial applications."



Top: Ultra-secure communication between Paris and Barcelona using secure quantum cryptography.  
Left: Members of the ICFO Corporate Liaison program.

# PEOPLE

## junior researchers

### The Caixa Catalunya-ICFO Summer Fellows

Jade Martínez, Marco Casale, Damián San Román Alerigi, Alba Alfonso, Bogna Bylicka, Marta Castro, David Mateo, Isabel Rubio, Piotr Sleczkowski, Mónica Marro, David McCloskey, Isabel Merchán, Luisa del Carmen Frías, Pablo Rosado

Over the summer, fourteen outstanding undergraduate students from Spain and abroad joined ICFO to get a first taste of lab research. This was the second edition of the Caixa Catalunya-ICFO Summer Fellows Research Program. "We are all very grateful to Caixa Catalunya for supporting the program, and to Silvia Carrasco for securing this support," says ICFO Director Lluís Torner.

During their 12-week stay, the Summer Fellows worked on a research project of their own, attended a wide range of lectures, visited ICFO labs, and networked with the ICFO community. Before the Fellows left, in September, for their next career destination, Michele Catanzaro asked them about their experience at ICFO.

*My name is Damián San Román Alerigi, I am 23. I was born in Buenos Aires, Argentina and was raised in Mexico. I have a physics degree from the Universidad Nacional Autónoma de México.*



**Q: Why did you choose to spend your summer at ICFO?**

A: Having heard a lot about ICFO, I wanted to know what it was like to work and study here, especially because this is the place where I would like to do my Ph.D.

**Q: What have you been working on?**

A: I am working in Morgan Mitchell's lab on a precise polarimeter for continuous wave which allows us to measure the classical polarization of light. But the same device can also be used for automating multiple qubits tomography, that is, for measuring the quantum state of photons.

**Q: Are you enjoying the experience?**

A: This is the best summer internship I have done so far. I like the fact that group leaders, postdocs, and students can freely share their ideas, taking science to the limit and combining basic science with everyday life applications.

**Q: What are your plans for the future?**

A: I'd like to combine basic research with the development of everyday life applications. Quantum information is my greatest interest and I am also very interested in biophysics, medical physics, energy-related research, and teaching. The tools and knowledge I would learn and develop during a Ph.D. at ICFO would be really important in achieving these goals.



ICFO Summer Fellows with Laia Miralles i Puig (ICFO HR & Education Head), Manuela Furkert (ICFO HR Officer), Silvia Carrasco (ICFO KTT Director) and Lluís Torner (ICFO Director)

*My name is Luisa C. Frías. I am from Seville in Spain. I am a student in chemistry and I will graduate in December 2008 at the Universidad de Sevilla. I'm 26 years old.*



**Q: Why did you choose to spend your summer at ICFO?**

A: I knew that ICFO is a great research center where I would have the opportunity to learn, investigate, and of course to meet important researchers from all over the world. This experience will help me decide which professional path I should choose in the future.

**Q: What have you been working on?**

A: I am working on a project with optical tweezers and Raman spectroscopy in Dmitri Petrov's group. The main goal is to obtain information on biochemical and biophysical processes with DNA and red blood cells.

**Q: Are you enjoying the experience?**

A: Yes, of course. My group leader and my workmates are wonderful people and I am learning a lot with my job. It is very interesting. Moreover, the international environment is fantastic.

**Q: What are your plans for the future?**

A: In the future, I would like to get a master's degree and later on I'd like to work in an important company to develop new techniques or new processes related to biophotonics.

*My name is Jade Martínez Llinàs and I'm 23 years old. I'm from Mallorca in Spain. I obtained a degree in physics from the Universitat de Barcelona in June 2008.*



**Q: Why did you choose to spend your summer at ICFO?**

A: During my studies I found optical, quantum, atomic, and solid state physics very interesting. I realized that doing a Ph.D. in photonics could be a good choice as it is a field lying between science and technology and based on quantum and optical physics. With the ICFO Summer Fellowship, I've had the chance to get an overview of the field and also some experience in research.

**Q: What have you been working on?**

A: I'm working in Morgan Mitchell's group. The aim is to develop cold trapped atoms as a medium for the storage and manipulation of quantum information, and for the study of controlled interactions between atoms and light.

**Q: Are you enjoying the experience?**

A: It's fantastic. I'm learning a lot by working with the help of my lab mates. I love the atmosphere and I'm glad I had opportunity to get an overview of what's going on at ICFO.

