PRESS RELEASE

More than 100,000 people challenge Einstein in a unique worldwide Quantum Physics experiment

- ***On November 30th, more than 100,000 people participated in the BIG Bell Test, a global experiment to test the laws of quantum physics.***
- ***Participants were able to complete more than half a million levels of the video game that generated more than 90 million bits, a number that tripled the initial expectations of the scientific team leading the project***

Barcelona, December 1st, 2016

On November 30th, for the first time, the world had the opportunity to participate in and contribute to this unique worldwide experiment, with the aim of testing the laws of quantum physics.

Coordinated by ICFO-The Institute of Photonic Sciences, twelve laboratories from around the world came together to put in motion the **BIG Bell Test:** ***worldwide quantum experiments powered by human randomness***, with the aim of demonstrating experimentally that the microscopic world is in fact as strange as quantum physics predicts: particles that behave in a random way, determining their properties only when we look at them; strange instantaneous interactions at a distance ... predictions that were questioned by Einstein, who rejected them completely.

During the 48 hours in which it was November 30th at some place on the planet, participants contributed to the initiative, generating sequences of zeros and ones through a video game to get participants to create sequences of numbers that were as random as possible. Each of these bits was used to control in real-time the experimental conditions of the labs. They moved mirrors, polarizing filters, waveplates ... elements located on optical tables and that affect the type of measurements that are made on the different quantum systems in each lab.

Together all the participants provided scientists with millions of unpredictable, independent decisions which were used to measure their particles. This independence is a crucial feature for the conclusions of the Bell tests to be valid. Using the sequences provided by the participants, the scientists have been able to verify whether or not their particles were intertwined by the "spooky action at a distance" that Einstein could not accept. In a nutshell, the Bell test states that experimentalists have to do their measurements with the help of human decisions and calculate the “Bell parameter” (also known as the parameter S). If the world is as Einstein believes, predictable and without “spooky actions at a distance”, then S cannot be greater than 2. That is, S should always be less than 2. Otherwise, the inequality has been violated, indicating the presence of intrinsically quantum phenomena.

By 13:00 CET, the minimum number of participations needed to assure enough bits to power the experiments had already been surpassed, registering above 1000 bits per second in a stable manner over the course of several hours. By early afternoon CET, some of the labs had been able to obtain preliminary results, confirming violations of Bell’s inequality, and thus refuting Einstein, giving their complete support to the predictions of quantum physics.

ICREA Professor at ICFO Morgan Mitchell reflects that “the project required contributions from many people in very different areas: the scientists pushed their experiments to new limits, the public very generously gave us their time in support of science, and educators found new ways to communicate between these two groups. I'm thrilled with all of the different things we have learned through the BIG Bell test. "

Carlos Abellán, researcher at ICFO and instigator of the Project, emphasizes that "the participation we achieved today for the Big Bell Test is absolutely astonishing and unprecedented. I'm excited about all the results we're already receiving from the labs"

In Barcelona, in collaboration with "La Caixa" Foundation, the BIG Bell Test team had the opportunity to share the project with an audience of more than 300 people gathered in the Auditorium of CosmoCaixa, who witnessed in real time through several live connections, the experiments running in different labs in Shanghai (China), Concepción (Chile), Nice (France) and Castelldefels (Spain). This group further contributed to the experiment by participating in mass in a final tournament of the video game, created with Kaitos Games, to find the most random person in the audience. The event was streamed live around the world, and in China alone generated an audience of more than 300,000 people.

The BIG Bell Test has succeeded in uniting the scientific world and society in a common goal -an experiment that has demonstrated the unique value of human randomness to study certain fundamental processes of nature.

The BIG Bell Test team thanks the thousands of users who have so generously and enthusiastically contributed to this initiative. Without this essential contribution, the experiment would never have been possible.

Finally, we would like to thank all the institutions that have helped support this project, such as the Generalitat de Catalunya, the Universitat Politècnica de Catalunya, the Cellex Foundation, the Mir-Puig Foundation, the Foundation Catalunya la Pedrera, "La Caixa" Foundation, AXA Research Fund , the European Research Council, Catalan Institution for Research and Advanced Studies (ICREA), the Severo Ochoa program of the Ministry of Economy, Industry and Competitiveness.

