Worldwide quantum physics experiments powered by human randomness
**EDITOR’S CORNER**

**Cuddling up to Schrödinger’s Cat**

Brook Hardwick  
Coordinating Editor

Due to the frontier nature of the work we do at ICFO, it can be a challenge to share the exciting but often highly complex details of our advances with the general public. Have a look at the “Latest Advances” section of this edition and you will see some pretty amazing findings, all of which have been published in top tier journals that our peers will study, test, and cite. However, the average man and woman on the street wants the big picture. They want to know if the findings will help cure cancer, give us a faster-better-smaller-smarter phone, save money, make the world cleaner and safer, or solve global warming.

But it IS possible to get people with no scientific background fully engaged and excited about the details of frontier research. The BIG BELL TEST - a worldwide scientific experiment coordinated by ICFO - managed to involve 100k+ people directly, and raise awareness in thousands more via mainstream media channels. This kind of “awakening” is almost as exciting as the scientific findings themselves.

The Big Bell Test was a rigorous frontier quantum physics experiment (or to be more exact, 12 experiments taking place simultaneously around the world) that aimed to verify whether or not particles can be intertwined by the “spooky action at a distance” that Einstein could not accept. As with any rigorous experiment, ICFO put together a motivated team to carefully plan and prepare every aspect of the project, including the key role of the general public in generating truly random sequences of bits that would fuel the experiments. The BBT team ensured the participation of the general public through explanations tailored to the audience, leaving LOTS of time for Q&A. They talked to colleagues, collaborators, teachers, students, friends, family, old people, young people and the media and thus the experiment came alive for people around the world who went on to share what they learned with others. While the scientists manned experiments to test entanglement and quantum correlations between particles in order to attempt to violate Bell’s inequality, over 100,000 members of the general public became “Bellsters,” providing their random bits to the experiment. Not only did they help test Bell’s theorem to see if Einstein was right or wrong, but they also started to follow the science, become familiar with some of the basic concepts of quantum physics, and began to cuddle up to Schrödinger’s cat. Who said you can’t communicate complex scientific questions to the general public?

ICFO has a triple mission: to carry our frontier research, train the next generation of scientists and technicians, and to take our findings out of the lab and into society. In 2015, ICFO launched the BIG BELL TEST, a project that embodied all aspects of this mission, something the Big Bell Test clearly does.

Thanks for taking the time to learn about the details of what is going on at ICFO... and feel free to share the excitement of what you learn!

---

**INDEX**

**EDITOR’S CORNER**  
Cuddling up to Schrödinger’s Cat  
Brook Hardwick  
Coordinating Editor

**HAPPENINGS**

**ICFO NEWS**

ICFO Day  
2015 Thesis Award and PhD Poster Awards

**BEYOND ICFO**

Alejandra Valencia

**GO & FLY**

Igor Verdeny, Luis José Salazar, Vito Giovanni Lucivero, David So, Anshuman Singh, Daniel Riolander, Miguel Rueda, Peter Weber, Giorgio Colangelo

**LATEST ADVANCES**

Tailoring single photons waveshapes

**Molecular Selfie**

Polaritons in layered 2D materials

**THE LAST WORD**

John Mather

**NEWCOMERS**

ICFO Day

**HAPPENINGS**

2015 Thesis Award and PhD Poster Awards

**COLLABORATION/PEOPLE**

The Big Bell Test

**ICFO COMMUNITY**

2016 GEFES Prize for Best Experimental Thesis

**RESULTS**

Atlante Award

**HIGH PROFILE**

National Senior Research Award 2016

**MYSTERY ICFO**

John Mather

**BEYOND ICFO**

Beyond ICFO

**GO & FLY**

Igor Verdeny, Luis José Salazar, Vito Giovanni Lucivero, David So, Anshuman Singh, Daniel Riolander, Miguel Rueda, Peter Weber, Giorgio Colangelo

**THE LAST WORD**

John Mather

**HIGH PROFILE**

National Senior Research Award 2016

**MYSTERY ICFO**

John Mather
The Foundation for Research and Innovation of Catalonia (FCRI) organizes the yearly National Research Awards to honor individual scientists and institutions for their outstanding contributions to society. For 2016, the organization awarded the National Research Award, the organization’s highest honor, to ICFO’s Director, Lluís Torner. This prize specifically recognizes a significant contribution to scientific progress on an international scale - in human and social, life, health, engineering, technology or experimental sciences. Dr Torner conceived and founded ICFO and has been its director since its inception in 2002. Under his leadership, the institute has become a forerunner in global frontier photonic research and its numerous applications in biomedicine, renewable energy, nanotechnology, graphene, quantum technology and information technology.