**Q: What are your plans for the future?**

A: I'm interested in doing a Ph.D. in biophysics. I have not yet chosen the topic; I need to contact some groups and see what they can offer me.

## community picture

ICFOians played to each other's strengths during the summer party's sporting activities and quiz games



# PEOPLE

## in focus

by Elisabeth Pain

### Manuela Furkert · Human Resources and Education

If you have joined ICFO in the last three years, then chances are that Manuela Furkert helped you do so. Manuela's main task as a human resources officer is to assist ICFO group leaders in the selection of new researchers and to take care of the administrative side of staff recruitment.

#### The Early Days

Manuela first came to Spain from her native Germany in 2001. Back then, she was a Master of Arts student in Latin-American studies from the *Freie Universität Berlin* who had come to the *Universitat de Barcelona* for a year with a bursary from the Erasmus student exchange program.

Her stay in Barcelona proved life changing. "I liked the lifestyle, and the culture, and the weather, and the people," Manuela says. She promised herself to come back as soon as she would finish her studies in Germany.

After obtaining her German diploma in 2004, Manuela spent four months working as an operative agent in a small insurance company in Barcelona. "From the very beginning it wasn't what I was meant to do but you need something to survive on," she says. Manuela used her spare time to find out what she really wanted to do.

She soon came across an ad from ICFO. "I liked the website. I had no idea what they were doing but I found it very interesting for the...environment" that the Institute offered, Manuela says. Having enjoyed the academic setting and the possibility to meet people from different countries when she was a student, Manuela was looking for a similar working environment. "I saw that in a good package" at ICFO, she says.

Manuela joined ICFO in March 2005 with an assistant position. She started helping with the selection of new research fellows, preparing applicants' CVs for screening. Head of Human Resources and Education Department Laia Miralles i Puig guided her in her training phase, and when Laia went on maternity leave the same year Manuela was ready to take on more responsibilities.

Almost at the same time, ICFO moved from the *Universitat Politècnica de Catalunya* to its current location in Casteldefells. "Moving was exciting," Manuela recalls. "I understood that for the researchers it's very nice to have everything in one place. For us as well; the administration now sees a bit more what the researchers are doing."

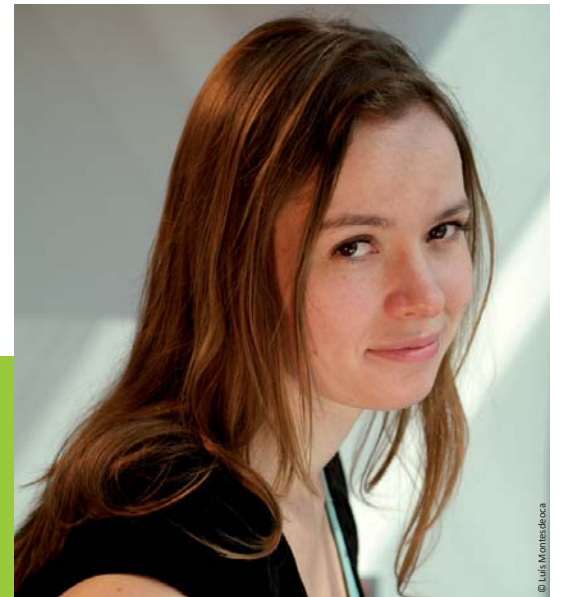
#### Taming the Beautiful Monster

Today Manuela is in charge of managing the database of all incoming applications. She also liaises with candidates and helps with recruitment once new researchers have been selected. Since she's joined, Manuela has seen the pace of

Having enjoyed the academic setting and the possibility to meet people from different countries when she was a student, Manuela was looking for a similar working environment

work increase dramatically. This spring, she handled 96 applications in the general call for Ph.D. students only. ICFO is "growing very fast...Sometimes I call it a 'beautiful monster,'" she jokes. Overall, "the growing of the responsibilities and of the database is very rewarding for me."

Manuela gets a lot out of her job both on a professional and personal level. She enjoys working in a team: "When I have something that bothers me or that I don't understand, I can ask someone and this is great," she says. She also likes the thinking and problem-solving the job requires and the opportunity to practice her languages--German, English, Spanish, Catalan, Portuguese, and Russian.



