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for LuxQuanta

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TRAINING

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to Atom-Light Interactions

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THE LAST WORD

Interview with  
Ángel Ramírez

p.12

# ICFONIANS 46

Community News Fall 2021



## Training and Discovery

## EDITOR'S CORNER

**Brook Hardwick**  
Contributing Editor



# Seize the moment

Summer Schools, Summer Fellows,  
Summer Fun...

ICFonians are by and large the kind of people who spot something interesting and worthwhile, and dive in head first. We seize the moment and squeeze as much as possible out of the opportunity. The Fall edition of *ICFonians* allows us to look back at the summer months when ICFonians step outside their daily routines for an interesting change of pace.

ICFO has a wide offering of training and discovery opportunities in the summer months targeting students and early career scientists. Last year due to the pandemic, we were unable to welcome a cohort of Summer Fellows to the institute, however this year we picked up with a great group of young scientists who took full advantage of the labs, lectures, tours and expertise that was offered as part of this program backed by Fundació Catalunya-La Pedrera. Some of the Summer Fellows will go on to complete Masters level work, while others have PhDs and other career plans on the horizon. We are pleased that they have taken full advantage of what ICFO had to offer this summer and hope that as Summer Fellows and ICFO alumni, they will be prepared for whatever lies ahead.

Frontiers Schools, organized by ICFO, often in partnership with other leading international research centers and universities to offer talented young researchers and students worldwide a first introduction to a thematic research area, are a central part of the ICFO training and development program. Coming out of over a year of online events, the organizing team was disappointed

that uncertainty around the COVID situation would not permit a fully in-person event, with the inherent networking interactions between students and leading experts that these events provide. Ever determined to seize the opportunity that the fantastic program presented, they proceeded with a hybrid format and were thrilled to see that this allowed even more students around the world to take advantage of an amazing learning opportunity. Sixteen lectures spread out over four days in two hubs (Barcelona and Rehovot, Israel), 19 poster presentations, and over 300 registered attendees from 27 countries set a record for this fantastic event dedicated to new atom-light interactions!

As tempting as these offerings are, ICFonians are not immune to the lure of some well-deserved R&R. After you have read up about our new ICONS leadership (p 11) who has signed up to work hard to help the PhD community get the most out of their PhD experience through educational and networking activities; and then read on about Ángel Ramírez, President of GTD (p 12), a company that started out as an entrepreneurial venture and has grown into a multinational giant that recently provided corporate VC seed funding for ICFO spin-off LuxQuanta (p 6); then we invite you to sit back and enjoy vicariously some highlights of ICFonians' summer fun. This edition's Community Pictures (p 11) will take you from the football pitch here in Castelldefels to the mountains, the Mediterranean, and beyond!

## Mystery ICFonian Chaitanya Kumar Suddapalli

Solution Ed #45

Research Fellow, Optical Parametric Oscillators group

## Science Quiz 1:B 2:C

Answers from p.12 3:A 4:B

## COVER



### Summer Fellows at La Pedrera.

Each year, ICFO offers a limited number of internships to outstanding undergraduate and Master's students to participate in the Summer Fellows Program. While conducting a challenging research project, Summer Fellows engage in a focused training program covering the basics and applications of the different research topics active at ICFO. This year, members of the program were invited by Fundació Catalunya-La Pedrera to participate in a guided tour of La Pedrera- Casa Milà, the Foundation's headquarters and a UNESCO World Heritage Site in Barcelona.

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# HAPPENINGS



**LUXQUANTA RECEIVES CORPORATE VENTURE CAPITAL SEED INVESTMENT**  
p. 6

**ICFO NEWCOMERS**

# Welcome to ICFO

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



**Papa Kwakye Kwarteng**  
Student



**Lucero Cárdenas Razo**  
Student



**Tatyana Ivanova**  
Student



**Cristian Tabares**  
Student



**Aleksandra Deeva**  
Student



**Birger Deserrano**  
Student



**Hanna Salamon**  
Student



**Pontus Walan**  
Student



**Edvin Sandén**  
Student



**Teodor Parella Dilmé**  
Student



**Carolina Fajardo**  
Student



**Max Zayas Orihuela**  
Summer Fellow 2021



**Arnau Mas**  
Summer Fellow 2021



**Alejandro Andrés**  
Summer Fellow 2021



**Enrique Cervero**  
Summer Fellow 2021



**Iris Cecilia Kalien**  
Summer Fellow 2021



**Saad Abdullah**  
PhD Student



**Sidney Palardonio**  
PhD Student



**Riccardo Bertini**  
PhD Student



**Marta Cagetti**  
PhD Student



**Iliyan Karadzhev**  
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**Julita Poborska**  
PhD Student



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Visiting PhD Student



**Martin Hörmann**  
Visiting PhD Student



**Aleksander Wozniak**  
Visiting PhD Student



**Abigail Stein**  
Visiting PhD Student-Fulbright



**Gaël Massé**  
Postdoctoral Research



**Katharina Chirvi**  
Postdoctoral Research



**Charlie-Ray Mann**  
Postdoctoral Research



**Carmen Martínez**  
Postdoctoral Research



**Malak El-Quessny**  
Postdoctoral Research



**Debranj Mandal**  
Postdoctoral Research



**Katerina Nikolaidou**  
Postdoctoral Research



**Seham Kamal**  
Visiting Scientist



**Rut Torner**  
Administration



**Elena Nolla**  
Administration



**Joana Ibáñez Solé**  
Administration



**Jordi Cortés**  
Administration

**Not pictured**

**Manel Madrid**  
Student

**Philipp Stammer**  
PhD Student

**Joel Compte**  
Student

## HAPPENINGS

## ICFO NEWS

## ICFO Scientific Advisory Board



**In July, part of the ICFO SAB met at the institute and provided guidance and advice about strategic projects that the institute will undertake.**

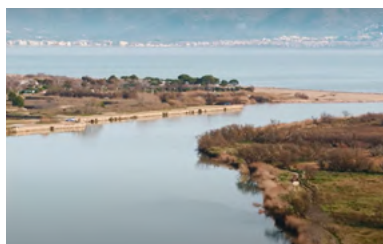
They also assessed the progress made in the implementation of the strategic plan associated with the Severo Ochoa 2020-2023 Excellence grant awarded to ICFO by the Government of Spain. Researchers took advantage of the visit to share research being conducted in the labs and the SAB members also visited the new addition to ICFO's facilities that will soon be completed in ICFO-W thanks to a philanthropic donation by Fundació Privada Mir-Puig. Due to the COVID-19 restrictions in place around the world, only a subgroup of the SAB was able to attend this particular meeting, therefore a new meeting of the full Board will take place as soon as COVID-19 permits.