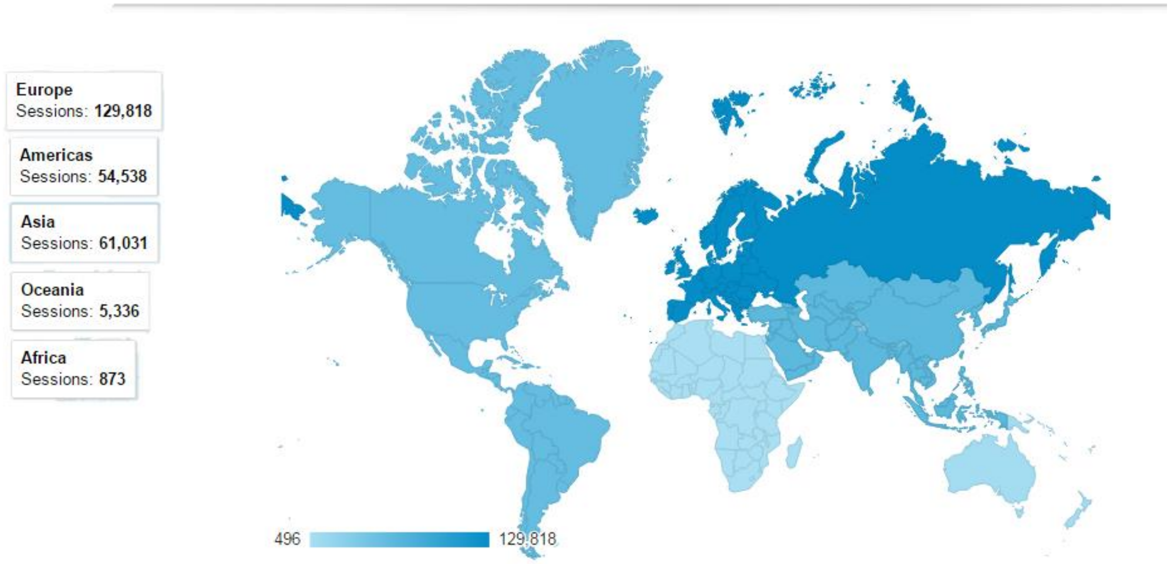
www.thebigbelltest.org

@TheBellsters

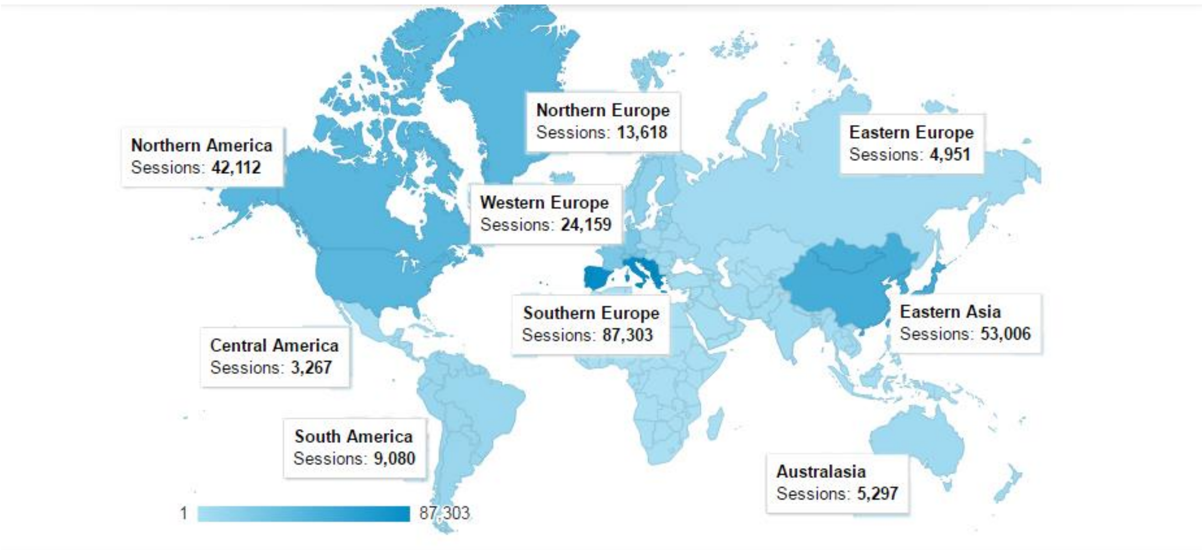
Figure: Live connection with the laboratory in Concepción (Chile) during the grand event of the BIG Bell Test in CosmoCaixa, of the "la Caixa" Obra Social, on November 30th.