HIGHLY CITED RESEARCHER
Clarivate Analytics, formerly the IP and Science business of Thomson Reuters, annually produces a Highly Cited Researchers list identifying international researchers who are some of the world’s most influential scientific minds. The list is compiled using indicators taken from InCites’ Essential Science Indicators across 21 broad fields. It is determined by the number of papers that rank in the top 1% according to citations for field and publication year in journals indexed in the WoS Core Collection between 2004-2014. The 2016 compilation in the field of physics gathers 107 influential thinkers, including ICREA Prof at ICFO Maciej Lewenstein. This is the third consecutive year in which Prof Lewenstein has made this prestigious list.

ATLANTE AWARD
Through the Atlante Award, Foment del Treball Nacional (the Institute of National Employment Promotion, a division of the Office of Prevention of Labor Risks), aims to encourage and stimulate companies to take initiatives towards the effective implementation of occupational risk prevention. In receiving this award, ICFO was singled out in the category of “integration of risk prevention”, recognizing the implementation of risk prevention actions in the enterprise management system that aim at the effective and stable integration of security in the organization and operation of the institute.

2016 GEFES PRIZE FOR BEST EXPERIMENTAL THESIS
Dr Nicolò Accanto is the 2016 recipient of the GEFES Prize for the Best Experimental Thesis based on his work on condensed matter physics. Accanto developed his thesis entitled “Coherent Control of Nonlinear Optical Processes in Individual Nanoparticles” under the supervision of ICREA Prof at ICFO Nick van Hulst. The goal of his research was to actively control the fundamental interactions between laser pulses and individual nanoparticles, extending the concept of coherent control to the nanoscale and ultrafast scale. The awarding organization GEFES (Specialized Group of Solid State Physics) is part of the Spanish Royal Society of Physics (RSEF).

2 ERC CONSOLIDATOR GRANTS
The ERC announced the awarding of its Consolidator Grants to 314 top researchers in Europe. Among these are two ICREA Professors at ICFO - Geraintos Konstantatos and Frank Koppens - for their projects HEINSOL and TOPONANOP respectively. For this call, the ERC evaluated 2,274 research proposals, out of which 13.8% have been selected for funding. The grants fall under the Excellent Science Pillar of Horizon 2020, the EU’s research and innovation program.
### Latest Advances

#### Molecular Selfie
In their recent study reported in *Science*, ICFO scientists from the Nanoscience and Ultrafast Optics Group in collaboration with researchers from the USA, the Netherlands, Denmark, and Germany reported on the imaging of molecular bond breakup in acetylene (C2H2) 9 fs after its ionization. The team tracked the individual atoms of the isolated acetylene molecule with a spatial resolution as small as 0.05 Ångström – less than the width of an individual atom – and with a temporal resolution of 0.6 femtoseconds. In doing so, they were even able to trigger the breakup of only one of the bonds of the molecule and see how one proton leaves the molecule. With this they used one of the molecule’s own electrons to image its structure - teaching the molecule to take a selfie!

#### Polaritons in Layered 2D Materials
An international group of experts led by the University of Minnesota, among them ICREA Prof at ICFO Frank Koppens, have published a review in *Nature Materials* that highlights how manipulation of 2D materials could make our modern day devices faster, smaller, and better, examining the optical properties of several dozen 2D materials to ultimately unify understanding of light-matter interactions in these materials. They report on how polaritons, a class of quasiparticles formed through the coupling of photons with electric charge dipole modes in solids, can create the speed of photon light particles and the small size of electrons. By exciting the polaritons in 2D materials, electromagnetic energy can be focused down to a volume a million times smaller compared to when it’s propagating in free space. Such results could have applications ranging from sensing and fingerprinting minute amounts of biomolecules, to optical communications, energy harvesting and security imaging.

#### An Invisible Electrode
An intensive effort has been devoted to the search of alternative transparent conducting materials that could definitively replace the semiconducting Indium Tin Oxide (ITO) as a transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material. Now, ICFO researchers Rini Abraham Maniyara, Valeria K. Mkhitarian, Tong Lai Chen, and Dhriti Sundar Ghosh, led by ICREA Prof at ICFO Valerio Pruneri, have developed a room temperature processed transparent conducting material.