## 2021 RSEF-BBVA Young Investigator Award for Experimental Physics



**The jury for the 2021 Spanish Royal Physics Society (RSEF) and the BBVA Foundation Physics Prizes has recently awarded ICFO Group Leader Prof. D. Pelayo García de Arquer the Young Investigator Award in Experimental Physic.** The jury highlighted his leadership in the area of materials science with very notable contributions in optoelectronics and clean and renewable energies. They emphasized the interdisciplinary nature of his work that includes the manipulation of the transfer of energy in nanostructured materials and catalysis, bringing together knowledge of physics, chemistry of materials and photonics. Through the Physics Prizes, the RSEF and the BBVA Foundation seek to recognize creativity, effort and achievement in the field of physics, thus acting as a stimulus to professionals who carry out their work both in research.

## Innovations to Monitor Water Quality



**The Catalan Water Agency (ACA) published a video illustrating their commitment to the safest and cleanest possible bathing areas in Catalonia.**

They highlight year-round work to monitor water quality as well as the additional scrutiny given to waters during the summer's peak bathing months. While current measures are guaranteeing excellent water standards, the ACA seeks to go a step further. The video draws attention to a **collaboration launched with ICFO** in 2020 through which the Optoelectronics group led by ICREA Prof Valerio Pruneri is working to develop a **system to detect and monitor undesirable microorganisms whose prevalence may increase dramatically after episodes of heavy rain and flooding.** The new mechanism under development will provide quantitative water quality results much faster, thus, improving the efficiency in the use of the natural environment while guaranteeing its quality and safety.

**Video:** [http://s.ic fo/ACA\\_video](http://s.ic fo/ACA_video)

## Master of Multidisciplinary Research in Experimental Sciences



**This September marked the Barcelona Institute of Science and Technology's (BIST) fifth annual Master of Multidisciplinary Research in Experimental Sciences (MMRES) Ceremony** at the Fundació Catalunya - La Pedrera Auditorium. The event brought together the incoming cohort of 23 students and the 21 graduating students of the BIST MMRES. This year in person, the event celebrated the enormous achievements of the outgoing class 2020/2021 and welcomed the new cohort into the BIST Community.

## Nature Index



**Nature Research compiles a database of information from an independently selected group of 82 high-quality science journals in order to rank institutions in terms of their scientific output.** It serves as an indicator of research excellence and institutional performance, drawing on information from a 12-month rolling window of data. In the most recent index, **the aggregate data of the institutes that constitute BIST (the Barcelona Institute of Science and Technology) holds the second overall national position,** only behind CSIC which aggregates data for 49 institutes in all areas of science. ICFO is one of 7 CERCA institutes that form BIST (the other members are CRG, IBEC, ICIQ, ICN2, IFAE and IRBB), and contributes 36% of its total share.

## Save the Date 2021 BIST Conference (registration now open)

### 2021 BIST Conference

Quantum Technologies:  
Present and Future

November, 2021

BIST Barcelona Institute of  
Science and Technology



Register now for the 2021 BIST Conference that will focus on a key BIST research initiative: **Quantum Technologies.** Leading experts will present the current status of quantum technologies in Catalonia, Europe, and the World, their applications in industry, and their influence in creative fields. The conference will take place **online and in-person** with additional satellite sessions held online. BIST Conference is **open to the whole scientific and innovation community and general public.**

**Main conference: Nov 3**

**Satellite sessions: Nov 2,4,5,16**

## Laserlab-Europe Position Paper

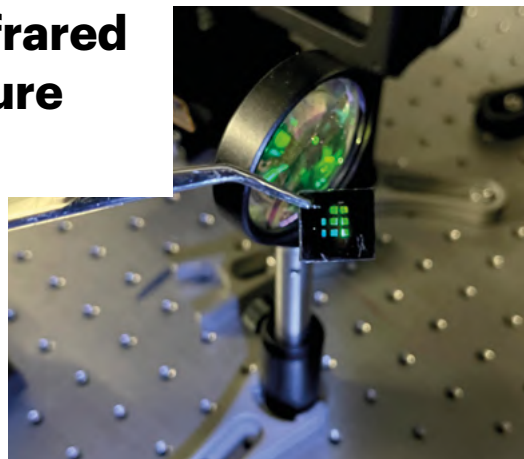


**Laserlab-Europe, a consortium of leading national laser research infrastructures, has published a joint position paper, in which it highlights its integrated, cross-domain and multi-faceted approach to address the societal challenges of the Horizon Europe Missions.** Together with associate partners, Laserlab-Europe covers the majority of European member states. Select European laboratories, including **ICFO's Attoscience and Ultrafast Optics (ICFO-Atto) facility** and the **Super-resolution Light Nanoscopy & Microscopy (SLN) facility,** participate in the Laserlab-Europe infrastructures and receive EC funding support in order to offer access to their facilities for research teams from Europe and beyond. With its extensive set of advanced laser research infrastructures, scientific expertise, innovative research and services, Laserlab-Europe promotes new horizons for the European Green Deal, Europe's Beating Cancer Plan, the UN's Sustainable Development Goals, and, in particular, the Horizon Europe Missions.

## LATEST ADVANCES

## Quantum dots enable infrared lasing at room temperature for silicon photonics

In a paper published in *Nature Photonics*, ICFO researchers Guy Whitworth, Mariona Dalmases, and Nima Taghipour, led by ICREA Prof at ICFO Gerasimos Konstantatos have reported **the achievement of a colloidal quantum-dot-based (CQD) infrared laser source operating at room temperature, compatible with CMOS technology and tunable to emit in the telecommunications window**, an important milestone needed for classical or quantum communications.