And above all, Manuela gets to know all kinds of new people and cultures. At ICFO "the social aspect is very nice," she says. There are many opportunities--like the *calçotades* and snow weekends--to get to know each other outside of work, she adds. This year in particular Manuela got a lot of satisfaction taking care of the administrative issues related to the selection and recruitment of undergraduates for the Caixa Catalunya Summer Fellows Research Program. The program "is important for the future," as it is an opportunity both for ICFO to attract students and for students to experience research, she says. "It's a very nice program. It's a little bit like ICFO. It's young and dynamic."

## in the frame

by Michele Catanzaro

### Green Brains and Ultracomputers

Giovanni and Giorgio Volpe, in Dmitri Petrov's and Romain Quidant's group, respectively, and Roberto Macovez in Jordi Martorell's group are this year's winners of the ICFO Visionary Thinkers Awards. The awards are aimed to encourage ICFO-nians to freely imagine what their field could be like by 2025.

The next round of the competition for the ICFO Visionary Thinkers Awards will be announced in February next year with a deadline in April.

All ICFO undergraduates, Ph.D. students, and post-docs are invited to take part.



Giovanni and Giorgio together explored the possibility of creating a new technology at the interface of classical and quantum physics that would match the computational power of the human brain (fig 1).



Roberto envisioned the future development of a new information technology--the 'Green Brain Technology'--that would allow users to sustainably manipulate data using light and organic molecules (fig 2).

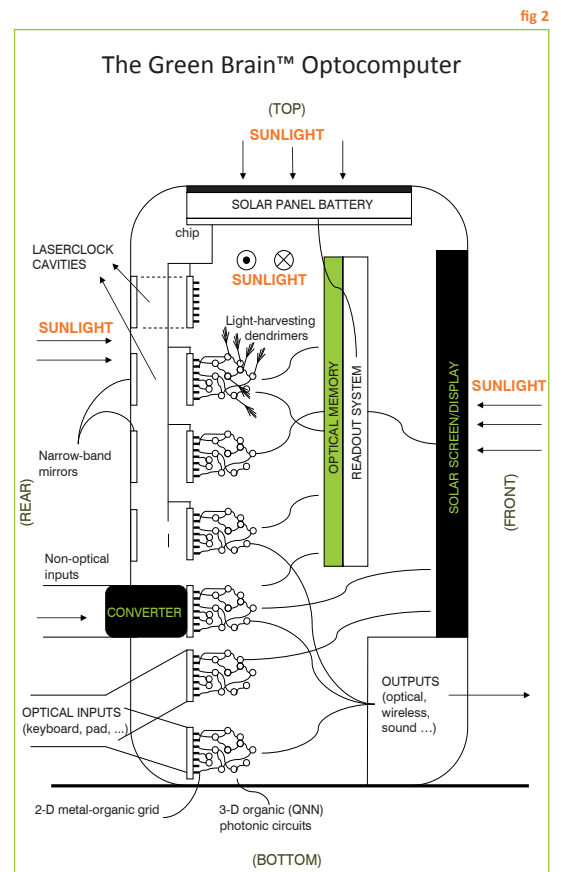
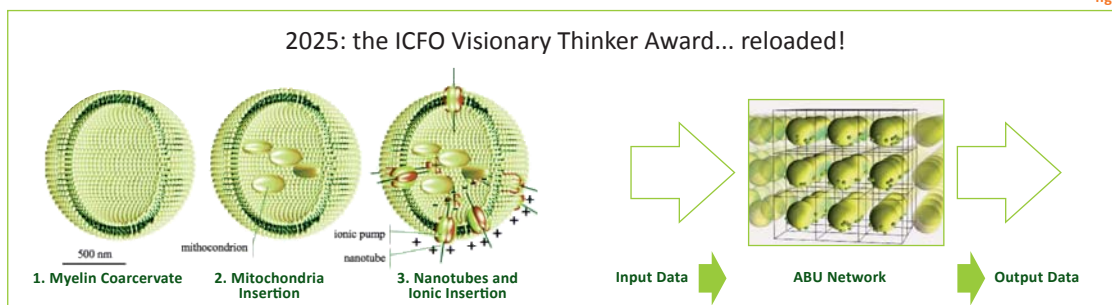


fig 2

fig 1

# PERSPECTIVES

## beyond icfo

by Elisabeth Pain

### Albert Molinos

Albert Molinos started collaborating with ICFO in 2003 while he was nearing the end of his Ph.D. in organic chemistry at the *Universitat de Barcelona*. He had synthesized a new type of organic molecules and was interested in testing their non-linear optical properties. Just as he was looking for potential partners in the optical field, Albert saw an ad from ICFO group leader Jordi Martorell that fit his research needs. The collaboration proved fruitful, and after graduating in 2004 Albert joined Jordi's lab for a two-year postdoc.