Total number of visits per continents to the website www.thebigbelltest.org from November 29 to Dec. 1 **Total # visits: 252,092**

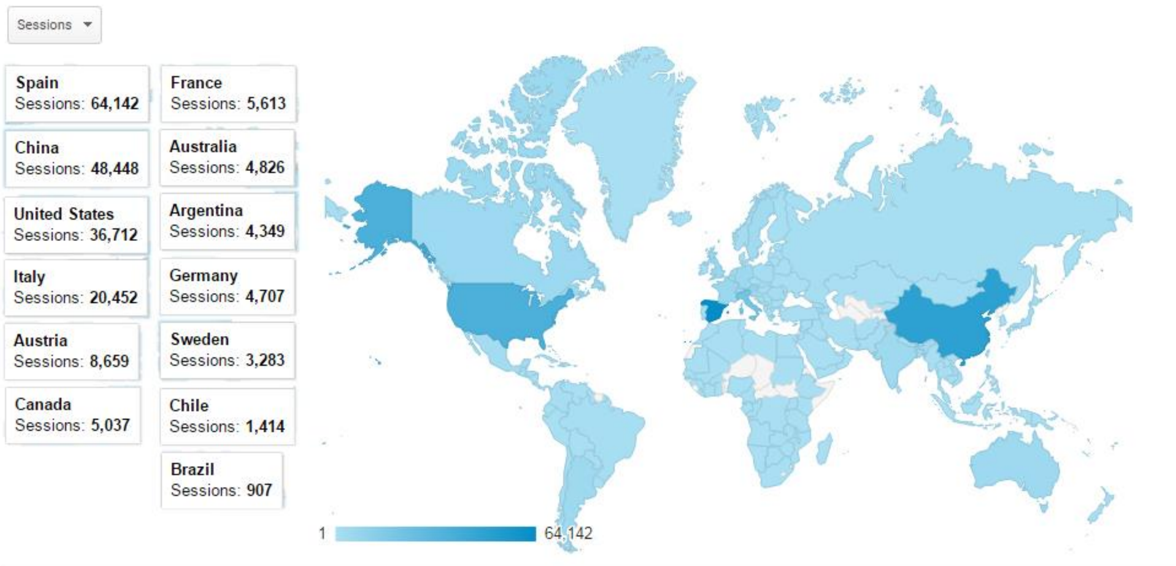
MAP OF CONTINENTS



SUBCONTINENTAL MAP

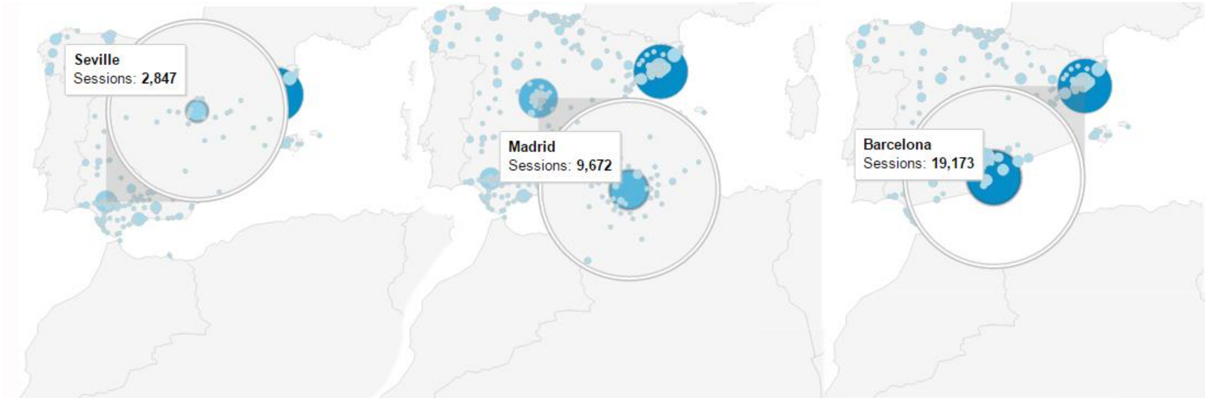


MAPA BY COUNTRIES



MAP BY CITIES

Total number of visits in Spain to the website www.thebigbelltest.org from November 29 to Dec. 1
Total # visits: 64.142