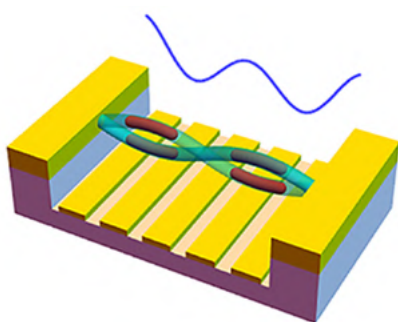
Previous studies had demonstrated stimulated emission and optical gain of quantum dots on thin films. Building on this, the researchers were ultimately able to insert the setup into a cavity to achieve lasing. With their experimental setup, they were able to demonstrate lasing emission across the eye-safe optical communication infrared spectrum and at room temperature, thus, possibly finding the last piece of the jigsaw puzzle for silicon photonics.

The results of this study are considered a major breakthrough in the field of CQD optoelectronics as they may facilitate fully integrated silicon photonics, paving the way towards low-cost solution processed and CMOS integrated lasing sources for on-chip comm or LIDAR applications.

## Mechanical qubits made of nanotubes and quantum dots

In a study published in *Physics Review X*, researchers Prof Fabio Pistoletti (CNRS, University of Bordeaux), Prof Andrew N. Cleland (University of Chicago), and Prof Dr Adrian Bachtold (ICFO) **develop a theoretical proposal for quantum information processing an innovative electromechanical system**, using a mechanical qubit composed of a nanotube resonator coupled to a double-quantum dot formed in the suspended nanotube.

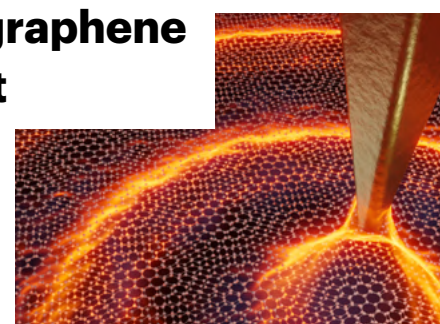
The researchers use the quantum dots to introduce a very strong "anharmonicity"



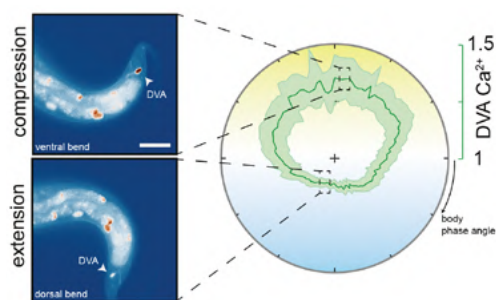
to the mechanical system, such that quantum information can be controllably encoded in just two quantum levels, a key requirement for manipulating and storing quantum information. This provides a simple and practical approach to a mechanically-based qubit, that further should display very long coherence times as well as easy qubit-qubit coupling, satisfying the major requirements for a quantum computer.

## Twisted bilayer graphene dances with light

In a recent work published in *Nature Physics*, ICFO researchers Niels Hesp, Iacopo Torre, David Barcons-Ruiz and Hanan Herzig Sheinfux, led by ICREA Prof at ICFO Frank Koppens, in collaboration with the research groups of Prof Pablo Jarillo-Herrero (MIT), Prof Marco Polini (University of Pisa), Prof Efthimios Kaxiras (Harvard), Prof Dmitri Efetov (ICFO) and NIMS (Japan), **have found that twisted bilayer graphene can be used to guide and control light at the nanometer scale. This is possible thanks to the interaction between light and the collective movement of the electrons in the material.**



By exploiting the properties of plasmons, the scientists were able to observe how these plasmons propagate in the material, while being strongly confined to it. Moreover, by observing the unusual collective optical phenomena occurring in the material, they were able to understand the peculiar properties of the electrons. This observation of propagating light, confined to the nanoscale, can be used as a platform for optical sensing of gases and bio-molecules.

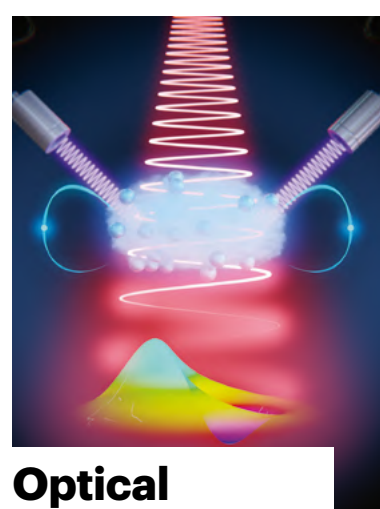


The team recorded videos of both wild-type *C. elegans* and mutant, and studied one of the *C. elegans* proprioceptor neurons, the DVA. They observed the changes in the neuron's calcium and potassium ion channels and how they induced or suppressed the neuron's activity.

## Self-movement and body position of the roundworm *Caenorhabditis elegans*

In a new study published in the journal *Science Advances*, ICFO researchers Ravi Das, Li-Chun Lin, Frederic Català-Castro, Nawaphat Malaiwong, Neus Sanfeliu-Cerdán, Montserrat Porta-de-la-Riva, and Aleksandra Pidde, led by ICFO Prof Michael Krieg **investigate the mechanics, molecules, and neurons driving locomotion in the roundworm *Caenorhabditis elegans*.**

They found that the alternation between tension and compression in the spectrin proteins of the sensory neurons regulates the body posture. They also point out a general mechanism of dendrites, responsible of transmitting the signals detected by the proprioceptor neurons. In this mechanism, compression and extension stresses modulate two opposing ion channels in the neurons, one excitatory and the other inhibitory, responsible for transmitting the signals. This generates functional compartmentalization, with active and inactive zones, allowing the neurons to be activated locally and improving the control of the overall movements.



## Optical Schrodinger's cat states in high harmonic generation

In a recent study published in *Nature Physics*, ICFO researchers ICREA Prof Maciej Lewenstein and Javier Rivera, ICFO Alumni Marcelo Ciappina, now at Technion-China, and Emilio Pisanty and

Philipp Stammer currently at Max Born Institute in Berlin, in collaboration with researchers from FORTH, **have reported on the theoretical and experimental demonstration that intense laser-atom interactions may lead to the generation of highly non-classical states of light.**

Such results have been obtained by using the process of high-harmonic generation in atoms, in which large numbers of photons from a driving laser pulse of infrared frequency are up-converted into photons of higher frequencies in the extreme ultraviolet spectral range. The quantum electrodynamical theory, formulated in this study, predicts that if the initial state of the driving laser is coherent, it remains coherent, but shifted in amplitude after interactions with the atomic medium.

This study opens the path towards the control of the non-classical states of ultra-intense light, and exploiting conditioning approaches on physical processes relevant to high-harmonic generation. This could link ultra-intense laser-matter physics and atto-science to quantum information science and quantum technologies in a novel, and completely unexpected manner.