#### Tailoring Single Photons Waveshapes
Quantum information networks transmit information through material quantum nodes via the transmission of quantum light, i.e. single photons. Because the quantum nodes may be composed of different quantum systems with varying properties and capabilities, the shape of the single photons must be tailored to achieve a strong interaction between the various nodes. ICFO researchers Pau Farrera, Boris Albrecht and Dr Georg Heinze, led by ICREA Prof at ICFO Hugues de Riedmatten, in collaboration with the University of Basel, report in *Nature Communications* on the creation of a heralded single photon source based on a quantum memory using a fast cooled Rubidium atom cloud. By using the read-out optical pulse, they were able to generate photons with arbitrary waveforms and temporal durations varying over three orders of magnitude. Being able to generate ultra-narrowband, pure and storable single photons with widely tuneable wave shapes is an enabling step toward hybrid quantum networks that require interconnection of remote disparate quantum systems.
On 30 November, everyone in the world had the opportunity to be part of an unprecedented global experiment gathering 12 labs around the globe in order to test the laws of quantum physics.

Coordinated by ICFO, The BIG Bell Test (BBT): worldwide quantum experiments powered by human randomness applied the unique value of human randomness to the study of fundamental processes of nature. Indeed, the BBT’s goal was to show that the microscopic world is in fact as strange as quantum physics predicts; down to the fundamental level, causality and realism give way to pure randomness.

The idea of a large-scale, human-driven experiment using internet technologies came from Carlos Abellán, PhD student at ICFO and instigator of the BBT project. Carlos and ICREA Prof at ICFO Morgan Mitchell, the BBT scientific coordinator, participated in the 2015 loophole-free Bell tests, which inspired them to embark on one of the most amazing projects they had ever conceived.

On 30 November, from Australia to west coast USA, participants were called to contribute to this initiative through a videogame, and to introduce sequences of 0s and 1s as randomly as possible. Each of these bits was then used to control, in real-time, the elements of optical tables – mirrors, polarizing filters, waveplates – selecting the type of measurements to be performed on the different quantum systems.

 Altogether more than 100,000 people completed over half a million videogame missions, providing the unique value of human randomness to the study of fundamental processes of nature. This independence is a crucial feature for the conclusions of the experiments to be valid.

On 30 November, from Australia to west coast USA, participants were called to contribute to this initiative through a videogame, and to introduce sequences of 0s and 1s as randomly as possible. Each of these bits was then used to control, in real-time, the elements of optical tables – mirrors, polarizing filters, waveplates – selecting the type of measurements to be performed on the different quantum systems.

The BIG Bell Test

More than 100,000 people challenge Einstein in a unique worldwide quantum physics experiment

On 30 November, everyone in the world had the opportunity to be part of an unprecedented global experiment gathering 12 labs around the globe in order to test the laws of quantum physics.

Coordinated by ICFO, The BIG Bell Test (BBT): worldwide quantum experiments powered by human randomness applied the unique value of human randomness to the study of fundamental processes of nature. Indeed, the BBT’s goal was to show that the microscopic world is in fact as strange as quantum physics predicts; down to the fundamental level, causality and realism give way to pure randomness.

The idea of a large-scale, human-driven experiment using internet technologies came from Carlos Abellán, PhD student at ICFO and instigator of the BBT project. Carlos and ICREA Prof at ICFO Morgan Mitchell, the BBT scientific coordinator, participated in the 2015 loophole-free Bell tests, which inspired them to embark on one of the most amazing projects they had ever conceived.

On 30 November, from Australia to west coast USA, participants were called to contribute to this initiative through a videogame, and to introduce sequences of 0s and 1s as randomly as possible. Each of these bits was then used to control, in real-time, the elements of optical tables – mirrors, polarizing filters, waveplates – selecting the type of measurements to be performed on the different quantum systems.

 Altogether more than 100,000 people completed over half a million videogame missions, providing the unique value of human randomness to the study of fundamental processes of nature. This independence is a crucial feature for the conclusions of the experiments to be valid.

On 30 November, everyone in the world had the opportunity to be part of an unprecedented global experiment gathering 12 labs around the globe in order to test the laws of quantum physics.