Here is a short summary of the abstracts, statements and curious facts of the twelve laboratories that have participated in the initiative:

1. Dipartimento di Fisica-Sapienza Università di Roma (Roma) in collaboration with the International Institute of Physics del Federal University of Rio Grande do Norte (Natal)

ABSTRACT - FUTURE QUANTUM COMPLEX NETWORKS: Q- INTERNET AND Q-TELEPORTATION

Complex networks between distant parties are ubiquitous nowadays and that will not be different in the development of future quantum technologies, most notably those based on Bell's theorem. By adopting a photonic setup we implemented a quantum network between three distant nodes whose correlations are mediated by two independent sources of entanglement. By employing human randomness, we violated a Bell inequality that allow us to witness the emergence of a new kind of non-local correlations in this complex scenario.

FACTS

- Yesterday evening we had a crash of the computer: we had to update all the software to control the different liquid crystals. But finally at 23:30 of 29 November we were again ready to go!
- Last week we decided to upgrade the apparatus from motorized waveplates to liquid crystals in order to enhance the overall rate of our experiments.
- In the Quantum Information Lab in Rome, 10000 double pairs of entangled photons are generated every second.

QUOTES

"With almost the same setup, the Quantum Information Lab in Rome performed and studied quantum teleportation with a new approach two weeks ago. This is a joint project with Daniel Cavalcanti and coworkers from ICFO."

2. Institute for Quantum Optics and Quantum Information (IQOQI) OEAW (Vienna)

ABSTRACT - BELL TEST ON PHOTONS

The experimental setup of IQOQI will generate pairs of light particles (photons), which are entangled in their polarization (i.e., the direction along which the electro-magnetic field of the photons oscillates). The photons of a pair are then separated and guided to individual measurement stations. There, the polarization is measured along two different directions, whereby the random numbers provided by the participants of the Big Bell Test dictate the actual setting. In this way, we can analyze the polarization correlations between photon pairs and see if the results violate the Bell inequality.

FACTS

- Within the blink of an eye, our setup can produce up to 5 million entangled photon pairs.
- In our lab, the random numbers of the participants are converted into the respective measurement settings within only 0.0000001 seconds (i.e., 100 nano-seconds).
- The measurement settings are implemented using so-called “Pockels Cells”. Thereby, a voltage of roughly 1500 V has to be applied across specific crystals the entangled photons have to pass.
- A similar kind of setup was used in an experiment between the Canary Islands of La Palma and Tenerife, in which we conducted a Bell test with entangled photons that were separated by 144km, still the world-record distance today.

QUOTE

“We would like to thank all Bellsters for their random numbers! But still, quantum mechanics won the race!“

PRESS RELEASE

3. División Óptica Cuántica (CITEDEF) and the Physics Department (FCEyN) from the Universidad de Buenos Aires (Buenos Aires)

ABSTRACT: MEASURING CORRELATIONS WITH THE HELP OF HUMANS

Our light source produces photon pairs with high correlation in their polarizations. Each photon of the pair is sent in different directions, towards two similar detection stages. Upon arrival to the detection stages, they travel through a waveplate that defines an orientation for polarization measurement, and a polarizer that projects the photon into two orthogonal polarization states. Naming the two possible outcomes (+) and (-) on each stage, the experiment consists in counting correlations between the possible outcomes of the whole experiment; (++), (+-), (-+) and (--); and compare the results with correlation limits imposed by different theories.

FACTS

- At the Buenos Aires laboratory, all the Waveplates and phase plates required to manipulate polarization and path quantum states are motorized. Some of them are mounted on stepper motors, and others are actuated with Arduino-controlled servo motors.
- The experimental setup at the Buenos Aires laboratory was originally used to implement quantum teleportation of a quantum bit between two separated stages, roughly four meters away from each other.
- Photons that propagate in open air at the Buenos Aires experiment are spatially filtered by coupling light with single mode fibers before the detection.
- In order to detect coincidences between photons at the two sides of the experiment, electrical cables must compensate different optical delays on the photon paths with a precision of 5E-10s (10 cm of cable).