Albert's experience at ICFO proved an ideal stepping stone for industry. Even though at first sight the world of photonics and the construction industry have little in common, "being at ICFO helped me get the job," says Albert, who today works for BASF Construction Chemicals.

#### Entering the World of Photonics

As a postdoc in Jordi's lab, Albert worked on producing new composite photonic crystals for the study of nonlinear interactions between light and centro-symmetric materials. "One of the most prominent things he did with us was to implement a new chemical reaction to be able to covalently bind highly nonlinear molecules onto the surface of the colloidal particles that formed a photonic crystal," Jordi says. "It was a challenging task because the entire chemical reaction had to be carried out in water under some very special conditions to avoid degradation of the colloids."

Another challenge Albert says he had to overcome during his time at ICFO "was trying to enter the photonics world, being a chemist." This involved reading several books and attending many talks, but Albert mainly learnt by soaking up knowledge from his environment. "As I was trying to make myself understandable to the physicists... I put a lot of efforts into understanding people at ICFO," Albert adds.

#### Moving to Industry

In summer 2006, Albert left ICFO for a six-month position at the local pharmaceutical company Esteve, where he helped synthesizing active ingredients for the production of medicines. Albert's next step was to take a technician position at BASF Construction Chemicals at Palau-solità i Plegamans near Barcelona, helping this time with the production of new building materials for the construction industry.

Only one year later, Albert was offered the position of technical manager and started running a lab with two chemists and one technician. Since then, Albert's role has been to

identify new market opportunities for the development of scientifically and economically viable building materials. Together with his team, Albert has "to translate scientific ideas into a profitable product for the customers, for us, [and for] the stakeholders," he says.

What Albert especially likes about his current job is precisely "the need to know about market and economic aspects [such as] market statistics, profitability, expected commercial value of things." Also rewarding is "the reality of seeing the results of your...project in a final product," he adds.

#### Building Bridges

Albert's previous experience at ICFO proved invaluable in his current job. The research Albert now conducts at BASF Construction Chemicals is done in a different setting and with clear commercial goals, but the chemical principles one needs to modify the surface of cement particles and of photonic crystals are pretty much the same, he says.

Another important aspect of Albert's job at BASF Construction Chemicals is to take part in meetings with people from



Albert's role at BASF Construction Chemicals is to identify new market opportunities for the development of scientifically and economically viable building materials

the production, marketing, and management departments. "You have to put [in] a lot of efforts to make yourself understandable to them, to convince them [to] believe in your ideas or projects," Albert says. Because ICFO does promote this kind of interactions, "my training at ICFO prepared me to be more open, to interact with people from different fields in the world of industry."

Albert may have left ICFO today, but he's staying close by. "It is part of my job at BASF to create networks with academics in order to start common projects," Albert says. He has recently started collaborating with ICFO group leader Valerio Pruneri. "The collaborative project aims at investigating highly innovative optical sensors for the construction industry," Valerio explains. New sensors based on photonic crystal fiber technology could help control the curing process in concrete and also make tunnels safer by detecting thermal stress changes that occur during fires for example, Valerio adds.

Building upon this first collaboration, BASF Construction Chemicals has become a member of the ICFO Corporate Liaison Program in September. Traditionally, the construction sector has mainly been partnering with polytechnic and architectural departments within universities, Albert says. Collaborating with ICFO "is a way of opening up a new gate to different kinds of collaboration."

## culture spot

by Laura Grau

One of the Catalan events that traditionally take place in autumn is *la Castanyada*.

In the old days, *la Castanyada* was celebrated in family on October 31 just after the evening meal. The chestnuts were roasted and placed on the table together with *panellets* (small, tasty almond cookies) and *boniatos* (sweet potatoes) and accompanied by a sweet white wine called *Moscate*.

Nowadays, the tradition is above all a good excuse for getting together with family or friends, drinking some nice wine, and eating chestnuts, *boniatos*, and *panellets*... So that's exactly what we've been doing here at ICFO in the afternoon of October 31. ICFO contributed the *Moscate*... and we thank all those of you who brought your delicious home-made *panellets* and your festive spirit!

If you've missed the event, here are some pictures!