Coordinated by ICFO, The BIG Bell Test (BBT): worldwide quantum experiments powered by human randomness applied the unique value of human randomness to the study of fundamental processes of nature. Indeed, the BBT’s goal was to show that the microscopic world is in fact as strange as quantum physics predicts; down to the fundamental level, causality and realism give way to pure randomness.

The idea of a large-scale, human-driven experiment using internet technologies came from Carlos Abellán, PhD student at ICFO and instigator of the BBT project. Carlos and ICREA Prof at ICFO Morgan Mitchell, the BBT scientific coordinator, participated in the 2015 loophole-free Bell tests, which inspired them to embark on one of the most amazing projects they had ever conceived.

On 30 November, from Australia to west coast USA, participants were called to contribute to this initiative through a videogame, and to introduce sequences of 0s and 1s as randomly as possible. Each of these bits was then used to control, in real-time, the elements of optical tables – mirrors, polarizing filters, waveplates – selecting the type of measurements to be performed on the different quantum systems.

 Altogether more than 100,000 people completed over half a million videogame missions, providing the unique value of human randomness to the study of fundamental processes of nature. This independence is a crucial feature for the conclusions of the experiments to be valid.

The BIG Bell Test

More than 100,000 people challenge Einstein in a unique worldwide quantum physics experiment

On 30 November, everyone in the world had the opportunity to be part of an unprecedented global experiment gathering 12 labs around the globe in order to test the laws of quantum physics.

Coordinated by ICFO, The BIG Bell Test (BBT): worldwide quantum experiments powered by human randomness applied the unique value of human randomness to the study of fundamental processes of nature. Indeed, the BBT’s goal was to show that the microscopic world is in fact as strange as quantum physics predicts; down to the fundamental level, causality and realism give way to pure randomness.

The idea of a large-scale, human-driven experiment using internet technologies came from Carlos Abellán, PhD student at ICFO and instigator of the BBT project. Carlos and ICREA Prof at ICFO Morgan Mitchell, the BBT scientific coordinator, participated in the 2015 loophole-free Bell tests, which inspired them to embark on one of the most amazing projects they had ever conceived.

On 30 November, from Australia to west coast USA, participants were called to contribute to this initiative through a videogame, and to introduce sequences of 0s and 1s as randomly as possible. Each of these bits was then used to control, in real-time, the elements of optical tables – mirrors, polarizing filters, waveplates – selecting the type of measurements to be performed on the different quantum systems.

 Altogether more than 100,000 people completed over half a million videogame missions, providing the unique value of human randomness to the study of fundamental processes of nature. This independence is a crucial feature for the conclusions of the experiments to be valid.

On 30 November, everyone in the world had the opportunity to be part of an unprecedented global experiment gathering 12 labs around the globe in order to test the laws of quantum physics.

Coordinated by ICFO, The BIG Bell Test (BBT): worldwide quantum experiments powered by human randomness applied the unique value of human randomness to the study of fundamental processes of nature. Indeed, the BBT’s goal was to show that the microscopic world is in fact as strange as quantum physics predicts; down to the fundamental level, causality and realism give way to pure randomness.

The idea of a large-scale, human-driven experiment using internet technologies came from Carlos Abellán, PhD student at ICFO and instigator of the BBT project. Carlos and ICREA Prof at ICFO Morgan Mitchell, the BBT scientific coordinator, participated in the 2015 loophole-free Bell tests, which inspired them to embark on one of the most amazing projects they had ever conceived.

On 30 November, from Australia to west coast USA, participants were called to contribute to this initiative through a videogame, and to introduce sequences of 0s and 1s as randomly as possible. Each of these bits was then used to control, in real-time, the elements of optical tables – mirrors, polarizing filters, waveplates – selecting the type of measurements to be performed on the different quantum systems.

 Altogether more than 100,000 people completed over half a million videogame missions, providing the unique value of human randomness to the study of fundamental processes of nature. This independence is a crucial feature for the conclusions of the experiments to be valid.
On 13 December, ICFO Day, a unique institution-wide event planned by ICFOnians for ICFOnians took place, allowing us all to have a better idea of the wide range of research and accomplishments that take place in the groups, labs and various divisions and departments of the institute.

This year’s theme was “Humanizing Science”, in which participants learned about interesting scientific results and a lot more: they gained insight into the stories behind those results, the people behind the stories and the collaboration on all levels at ICFO that makes really great science possible. The day’s activities included debates, lab tours, short talks, poster sessions, challenges, an ICFO Family photo, the announcement of the 2015 ICFO Thesis Awards and Poster Awards, and a surprise rhythmic demonstration of the concepts of Super Resolution Microscopy by some creative and energetic ICFOnians. An intense community event concluded on a high note with the annual Festive Dinner.