QUOTE

"The team at Buenos Aires; Laura, Nacho, Agus, Chris, Ari and Richi want to say THANK YOU BELLSTERS!!!

The "B"-day started early at Buenos Aires!! We didn't want to miss the fun due to the time difference with Barcelona. For us it was the first time that ALL the Lab crew was simultaneously involved in a single experiment. Big Bell Test = Big Time Fun."

PRESS RELEASE

4. Centre for Quantum Computation and Communication Technology (CQC2T) – Griffith University (Brisbane)

ABSTRACT - SCHRÖDINGER PREDICTIONS

Our experiment will use pairs of entangled photons – single particles of light connected in a quantum way – to test whether measurements of one particle affects the outcomes of the measurement of the other particle. Erwin Schrodinger, one of the founders of quantum physics, predicted this effect and named it 'steering'. This will be the first test of steering using human-generated randomness, and the random numbers will be used to set optical elements to measure the polarization of light – a bit like using polarized sunglasses!

FACTS

- The Quantum Optics and Information Lab at Griffith University operates in semi-darkness and uses gentle colored LED lighting to protect the sensitive photon detectors.
- When travelling through glass optical fibers, photons move at about 2/3 of the speed that light travels in air.
- The quantum version of bits (zeros and ones) can be encoded, and measured, in light beams using polarization. It's the same idea as polarized sunglasses, but at a quantum scale - with single particles of light.
- 'Quantum steering' is an experiment that closely resembles a Bell test, but one of the two measurement devices is treated a little differently.
- If two far-apart people can successfully perform a Bell test, then they can use the random bits they share to send a message with absolute security.
- November 30 will start in Australia and Asia well before it does in Europe. We'll get the first random numbers on the big day!

QUOTE

"It was fantastic that we could receive random numbers from people all around the world! The Big Bell Test brought people together in one big worldwide project."

"In the hot Australian summer, it was great to stay cool in the lab at Griffith University and measure some photons."

"The Big Bell Test can remind us that the fundamentals of the quantum world can lead us to new ideas and new technologies. At Griffith University, that's what we're working towards."

"It will be great to harness this quantum weirdness for new technologies in the future."

5. Nodo del Centro de Optica y Fotónica (CEFOP) - Departamento de Ingeniería Eléctrica of the Universidad de Concepción (Concepción), in collaboration with the Departamento de Ingeniería Eléctrica – the Linköping Universitet (Linköping), the Universidad de Sevilla (Sevilla) and the Dipartimento di Fisica-Sapienza Università di Roma (Roma).

ABSTRACT - MAKING OUR TELECOMMUNICATION FIBER-OPTICAL NETWORKS 100% SECURE

One of the main goals of our experiment in Chile is to use the Bell test to guarantee the security of the current telecommunication fiber-optical networks as valid channels to perform quantum cryptography, secure communications guaranteed by the laws of quantum physics. That is, guarantee that no hacker is able to break the system! This experiment employs energy-time entanglement, which is a very robust kind of entanglement and thus well suited for long-distance distribution in fibers. We employ a recently developed configuration that is able to remove a flaw in standard energy-time Bell tests. The random numbers provided by the BBT server will be used to choose different measurement settings on the photon pairs, and thus demonstrate a Bell violation.

FACTS

- One of the practical applications of a Bell test is to guarantee the security of communications.
- In the experiment performed in Concepción, Chile, piezo-electric devices are employed to extend and contract a piece of optical fiber up to 50 thousand times per second, in order to keep the communication channels between the source and Alice and Bob stable.
- Quantum communication systems based on Bell tests are expected to be deployed to complement commercial encryption systems in the next few years.
- There are already systems used for commercial purposes that rely on quantum cryptography.

QUOTE

"We thank everyone that took part by sending numbers that we could use in our experiment. We have also enjoyed very much explaining what we do in the lab, and to raise awareness for quantum information science".