## HAPPENINGS

## BUSINESS NEWS

# LuxQuanta Receives Corporate Venture Capital Seed Investment

Investment round to fuel ICFO's 10th spin-off, advancing LuxQuanta's strategic growth plan

**LuxQuanta Technologies S. L.**, a technology spin-off launched in May 2021 from ICFO's KTT Launchpad, is advancing towards its goal of providing high-performance and cost-effective quantum cryptography solutions, including continuous variable quantum key distribution systems, to implement an extra layer of security services for companies and network infrastructures. **The young company recently received investment from industry leader Corning and GTD that represents an important step forward in establishing LuxQuanta as a unique provider of quantum-safe security solutions for current communication infrastructures.**

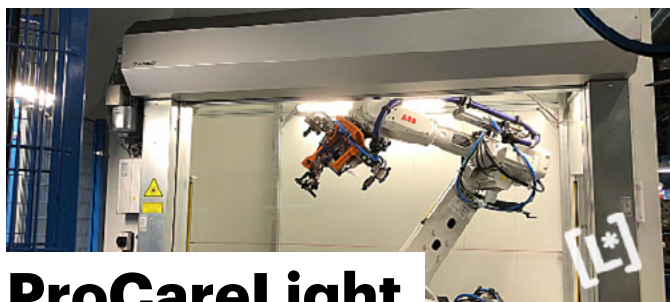
LuxQuanta's technology and IP originated in the ICFO research group led by ICREA Prof Dr Valerio Pruneri. The investment from Corning and GTD will enable LuxQuanta to bring technology from the lab to commercialization, enabling the deployment of quantum key distribution technology for securing digital data in the near future.



*"This investment is an important first step for LuxQuanta to become a leading provider of quantum-safe solutions. GTD and Corning are companies whose technology is complementary to LuxQuanta products. We are very excited to work with them to leverage synergies and build strong collaboration,"* commented **LuxQuanta's CTO, Sebastian Etcheverry.**

**Corning Incorporated** ([www.corning.com](http://www.corning.com)) is one of the world's leading innovators in materials science, with a 170-year track record of life-changing inventions.

**GTD** ([www.gtd.es](http://www.gtd.es)) is a high-tech company, committed to the design, integration and operation of complex, mission-critical applications and systems throughout the world.



## ProCareLight launches LASERKUBIK

A new laser enclosure for an innovative laser cleaning system

ProCareLight, a company specialized in laser safety that spun-out of ICFO in 2013, is widely known in the research and industrial environments as the most experienced consultancy advisor in the field. **Recently** it has widened its business scope by **supplying laser protection products and developing its LASERKUBIK customized enclosures for industrial manufacturing laser cells.**

In collaboration with the leading automated welding company Serra Soldadura, ProCareLight has designed, built and installed a LASERKUBIK enclosure for an innovative laser cleaning system in an automotive factory in Hungary.

This innovative laser cleaning technology is being introduced into factories and assembly lines, especially into the automotive sector and in this case in Hungary for the cleaning of the Front Subframes of the Volkswagen MEB41.

The laser manufacturer TRUMPF has designed new systems that can deliver up to 2 KW of infrared pulsed radiation, capable of removing residues from previous welding operations and thus preparing the manufactured part for the finishing stages. The LASERKUBIK for this project has length-width dimensions of 4.5 x 2.75m, a total height of 4m, and provides the necessary protection for the operation of the new TRUMPF Tru-Micro laser and the protection of the rest of the machinery and workers.

*"It is essential that direct or diffuse optical radiation produced in laser manufacturing processes be prevented from reaching people where it can cause permanent injuries, especially to the eyesight,"* underscores **JM Silvestre, CEO of PROCARELIGHT.**

European Union legislation obliges companies to take measures to avoid exposing workers to artificial optical radiation, through Directive 2006/25/EC, which has been transposed into the legislation of all member states. PROCARELIGHT offers its LASERKUBIK enclosures for production cells, facilitating the use of laser technology with total safety and helping its customers to comply with the obligations for the health of their workers, in terms of protection against radiation from laser systems.

## ACTPHAST

Opportunities that will allow companies and European researchers access to Photonics innovation solutions and technology support



ACTPHAST, an ICT project funded by the European Union's H2020 program, is a "one-stop-shop" for supporting photonics innovation.

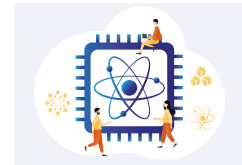
Two ACTPHAST projects are currently running to support innovation in Photonics, one for companies and the other one for researchers, and have received an **extension due to the COVID pandemic.** One of them, ACTPHAST 4.0, is entering its final year and is now **actively encouraging companies to take advantage of available funding which will make it possible for them to receive hands-on support from experts.**

- **ACTPHAST 4.0** is especially designed to support **European companies** who want to boost the innovation of their project with photonics. It is open to companies of all sizes, but particularly targeting SMEs who do not have the financial resources to invest in in-house R&D expertise and state-of-the-art technologies, allowing them to undertake risky innovation projects by giving them **direct access to the expertise and state-of-the-art facilities of Europe's leading photonics research centers (the ACTPHAST Partners).** This enables companies to exploit the tremendous commercial potential of applied photonics. ICFO is one of 24 research institutes who together make up the ACTPHAST 4.0 Partners.
- **ACTPHAST4R** aims to support researchers who have a conceptual breakthrough and would like to realize their prototype (or some components for their prototype) with mature photonics technologies. It is particularly targeted to researchers from non-photonics domains that are actively **seeking to innovate and exploit new conceptual breakthroughs enabled by photonics.** Researchers are given access to the advanced photonics technology platforms in order to demonstrate their conceptual breakthroughs with industrially-relevant equipment. In addition to maturing and building demonstrators, ACTPHAST4R offers **internship** at photonics technology centers, **hands-on** training with the advanced photonics technologies, and **deployment coaching** by experienced ACTPHAST4R business development experts.

ICFO participates in both ACTPHAST 4.0 and ACTPHAST 4R. Companies and researchers that submit proposals seeking support from ICFO experts that could lead to economically viable innovations for industries are encouraged to apply now.