2015 ICFO PhD Thesis Award

Among more than 15 theses defended by ICFO PhD Students in 2015, the selection committee had an in-depth deliberation to select the winner of the PhD Thesis Award. This award was created in order to distinguish particularly brilliant PhD theses defended at ICFO and in doing so, to highlight and reward extraordinary PhD students whose research progress while at the institute has proven to be highly creative and ambitious. This year, the committee conferred the awards as follows:

- In the theoretical field to: JORDI TURA, in recognition of the exceptional thesis: “Characterizing Entanglement and Quantum Correlations Constrained by Symmetry” supervised by Prof Dr Maciej Lewenstein & Dr Remigiusz Augusiak
- And, in the experimental field, ex aequo to: FEDERICA BEDUINI, in recognition of the exceptional thesis: “Entanglement and State Characterisation from Two-Photon Interference”, supervised by Prof Dr Morgan Mitchell, and to JUAN A. TORREÑO, in recognition of the exceptional thesis: Membrane Protein Nanoclustering as a Functional Unit of Immune Cells - from nanoscopy to function supervised by Prof Dr Maria García Parajo and Dr Carlo Manzo.

JORDI, FEDERICA and JUAN A. received their awards in the ceremony held on 13 December during the ICFO Day.

PhD Poster Session & Award

Congratulations to the winners of 7th edition of the ICFO PhD Student Poster Session

The ICFO Student Poster Session was created as an opportunity for the exchange of ideas and knowledge among ICFOnians of different groups and areas. Now in its seventh edition, it took place in the scope of the ICFO Day event.

Twenty-nine posters were exhibited in the Nest Hall for more than two weeks ensuring that all ICFOnians could view them and benefit from the broad range of topics covered. ICFOnians were asked to vote for the best poster. The poster awardees were chosen based on the PhD Commission’s deliberation and the recommendation of an external Committee in addition to this popular vote.

Congratulations to the following winners:

- 1st place: KAVITHA KALAVOOR GOPALAN Optoelectronics group led by Prof Dr Valerio Pruneri Poster #18 “Pyro-resistant infrared detector using graphene on LiAgO3”
- 2nd place: ACHIM WOESSNER Quantum Nano-Optoelectronics group led by Prof Dr Frank Koppens Poster #12 “Non-invasive photodocument nanoscopy on bare and h-BN encapsulated graphene”
- 3rd place: IRENE ALDA Plasmon Nanoptics group led by Prof Dr Romain Quadt Poster #8 “Planar Paul traps for trapping and manipulation of single nanoparticles”
When I was asked to give you an idea of how I have grown professionally since I left ICFO, the first thing that came to my mind was the idea of independence. My work today has been directly shaped by the varied experiences that I had in my six + years at ICFO as a postdoc and in Outreach in the KTT unit.

I am now an associate professor at Universidad de los Andes in Bogotá, Colombia, which involves research, teaching and administrative work. In one way or another, I also did all these activities when I was at ICFO; I carried out my research as a postdoc in Juan Perez’s group, and when working in KTT, I worked under Silvia Carrasco’s supervision. In my current work, I have become the group leader, the reference point for those in my group. The independence and responsibility that comes with my role are the newest aspects of my professional life.

I left ICFO in July 2012 and moved to Colombia after 12 years of living abroad between the US and Europe. I arrived in Bogotá to establish the country’s first laboratory in experimental quantum optics. Now, four and a half years later, I am very proud of what has been achieved. In my group, we run experiments where we generate and characterize pairs of entangled photons and heralded single photons. We have published in international peer review journals, presented our work in international conferences and engaged students at all levels in experimental quantum optics research.

This has all been possible thanks to the scientific and not-strictly scientific skills that I learned at ICFO. Obviously, from a scientific perspective my PhD studies in the US and my postdoctoral experience are central to my daily work. However, from a wider perspective, ICFO taught me the value of a high quality administrative organization and the importance of thinking beyond the optical table when doing frontier research. At ICFO, I started seeing light as a tool for many applications. I try to convey this to my current students in hopes of motivating them to think of bringing photonics out of the lab.