6. USA National Institute of Standards and Technology (NIST-Boulder)

ABSTRACT - HUMAN BELL TEST: PUSHING THE LIMITS OF SCIENCE

Quantum mechanics predicts that objects can share a connection stronger than anything we experience in our everyday experiences, something that is called quantum entanglement. Even if the objects are separated by a great distances, independent measurements on them will show they are correlated in ways that cannot be explained by classical physics or intuitions. These properties, which Einstein termed "spooky actions at a distance," can be tested in an experiment known as a Bell test. In 2015, NIST was one of the first groups to carry out a complete test of Bell theorem using quantum states of light, and conclusively show the presence of this "spooky action." However, in that experiment the decisions about how to carry out the measurements were made by random numbers generated from different physical processes. There still remain questions about whether human can have any influence on such quantum decisions. We will be repeating our experiment from 2015, but this time using random numbers provide by you. You will get to directly control our experiment, and we will be able to see if the results using human inputs differ from those using random numbers from physical sources.

FACTS

- We create 400,000 entangled photons per second to use in our experiment.
- 35 researchers from ten institutes in North America and Europe came together to help us build our first version of the loophole-free Bell test.
- To make our experiment happen, we need to use fast devices that can measure our photons. These devices can be switched on in only a few billionths of a second.
- During the three months we conducted our first Bell test in 2015 (not using human generated random numbers), one of our scientists got married. Talk about entanglement!
- We use the world's best low-light camera to detect our photons. These detectors are made out of superconductors, and must be operated at less than a degree above absolute zero.
- To perform the experiment, we must squeeze our photons into a tiny cable made of glass that is only a few millionths of a meter in diameter. Getting the photons to hit this tiny target is a feat of quantum archery.

QUOTE

"In 1964 John Bell profoundly changed the way we think about quantum mechanics. Bell's theorem lies at the very heart of quantum mechanics, philosophy, and a new class of technological breakthroughs based on quantum mechanics."

7. Quantum Device Lab (QUDEV), ETH Zurich (Zurich)

ABSTRACT - BELL TEST IN SUPERCONDUCTING SYSTEMS: QUANTUM COMPUTING

We perform our Bell test on two qubits (quantum bits) of a small superconducting quantum computer comprising four quantum bits. The entire setup is controlled by custom software, which is waiting for being fed with random numbers to execute the various instances of the Bell test according to the free will of volunteers. Qubits – unlike classical bits – can represent any superposition between 0 and 1. In our case they are encoded in a combination of charges that are allowed to coherently jump between two pieces of superconducting aluminum. For the processor to work it is cooled to a temperature of 25 mK (100 times cooler than outer space!). This cool temperature not only renders the entire chip superconducting, but also suppresses electrical noise to an extent that makes it possible to precisely control the states of the qubits using microwave radiation (the same kind as the one used in a microwave oven or in WiFi). The radiation is guided in cables, similar to optical fibers, from generators and modulators into the special refrigerator in which the quantum processor is mounted.

FACTS

Bell test in ETH Zürich

- is done by 5 quantum logic operations on small quantum computer,
- is done with a small superconductive quantum computer,
- runs on a processor 100 time cooler than outer space,
- is measured 10 000 times every second,
- is cooled by liquid Helium and quantum effects,
- makes uses microwave photons instead of visible light.

QUOTE

"This experiment is quite different from our daily life in the laboratory as we usually do not have really fixed deadlines. In experimental science the problems always appear when least expected. This time we were not able to postpone the final experiments and to get all of the problems solved in time we really felt the importance of working as a good team we are"

8. ICFO – The Institute of Photonic Sciences (Barcelona)

ABSTRACT- ENTANGLEMENT BEWTEEN ATOMS AND LIGHT: QUANTUM MEMORIES FOR QUANTUM INFO!

Our experiment will test Bell correlations between two very different quantum objects: a single photon and a single collective spin-excitation (called a spin-wave) involving millions of atoms in a laser-cooled atomic cloud. We will generate entanglement probabilistically between a photonic time-bin qubit well suited for transmission in optical fibers and a spin-wave qubit stored in a quantum memory. After a controllable storage time, the spin-wave qubit will then be converted deterministically into another photonic time-bin qubit. Both photonic qubits will be analysed using optical interferometers. The random numbers provided by the public will be used to randomly choose the measurement bases by changing the phase of each interferometer using a piezoelectric device.

FACTS

- We generate entanglement between two very different quantum objects: a single photon and a cloud of 1 million Rubidium atoms.
- Our experiment involves 1 million Rubidium atoms cooled to 100 micro degrees above absolute zero (around -273 degrees Celsius) inside an ultra-high vacuum chamber, with a pressure 1 trillion time smaller than atmospheric pressure. And it works!
- The atoms in our vacuum chamber move at a velocity of 10 cm per second, about 5000 times slower than the molecules of air at room temperature.
- To analyze our entangled state, we need to stabilize the length of a 40 meters long optical fiber with a precision of less than 50 nanometers.
- The entanglement can be stored for a programmable time in our cloud of cold atoms, which serves as a quantum memory.