**+INFO**  
[www.actphast.eu](http://www.actphast.eu)

# COLLABORATION



**ICFO MACIEJ  
LEWENSTEIN QUANTUM  
SCHOOL FOR TEACHERS**  
p. 9

## YOUNG TALENT

# ICFO Summer Fellows 2021

After a one-year hiatus due to the global pandemic, the ICFO Summer Fellows program, with the support of Fundació Catalunya-La Pedrera, was back in full swing again this summer for its 15<sup>th</sup> edition.

Ten undergraduate and Master's students spent the summer at ICFO, carrying out challenging research projects under the supervision of a Group Leader and with the assistance of Postdocs or PhD students. In addition, the fellows take part in a series of Summer Lectures that are designed to introduce newcomers to the many different research lines at ICFO, as well as lab tours and other activities that allow young scientists to experience ICFO as a researcher.



### ICFO SUMMER FELLOWS 2021

(Left to Right) Top row: Jaime Echave-Sustaeta, Jacopo De Santis, Max Zayas and Enrique Cervero. Middle: Sylvia Lacher, Arnau Mas, Paula Cordero and Maria Flors Mor. Bottom: Rob Sewell (Head of Academic Affairs) and Giovanna Petrillo (Academic Affairs)



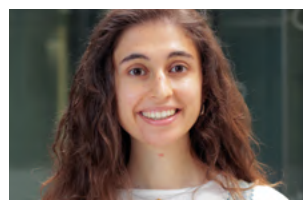
**01. Alejandro Andrés**  
Quantum Nano-Optoelectronics group led by ICREA Prof at ICFO Frank Koppens

*Thanks to the Summer Fellows program, I am more eager to pursue a PhD in Quantum Physics, Photonics or new technologies. It has also helped me discover that research topics are very diverse, even inside the same branch of knowledge.*



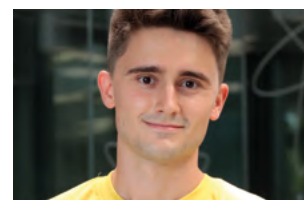
**02. Enrique Cervero**  
Quantum Information Theory group led by ICREA Prof at ICFO Antonio Acín

*What really stands out about the experience is to be treated just like any another researcher, instead of a student. The learning curve was steep, as is always the case with Mathematics whenever you delve into a new topic, but everybody was always really helpful and available for chats.*



**03. Paula Cordero**  
Medical Optics group led by ICREA Prof at ICFO Turgut Durduran

*I came to ICFO for the opportunity to work in a cutting-edge research center and with enthusiastic scientists and students, and to acquire new knowledge. I am happy to have learned all the techniques that my group works on, the experience to work in a lab and participate in the development of a medical optics device.*



**04. Jaime Echave-Sustaeta**  
Nanophotonics Theory group led by ICREA Prof at ICFO Javier García de Abajo

*I knew a former Summer Fellow who told me about the experience and I wanted to get exposure to the actual research. I know now that I want to go into research and I am more confident about my own skills (and also, aware of my flaws).*



**05. Iris-Cecilia Kaliën**  
Atomic Quantum Optics group led by ICREA Prof at ICFO Morgan Mitchell

*I am currently planning on taking a gap year to prepare for a PhD. The SF program has helped me sharpen my ideas and demonstrated what other possibilities are out there, through talking to the colleagues in my group but also through the conversations I had and the connections I made with the other Summer Fellows.*



**06. Sylvia Lacher**  
Attoscience and Ultrafast Optics group led by ICREA Prof at ICFO Jens Biegert

*I applied for the SF fellowship as I didn't have any lab experience and I wanted to know what a future career would look like if I still wanted to pursue a PhD. I also wanted to see how what I was learning in the classroom applied to current research projects.*



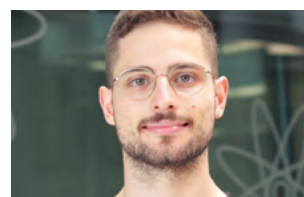
**07. Arnau Mas**  
Quantum Information Theory group led by ICREA Prof at ICFO Antonio Acín

*I will move on to a Master's degree in mathematical physics, so the experience at ICFO (having been in a theory group) will most definitely be beneficial and helpful.*



**08. Maria Flors Mor**  
Theoretical Quantum-Nano Photonics group led by ICREA Prof at ICFO Darrick Chang

*What I have learned during these past months at ICFO can be applied to the work I did during my master and it has helped me to have a better understanding on the scientific papers I'm interested in.*



**09. Jacopo De Santis**  
Atomic Quantum Optics group led by ICREA Prof at ICFO Morgan Mitchell

*I gained the ability to deal on my own with the many different problems that arise daily in the lab, for example building the equipment I need or finding alternative solutions.*



**10. Max Zayas**  
Ultracold Quantum Gases group led by Prof Leticia Tarruell

*The work environment is quite positive. All the members of the group have been willing to help me when I needed it, but they have also allowed me to solve problems on my own and make decisions actively in my project.*

## COLLABORATION

## TRAINING FOR INNOVATION

# ICFO-Weizmann School on the Frontiers of Light

July 5-8

## New Approaches to Atom-Light Interactions

ICFO organizes annual schools that offer talented young researchers and students worldwide a first introduction to a thematic research area and a taste of an international research environment. Regularly offered in partnership with leading international organizations, these schools incorporate a dynamic and social learning environment including lectures, group discussions, direct interactions with the lecturers, student talks and poster presentations.

In July, ICFO and the Weizmann Institute of Science teamed up to offer a School focusing on 'New Approaches to Atom-Light Interactions', exposing young researchers to some of the recent exciting approaches to next generation atom-light interfaces. The new platforms covered included ordered atomic arrays, ensembles of Rydberg atoms, atomic interfaces with nano- and micro-photonic structures, and superconducting circuit QED-based systems.

The organizing faculty members were ICREA Prof at ICFO Dr Darrick Chang and ICFO Prof Dr Robert Sewell, and Professors Ofer Firstenberg and Ephraim Shahmoon from the Weizmann Institute of Science.

As COVID-related travel restrictions did not allow for all participants to meet together in one location, this 4-day joint school was held in-person at both the ICFO and Weizmann hubs, with lectures at one location simulcast to the other. In-person activities included tutorials, Q&A sessions with the local lecturers, and interactive thematic sessions. There were also joint online discussion sessions between the hubs. Students participating in the two local hubs were invited to present a poster of their current research, with the organizing committee selecting some of these posters and inviting students to give a contributed short talk.