ICFOians try the delights of the autumn Catalan tradition

*la Castanyada*



# THE LAST WORD

## high profile

**Professor Roy Glauber, Mallinckrodt Professor of Physics at Harvard University in the USA, is co-recipient of the 2005 Nobel Prize in physics for his contribution to the quantum theory of optical coherence. He is also Distinguished Invited Professor at ICFO.**



Elisabeth Pain talks with Professor Glauber about his research career and the way quantum optics is going.

**Q: How far back does your interest in optics go?**

**A:** When I was about 10 years old I became very interested in astronomy and in building optical instruments. One of them was a light polarizing device which worked by means of reflections by black mirrors. I did not really know what light polarization was but I was fascinated to be able to see wonderful colors in clear materials like cellophane and mica. I then began trying to build little telescopes with magnifying glasses and discovered that they didn't work very well. So when I was about 12, I undertook a year-long project to grind a concave mirror and build a reflecting telescope.

**Q: How did you first get into quantum optics?**

**A:** Quantum optics wasn't really a subject in those early days. The important subject to work on in the 50's was the quantum theory of fields, which was really the theory of elementary particles. One of the elementary particles, of course, was the light quantum. All of the work up to approximately the early 60's had dealt with verifying the fundamental theory of quantum electrodynamics and that meant doing complicated calculations for problems containing only one or two light quanta. So there was really something missing from all of this earlier work, and that was the development of techniques for dealing in statistical terms with many light quanta at a time.

A question in the air then concerned what seemed to be the tendency of light quanta in ordinary light beams to come in pairs or even clusters. What did it mean from a quantum mechanical standpoint? The first papers I wrote in quantum optics point out that a laser would produce an entirely different sort of light beam in which there was no tendency at all for light quanta to come in pairs. That led to the development of a whole range of mathematical techniques for treating multi-photon problems. That's how 'quantum optics' really came into being.

**Q: What do you find fascinating about this field?**

**A:** Well, one thing that fascinates me is how far it has gone and how rapidly. The earliest phenomena we studied were not very different from ones you could describe in classical terms and could easily picture mentally. But we have been led further and further away from that now.

The current preoccupation of people in quantum optics is entanglement, that is, the description of remarkable correlations which you can bring about quantum mechanically between events at widely separated places and times. These entanglement phenomena promise now to have practical applications. It's about the last thing one ever could have imagined in those beginning days.

**Q: What areas of quantum optics are most likely to expand in the future?**

**A:** One never knows. It's a good idea not to become too deeply rooted in the interests of the last couple of years, because you can be almost certain that those interests will shift before long.

**Q: You've visited ICFO a couple of times already. What was your impression?**

**A:** The first visit was too brief. The second lasted almost a month in May and I found that quite exciting. The laboratory is very promising. It has an excellent staff and seems to be very well run and very well equipped. I was surprised at how many students came out for the coffee session organized by the ICFO-OSA Student Chapter and how enthusiastic they were. The students were well informed and they asked excellent questions.

**Q: What advice would you give young scientists for a successful career?**

**A:** The rules would be almost the same for every scientific field: that it takes a great deal of devotion and hard work, but above all curiosity. The itch of curiosity is really the basis of all research and discovery.

**Q: Anything in your career you would do differently?**

**A:** Back in those days a theoretical physicist was expected to be able to work in many related fields of physics and they were all in a more primitive state. I shifted interest several times and, as a result, there is no great unity among the things I have worked on. Many of my colleagues don't even know that those different things were done by one person. It may be that it would have been a better idea to stick to one field, but I will never be able to answer that question.

During his last visit at ICFO Professor Glauber met up with the ICFO-OSA Student Chapter



## sudoku

easy

	1		3	4				
9	3			5		4		2
		8	6			7	1	
	2	7			8		3	5
			5		3			
3	6		2			8	4	
	5	4			9	2		
2		9		8			5	1
			1	2			7	

medium

	4	3				6		
			6	9				5
8					4			7
		6	7		2		9	
	2			3			5	
	1		8		6	2		
1			9					4
5				7	1			
		2				7	8	

difficult

	4		9	6	1		3	
1								9
		7				6		
4	3		7		5		6	2
				2				
7	2		3		4		8	1
		8				1		
9								3
	5		8	1	9		4	

very difficult

			3	2		4		
	8			4				1
	9		8					7
	4	6						3
			3		9			
	5					2	7	
2					1			9
4				8				5
	6		5	9				

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