QUOTE

"It was an amazing experience. It was great to see random numbers from people all around the world take control of our experiment. Thanks to the Bellsters!"

9. Arc Center of Excellence for Engineered Quantum Systems (EQUS) - University of Queensland (Brisbane)

ABSTRACT - ENTANGLEMENT THROUGH TIME!

Our experiment will study quantum correlations in time. Quantum entanglement is usually thought of as a strong connection between two (or more) particles that are separated in space. Such entanglement can be revealed by Alice and Bob, who each measure one of these particles, in a Bell-inequality test. However, quantum correlations cannot only exist across space. Alice and Bob could also be separated in time, rather than space, and perform their measurements on the same quantum system at different times. Such an experiment can reveal so-called temporal entanglement, which is a much less well-known form of entanglement. In our experiment Alice and Bob will use human-generated random numbers to choose measurement settings for a Bell-inequality test for temporal quantum correlations. Studying temporal quantum correlations will help us to understand the structure and power of quantum correlations.

FACTS

- Quantum entanglement is the strongest link between two particles that exists in nature. Yet, it is not the strongest allowed by the laws of physics. Why quantum entanglement is just as strong as it is and not stronger is still an open question.
- For a weekend during Brisbane summer the Quantum Technology Lab was run by a family of brushtail possums.
- Bell's theorem shows that quantum particles do not follow the rules of cause and effect as we know it.
- When two quantum particles are entangled, they behave as if they were one. No matter how far apart they are in space, or time.
- Quantum entanglement ~~is~~ across space is exclusive. If Alice is entangled with Bob, then Bob cannot, at the same time, be entangled with Charlie.
- When you are sitting still, you are actually traveling through time, and according to quantum mechanics, your present self can be entangled with your past, or future self.
- Quantum correlations cannot be explained as cause and effect, even if Alice's measurement outcome influences Bob's at infinite speed.

QUOTE

"Thanks to all the Bellsters who provided the random numbers we needed to keep our experiments going."

10. Center for excellence and Synergetic Innovation Center of Quantum Information and Quantum Physics (CAS) / USTC – University of Science and Technology of China (Shanghai)

ABSTRACT - HUMAN RANDOMNESS TO GENERATE QUANTUM RANDOM NUMBERS

It has been shown in theory that Bell inequality violations can be used to generate perfectly random bits with very strong guarantees, stronger than any other known method to make random bits. But a Bell test itself requires random bits as input, to choose the basis settings. This seems to create a "boostrapping problem", in which guaranteed randomness is required in order to produce guaranteed randomness. Human randomness may provide a solution. Because people have free will they are unpredictable, but we also know that they are not perfectly random; there are always some patterns in the things they choose to do. In our experiment we will use a different Bell inequality (not the usual CHSH inequality), one that has only a mild randomness requirement. We will then experimentally verify if there is a violation using randomness from human choices (free will). This will help us to test our Bell inequality and to close the randomness loophole with the help of human free will.

FACTS

- The diameter of the single photon superconduct nano wire detector is only tens of microns, which is much smaller than your hair diameter
- The frequency of generated entanglement photon pairs, although invisible, is very suitable for transmitting in optical fibers.
- Do you know that to cool down to a very low temperature, you need to pump the chamber to vacuum first.
- The entanglement pair generation is a kind of "nonlinear optics", one pair of entanglement is generated with more than 1 000 000 000 pump photons hit the crystal.

11. Ludwig-Maximilians-Universität München (LMU) (Munich)

ABSTRACT- ENTANGLEMENT THROUGH SPACE!

The team at the LMU in Munich stores two single atoms in two labs 400 m apart. To test Bell's inequality the spins of the atoms are first entangled and then very quickly measured, here the Bellsters contribute to the decisions how each measurement is done.