While participants were disappointed to lose the opportunity to gather all together in person for this event, **the online format was hugely successful in terms of reaching a diverse audience and**



Weizmann Hub



ICFO Hub

**allowing participants from around the world who normally would not have had access to this school, to connect.** There were over 300 attendees registered for the school, reaching 27 countries. Over 100 attendees connected at a time for the over 20 hours of online session.

Through the SPIE@ICFO Chair for Diversity in the Photonic Sciences, ICFO offered travel fellowships for international masters and undergraduate students to participate in person at one of the hubs, with preference given to students from developing countries. Although COVID restrictions made it difficult for these students to travel in many instances, 13 external students were able to join at ICFO, and thanks to the support of both SPIE and additionally OSA, word of this school and the opportunity to connect remotely reached interested students around the world, making it possible for this ICFO- Weizmann School on the Frontiers of Light to have a truly global reach.



## Launch of the Master in Quantum Science and Technology

**ICFO is one of the leading research institutes and universities in the Barcelona region behind the recently launched Master in Quantum Science and Technology in Barcelona**

The program, aimed at graduates in Physics, Physical Engineering or equivalent degrees who want to continue specialization studies in Quantum Science and Technologies, offers access to cutting-edge theoretical and experimental research in the fields of quantum sensing, communication, computing and simulation. Direct connections to industry through the QuantumCAT community, in addition to the participation of high-tech companies in the teaching program and an annual careers symposium, will facilitate the future integration of students in both academic and industrial sectors.

*"Quantum physics will play a major role in the next developments in our capacity to compute, communicate, and measure with precision. A solid education in Quantum sciences will be a crucial asset to both push the boundaries of our knowledge and also to develop new industrial products profiting from the intricate quantum properties. This master is the seed for a quantum future."*

**Prof Bruno Julia**

Coordinator of the Master in the Quantum Science and Technology program notes

*"Quantum technology is growing rapidly in Catalonia, with universities, research centers, startup companies and established industrials all working to bring about the second quantum revolution. QuantumCAT, strongly supports the creation of the Master in QST, as a way to boost the skilled workforce in this dynamic industry. We look forward to working with MQST students and graduates."*

**ICREA Prof at ICFO Dr Morgan Mitchell**

Leader of the Atomic Quantum Optics group at ICFO and Coordinator of QuantumCAT, the Quantum Technologies Hub of Catalonia

**+INFO**

[www.quantummaterbarcelona.eu](http://www.quantummaterbarcelona.eu)

## TRAINING- SAVE THE DATE



ICFO<sup>®</sup>

## Schools on the Frontiers of Light

\*\*Schools to be held this year in hybrid and/or online format

[www.frontier.icfo.eu](http://www.frontier.icfo.eu)

**October 25-28, 2021**

**ICFO- UT Stanford International School on the Frontiers of Light:**  
*Photons for Green Energy*

**November 8-12, 2021**

**ICFO- UNAM International School on the Frontiers of Light:**  
*Quantum Challenges*

Through the SPIE@ICFO Chair for Diversity in the Photonic Sciences, ICFO offers Travel Fellowships for international masters and undergraduate students to participate in ICFO Schools, with preference given to students from developing countries.



## OUTREACH

# ICFO Maciej Lewenstein Quantum School for Teachers

## Quantum Technologies course for high-school teachers

This July, the *Col·legi Oficial de Doctors i Llicenciats en Filosofia i Lletres i en Ciències de Catalunya* invited the ICFO outreach team to give a course for their summer school. **We designed a course about quantum technologies, a 10-day journey that took the participants from the basic concepts of quantum physics to emerging quantum technologies.** The possibility of learning directly from ICFOians about topics that are hot but that are usually perceived as difficult to understand was attractive to many high-school science teachers and the course was fully booked.

On the first day, the participants met ICFO group leader ICREA Prof Dr Maciej Lewenstein who introduced them to the realm of quantum technologies. On the same day they also took part in the quantum edition of the *Decide Game* designed by ICFO. This activity allowed them to get acquainted with an unknown topic in a dynamic and entertaining way through discussions in small teams.



During the rest of the course, they learned more about quantum physics and the related emerging technologies through online classes, animation and videos extracted from the Quantum Tour and other ICFO projects.

*"[This course] gave me a general idea of what quantum physics is. I started from scratch and now I feel competent."*

- participating teacher

All the materials provided to the participants during the course, including the activities for the classroom developed by the ICFO outreach team, will be available online in three languages (Catalan, Spanish and English) as part of the **ICFO Maciej Lewenstein Quantum School for Teachers**. This is a new program that aims to train teachers and provide them the tools to introduce the quantum world to new generations who will most likely observe the impact of (even more) quantum technologies in their lives.



## Art & Science: Hac Te residencies

Over the years, ICFO has been increasingly involved in projects at the interface between art and science, with ICFOians mixing their photonics knowledge with music and visual arts and partnering with artists of different disciplines

**Hac Te**, a new Barcelona hub focused on the exploration and development of the intersections between Art, Science and Technology, was launched in December 2020 and connects leading organizations in those fields. ICFO is one of the founding partners together with UOC, UPC, Fira Barcelona, BSC, BIST, Barcelona Tech City, HANGAR and New Art foundation. The initiative, supported by institutions such as the Barcelona City Council, the Government of Catalonia and the Barcelona Chamber of Commerce, aims to boost the **digital transformation of society** and to make Barcelona a **global center for research, training, dissemination, transfer and production in this field**. Fostering relations between the many different parties that already work separately in Barcelona in the fields of art, design, science and technology, could in fact produce valuable knowledge to meet the challenges of the digital transformation needed for the development of society.

**In June 2021, Hac Te offered five grants for research and production of artistic works in the field of confluence between art, science and technology.** In addition to supporting funds, the grant included a residency at one of the research centers during which artists were given the opportunity to receive mentorship from the researchers to feed the scientific inspiration of their projects.

Five projects were awarded from 71 proposals submitted. One of these projects, **"Dark Chambers of Ideology" (Cambres fosques de la ideologia)** by *Estampa*, an up and coming artistic collective and professional studio specialized in experimental cinema and animation, data visualization and interactive media, chose to collaborate with ICFO for their project. This entailed an investigation into the technological mediations that operate behind the images and in which different audiovisual formats are used, putting the darkroom in dialogue with the operational images of artificial intelligence. *Estampa* and ICFO had a first working session in September, in which they visited the institute, experimented with the Schlieren camera in the ICFOseum, and had a productive meeting with Dr Jordi Andilla of the SLN team in which they delved into the fascinating world of high-resolution microscopy, discussing the techniques and elements they could use for their installation. More interactions will follow to help *Estampa* make their vision a reality and with the goal of showcasing their work in the 2022 edition of Ars Electronica in Linz.