In Colombia, I am also doing some outreach. I have always been interested in outreach but ICFO definitely got me motivated to do more in this area. Current ICFOians and Alumni will probably recall that I was always looking for “guides” to show the labs to visitors. (I remember that we even showed visitors the mechanical and electrical workshops.) I still do that at my university, where I encourage high school students, the general public and people from industry to visit as a way of enhancing the scientific culture in Colombia and exploring possibilities for technology transfer.

So now that you know about my research, if you ICFOians happen to be around Colombia, come and visit me. But if in your mind Colombia means hot tropical weather, be aware that Bogotá is 2600 meters (8530 feet) above sea level, so remember to bring a coat and also your ICFO coffee cup to talk about photons and enjoy a wonderful Colombian coffee.
We learned in school about Occam’s razor as a guide to good explanations. But we see now that nature acts in the opposite way: if something can be improved by being more complicated, it will be.

JOHN MATHER is the Senior Astrophysicist and Senior Project Scientist for the James Webb Space Telescope at NASA’s Goddard Space Flight Center. He is the recipient of numerous awards, including the Nobel Prize in Physics in 2006 with George Smoot, for his work on the Cosmic Background Explorer (COBE) confirming the expanding universe model to extraordinary accuracy, and initiating the study of cosmology as a precision science.

What is the scientific discovery that has most awed you?
I’m still astonished at the accomplishments of molecular biology, which are pouring in at an incredible rate. With human hands and minds, we’ve discovered some of nature’s tools that let us see the details of cell-to-cell combat and disaster repair. We know that bacteria keep digital records of viral attacks, for use in future defense. We know that cells repair chromosome damage and we’ve learned how to use that mechanism to do genetic engineering. We’ve learned the physical structures of the nano-machines that process DNA and RNA for replication and control. We’ve learned about micro-motors that convert incoming molecular energy into the ATP molecules the cells use to power everything. The list goes on and on. It depends on many tools the physicists have invented, as well as on higher math and computers. And every day is a surprise. We learned in school about Occam’s razor as a guide to good explanations. But we see now that nature acts in the opposite way: if something can be improved by being more complicated, it will be.

Which of your professional accomplishments would have most surprised the young John Mather?
The young John Mather had no idea how far the space program would go. When Sputnik went up in 1957 and the Apollo astronauts walked on the moon in 1969, I never guessed that astronomers would be able to see so much better, that we would be able to hunt for life on other planets in the solar system and beyond, that optics could be developed so far beyond classical lens design and diffraction. And I certainly had no idea that I would become a NASA employee helping to lead a team in building the most powerful telescope yet, or that I would have helped to lead a team to Nobel-prize winning discoveries.

“I admire my colleagues immensely, for the intellect and talent, for their drive and determination to ensure success, and for their commitment to public service. And we laugh a lot too!”

What has been the most rewarding aspect of the JWST project for you so far?
I really enjoy working with brilliant scientists and engineers, to build something that’s never been built before, to discover something that’s never been known before. I admire my colleagues immensely, for the intellect and talent, for their drive and determination to ensure success, and for their commitment to public service. And we laugh a lot too!

What kind of advice would you give to a young PhD student starting his/her career in science?
Science is more than ever a team sport, so choose your team with thought to how people work together. Good leadership can bring joy; cranky people can bring sorrow. So before choosing your PhD advisor, talk with the other students, see how they like their advisor, see how they talk with each other, see whether they are being well prepared to prosper in an uncertain world.

SUDOKU

CHALLENGE

MYSTERY ICFOnian

How much do you know about the people you work with? ICFOnians are a fascinating group, with hobbies, interests and talents that may surprise you. Have a look around and see if you can guess who this edition’s Mystery ICFOnian is! Look for the answer in next edition’s Challenge section!

1. She has a delicious creative streak.
2. Her favorite vacation was a trip to Graceland.
3. She sometimes dreams of having the chance to study something new like Oriental Art History.
4. The force that guards her home is a 1.5-year-old German Shepherd named Lukas Skywalker.
5. There are few ICFOnians that she does not know by name.
6. With all her experience in and around airports, she can recite almost all of the FAA security check-in speech from memory.

Whether you’d like to subscribe to ICFOnians, change your email address, or have some comments and ideas for future content, we’d love to hear from you!
To subscribe or to read back issues of ICFOnians, please visit the IFCO Website www.icfo.eu
To get in touch, please send us an email to communications@icfo.eu indicating your name, email address, and institution.