FACTS

- Technical detail: the random bits from Bellsters will switch the polarization of read-out beams which measure the spin direction of the atoms.
- At the LMU a single atom can be entangled with a single photon which is then sent to a different lab 400 meters away.
- At the LMU there are two single atoms 400 meters apart, which can be entangled although they never interact.
- At the LMU it takes only a millionth of a second to measure the atomic spin state, for this an electron is torn away from the atom.
- At the LMU the optical fiber connecting the two labs goes via the two fountains in front of the main building.
- It took over 40 years of experimental development to perform conclusive tests of Bell's inequality.

QUOTE

"Thanks to all Bellsters for their contribution and their interest in our research! Our measurement will have to go on several more days, so we are quite excited about how it will evolve and what the results will be."

12. Laboratoire de Physique de la Matière Condensée (LPMC) - Université Nice/CNRS (Nice)

ABSTRACT - HUMANS DECISIONS ARE INDEPENDENT FROM QUANTUM SYSTEMS

The experiment at the University Nice Sophia Antipolis / CNRS (France) is based on a Sagnac-type source generating pairs of entangled photons (light particles). The twin photons are separated and each of them is sent to one user, say Alice and Bob. The Bellsters control the very way questions are asked to those photons. If it happens, by chance, that both photons are submitted to the same question, both should always provide the same answer, that is to say correlated. In other words, such correlated randomness established at remote locations is the signature of the existence entanglement and, more strikingly, that the Bellsters do not influence the obtained results.

FACTS

- Three days before the D-day of the Big Bell Test, the air conditioning system of the entire institute actually failed! The technician from the university maintenance service came immediately (which is great), climbed to the roof where the main system is, had a look at it, then looked at us, and said: "I have no idea what to do!!" Here we believe that the next worldwide experiment should be the Big Murphy's Law Test!
- On the other hand, Nice is recognized to be the warmest city in France during autumn and winter seasons. The Nice team had, however, never felt so cold compared to the night of the Big Bell Test due to an amazingly efficient air conditioning system!!
- The 1st of January 2017, the LPMC-Nice will be renamed "Institut de Physique de Nice" (Nice Institute of Physics), with the amazing acronym InΦnI, which is a palindrome :)) The members of the Nice team actually believe that, with the Big Bell Test, they are already on the good rails towards reaching InΦnI-ty!!
- As all physics teams, the Nice team members have internal private jokes. Following the very arrival date of Tom Lunghi in the team, a period during which nobody knew him really much, a recurrent joke came out, which is to ask the question : "Where is Tom Lunghi ?", even if he is in the same place as the others, and then the others answer: "Who ?" During the night of the Big Bell Test, at the very moment the university web-server failed, the same question was asked, this time in a pertinent manner: "Where is Tom?". The answer was then: "God, he is at home, sleeping!!". Another comment came subsequently: "Oh my Gosh, we are in the very s¨¨¨" then!!".

PRESS RELEASE

About ICFO

ICFO - The Institute of Photonic Sciences, member of The Barcelona Institute of Science and Technology, is a research center located in a specially designed, 14.000 m2-building situated in the Mediterranean Technology Park in the metropolitan area of Barcelona. It currently hosts 350 people, including re-search group leaders, post-doctoral researchers, PhD students, research engineers, and staff. ICFOnians are organized in 23 research groups working in 60 state-of-the-art research laboratories, equipped with the latest experimental facilities and supported by a range of cutting-edge facilities for nanofabrication, characterization, imaging and engineering.

The Severo Ochoa distinction awarded by the Ministry of Science and Innovation, as well as 13 ICREA Professorships, 18 European Research Council grants and 6 Fundació Cellex Barcelona Nest Fellow-ships, demonstrate the centre's dedication to research excellence, as does the institute's consistent appearance in top worldwide positions in international rankings. From an industrial standpoint, ICFO participates actively in the European Technological Platform Photonics21 and is also very proactive in fostering entrepreneurial activities and spin-off creation. The center participates in incubator activities and seeks to attract venture capital investment. ICFO hosts an active Corporate Liaison Program that aims at creating collaborations and links between industry and ICFO researchers. To date, ICFO has created 5 successful start-up companies.

Contact information

Morgan Mitchell
Quantum Information with Cold Atoms and Non-classical Light
morgan.mitchell@icfo.eu
+34 93 553 4017

Alina Hirschmann
Corporate Communications Unit at ICFO
alina.hirschmann@icfo.eu
+34 93 554 2246
+34 691 513 974
@ICFOnians
www.icfo.eu