## PEOPLE

## BEYOND ICFO

# Career Paths for Postdocs

The *Beyond ICFO* annual career event brings together members of the Alumni network to showcase ways that they are applying their training in a variety of career paths

By sharing their experiences with the ICFO community, Alumni are able to introduce career options and applications of scientific training that may not be on the radar of ICFOians who may be considering their next career move. This year, ICFOians who were postdocs at the institute and that have gone on to follow a variety of professional routes, both in and outside of academia, came together to share insights on the decisions they made that influenced their career choices.



## Panel Discussion



### ALESSANDRO CERÈ

Senior ML Specialist  
Solution Architect at  
**AWS**

*"As scientists we have a lot of technical knowledge, but this knowledge is not what makes us valuable in industry. Our value is the ability to translate, to talk across the spectrum and talk both to executives and technical people. And you learn that from years of teaching, outreach activities, etc. That's the value you can bring"*



### CAITRIONA CREELY

Program Manager:  
Data Infrastructures and  
Personalized Medicine  
at the **Irish Health  
Research Board**

*"Step back and reflect a little bit about yourselves: 'When am I most energized at work?', 'What really motivates me?' and then look for an area where you can contribute, whether it's industry, academia, public sector, healthcare... It doesn't matter. If it motivates you, that's how you'll make a difference"*



### RICCARDO SAPIENZA

Professor of Physics  
at **Blackett Laboratory,  
Imperial College  
London**

*"I'd like to dispel some myths that are behind the Academic path: you don't need to have the largest number of Nature papers. What you need to become an academic is to have a vision and a story. You need to want to do something different, and then work in something that you're motivated to do and that is a breakthrough idea"*

## Prof Michael Totzeck

### Keynote talk

The event kicked off with perspectives from an industry leader that draws much of its talented workforce from PhD and Postdoc Community.



**Prof Michael Totzeck**, Research Fellow at Carl Zeiss AG, opened the event with a talk that compared the goals and hard skills relevant for positions in industry and academia. He shared tips with ICFOians about the best ways to excel in their career paths, both in industry and academia, and the soft skills needed to succeed.

## LEADERSHIP

## New Board for ICONS

The general assembly of the ICFO Organization and Network of Students (ICONS) appoints a new board of officers by an open vote

**ICONS promotes educational activities for students, boosting their career opportunities by drawing them closer to the photonics community.** Likewise, the network endeavors to intensify the interaction and collaboration of its members within ICFO by organizing social events like Social Friday, and in typical years, the annual International Food Festival, amongst others.



### 2021 ICONS LEADERS:

(L to R) **Julita Poborska** (Diversity and Inclusion Officer); **Carolina Fajardo** (Secretary); **Cristian Boghiu** (Treasurer); **Giulia Lo Gerfo** (Vice-President); **Blanca Belsa** (President); **Jessica Angulo** (Communications Officer)

This new team takes over from outgoing leaders **Arturo Villegas** (President); **Blanca Belsa** (Vice-President); **Montserrat Álvarez** (Secretary); **Jana Ockova** (Treasurer); **Cristian Boghiu** (Communications Officer); and **Pablo Fernández** (Diversity Officer).

In spite of the peculiarities of this atypical year that was marked by social distancing for COVID, this leadership team was very active, working to launch programs for the PhD community and the institution in general, including the first institutional PRIDE Month celebration at ICFO. Congratulations to the new ICONS leaders and many thanks to the outgoing team for all your efforts to enrich the experience of PhD students at ICFO.

GO & FLY

### Congratulations to 4 New ICFO PhD Graduates

235 ICFOians have successfully defended their theses

Continuing to adapt to the need for social distancing, ICFO's newest PhD graduates defended their theses in a hybrid format, with the thesis committees, colleagues, friends and family supporting them in this important moment from the auditorium and online.

Each of these ICFOians has played an important role in ICFO's success and reputation as a leading international research institute. Honoring ICFO's tradition, ICFOians celebrate this important personal, professional and institutional milestone and encourage you to Go & Fly! Remember that wherever you go, you will always be a part of the ICFO community.



**232** July 7, 2021

**SLAVEN TEPŠIĆ**  
*"Optomechanical Resonators Based on Low Dimensional Materials"*  
 TD: Prof Dr Adrian Bachtold



**233** September 8, 2021

**NILS-ERIC GUENTHER**  
*"Dynamics of Quantum Mixtures"*  
 TD: ICREA Prof Dr Maciej Lewenstein and Dr Pietro Massignan



**234** September 28, 2021

**PAU GÓMEZ KABELKA**  
*"Spinor Bose-Einstein Coagnetometer and Interhyperfine Interactions in Rb87"*  
 TD: ICREA Prof Dr Morgan W. Mitchell



**235** September 29, 2021

**GUILLERMO MARTÍNEZ-DENEGRI SÁNCHEZ**  
*"Light Harvesting and Energy Efficiency in Perovskite Solar Cells and Their Applications"*  
 TD: UPC Prof Dr Jordi Martorell

COMMUNITY PICTURES

When the weather gets warm, ICFOians hit the road to recharge their batteries. Adventure, relaxation, sports, culture and site seeing- you name it, we did it!



ICFO Excursionists are back! Camí de Ronda from l'Ampolla to l'Ametlla de Mar



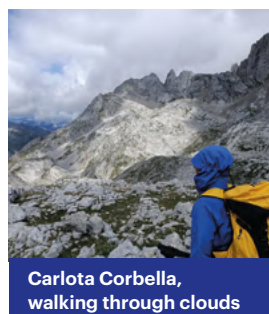
Andrea Morales, waking up on Rhule Refuge in the french Pyrenees



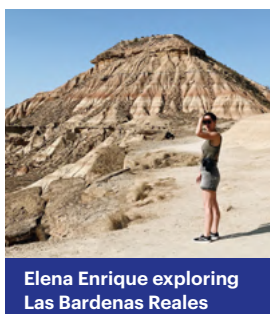
Marta Martín, laying on Mallorca's beach



Rajashree Haldankar at Palma Aquarium, Mallorca



Carlota Corbella, walking through clouds



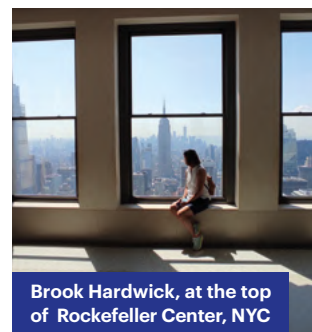
Elena Enrique exploring Las Bardenas Reales



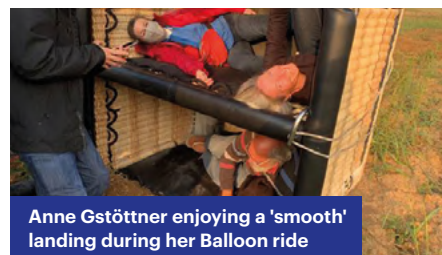
Ariadna Martínez, in Prada de Conflent to present ICFO's Health portfolio at la Universitat Catalana d'Estiu



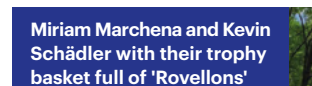
Stuti Gugnani, snorkelling during her holidays in Calpe, Alicante



Brook Hardwick, at the top of Rockefeller Center, NYC



Anne Gstöttner enjoying a 'smooth' landing during her Balloon ride



Miriam Marchena and Kevin Schädler with their trophy basket full of 'Rovellons'



Projects Team reunion in Menorca



ICFO Football Tournament!



Gabriel Fernández visited La Maleza wildlife park and saw two specimens of the extinct aurochs



### Mystery ICFOian

How much do you know about the people you work with?

ICFOians 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 ICFOian is! Look for the answer in the next edition of ICFOians.

1. Prior to coming to Castelldefels, she lived in the US and Argentina.
2. She never leaves her house without earrings on.
3. She and her family share their house with other flat mates.
4. Many ICFOians have her cellphone number.
5. She enjoys playing board games and her favorite is *Carcassonne*.

# THE LAST WORD

## HIGH PROFILE

## Ángel Ramírez

President, GTD

### Can you give a brief overview of GTD?

We founded our company 34 years ago and we are now over 400 engineers, scientists, IT professionals from multiple nationalities, all working together. Our average age is 29- we are constantly injecting young, new human capital. We work in four large sectors: Aerospace Engineering; Defense and Security; Energy and Scientific facilities; and Logistics and transport. The founding partners of GTD brought together strong backgrounds in industrial automation, control processes, regulation, instrumentation, real-time computing... but we never dreamed we'd be working in the aerospace sector. Our initial focus was on industrial robotics, which is still an important part of our business. The leitmotiv of GTD is that we do not do things that are easy; we do things that are critical. Our work is tremendously precise and always with the premise of operational safety. Operational safety issues are tremendously important, and we are experts in this area.

### GTG has recently invested corporate seed capital in ICFO's spin-off LuxQuanta. How do their activities fit in GTD's portfolio?

We consider our investment in LuxQuanta an industrial investment, where we can turn to them as often as necessary to help us to meet our clients' needs that we are currently unable to meet. One of these is in the aerospace sector. We have observed for many years that there could be an impending threat in terms of interception and intrusion from the quantum computer. This may still be years away, but with regard to new constellations, some with dual military and civilian uses, there are many links



that could be vulnerable to a quantum computer or a conventional super computer. The building block to protect these is Quantum Key Distribution- which is exactly what LuxQuanta is developing.

In addition to the aerospace sector, we have shared interests with LuxQuanta in the Defense and Security sector where there are concerns for cybersecurity in telecommunications systems, in critical environments and networks, where the possibility of intrusion must be mitigated. We also have shared interests in technologies we are using in the Energy and Science sector where we could potentially collaborate and/or exchange experiences with the goal of developing new technologies, the sooner the better, for mutual benefit.

### As a high-tech company with a large part of your client base being international, is there a plus to being located in Barcelona?

I am not the only one that think that thinks there is a plus to being located here- everyone is happy to come to Barcelona! When we have kick-off meetings to start projects with clients from Egypt, Denmark, Norway..., we offer to go to their offices but they prefer

*“The leitmotiv of GTD is that we do not do things that are easy; we do things that are critical.”*

to bring their teams to us. And our employees love Barcelona- there are more than just economic arguments to draw people here to work. At ICFO there are also many international researchers who could go anywhere. In fact, ICFO is a great example of what makes Barcelona great. It is a place that brings together excellent hard-core science with the development of new businesses. We also have world-class biomedical talent and Barcelona Super Computing - an international reference center, among others. And all this happens right here.

### Can you share your advice for our PhD students and post-doctoral researchers wanting to start a career in industry or even create their own companies?

My first recommendation if you want to start your own company is to never do it alone. Five of us founded GTD and if we had not been five, it would not have worked. Together we have created more than 15 companies, some have succeeded and some have not. Second, you have to have solid experience and expertise and a clear plan. Finally, when you are young and don't have a lot of money to lose, you may not want to take the risk. This is a “virus” that you either have or you don't. I have had this virus my whole life. I started putting things together and selling them from home when I was 14 years old!

## Science Quiz

**Quantum discord measures the extra information that Alice's state gives about Bob's state, beyond what classical physics allows.** There are states with discord that are not entangled, so this is non-classicality beyond entanglement. Calculating discord is a NP-complete problem, so approximate measures are useful. The below article relates two approximate discord measures.

**“Equivalence regimes for geometric quantum discord and local quantum uncertainty”**, O. Cordero, A. Villegas, J-R Alvarez, R. de J. León-Montiel, M. H. M. Passos, and J. P. Torres, Phys. Rev. A, 104, 042401 (2021)

### 1. When was entanglement first described ?

- A) 1905
- B) 1935
- C) 1964

### 2. What is the “N” in NP ?

- A) Not
- B) Numerical
- C) Nondeterministic

### 3. When was discord first described ?

- A) 2001 (A space odyssey)
- B) 2010 (The year we make contact)
- C) 2061 (Odyssey three)

### 4. Who was the first ICFOnian to publish about discord?

- A) L. Aolita
- B) D. Cavalcanti
- C) A. Streltsov

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Have you got news  
to share?

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