

Large Bell test

Quantum research using laymen

By Oliver Morsch / 8.12.2016, 13:11

Albert Einstein did not want to accept the fact that quantum objects can be connected by a ha
Researchers have hired volunteers to finally disprove him.

Only a few ordinary citizens dare ultimately to understand the elusive quantum physics or even to contribute to their exploration. But that is exactly what 100,000 people have done on 30th November from around the world - from middle school students to retirees. A research project co-ordinated by the Instituto de Ciencias Fotónicas (ICFO) in Barcelona, where twelve scientific institutions participated worldwide, examined the quantum mechanics of the physicists, which has caused controversy since Albert Einstein's time.

Spooky distance

This "big-bell test" was concerned with the so-called entanglement, according to which a measurement on a quantum object, such as a light particle, directly affects the properties of another, far-away particle without the need to transmit information. For example, if a vertical direction of oscillation (polarization) is measured on one of two entangled light particles, then one can be certain that the other has a horizontal polarization at the same moment - even though, according to the laws of quantum physics, Has a defined polarization. The physical reality would therefore not be local because the influence is instantaneous.

Quantum Entanglement & Spooky Action a...



Albert Einstein did not believe in such a "haunting distance" and assumed that quantum physics itself was incomplete. In 1964, however, the Northern physicist John Bell developed a mathematical inequality, with which the question could finally be clarified experimentally. One had only to produce many interrelated particle pairs, to carry out measurements on both particles, and to calculate how strongly the results of the measurements were correlated. For example, in the above example, the results are more often "vertical-horizontal" than would be possible with a local description of reality, the non-local entanglement is proved - and Einstein was wrong with his skepticism.



Test of quantum theory without loophole

Definitive physics

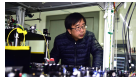
By Christian Speicher / 1.9.2015, 14:32

For more than thirty years, physicists have already performed such experiments, and [so far all of them have confirmed quantum physics](#) . However, until the very end, there was a "loophole", which had to be concluded for the final clarification of the question. For a "Bell test" to be watertight, each measurement must randomly decide in which direction the polarization is to be observed. To date, random generators based on the spontaneous decay of atomic states have been used. However, the question remained open as to whether there might be a connection between these states and those of the particles to be measured, which could falsify the tests. [A recent experiment, therefore](#), used the color of the light from distant stars to randomly establish the directions of observation. Another possibility is to use no physical system, but the free human will.

The human being as a random generator

Here, the "Bellsters" come into play, which last week helped the physicists to close the random loophole. They played various computer games on the Internet, in which atoms had to be caught by pressing the buttons 0 or 1 quickly. In this way the players generated a rapid succession of random numbers, which could be assumed to be "real" by chance, because they depended on human arbitrariness. In Barcelona, random numbers from all over the world converged and were distributed from there to the institutes on five continents, where entanglement experiments were carried out at the same time.

[In the laboratory of Andreas Wallraff](#) at the ETH Zurich, more than eight million tests of the Bell inequalities were made. According to the preliminary results, which still need to be evaluated, one can already say: Einstein was wrong. And the probability that the researchers of the «Big-Bell-Test» will be wrong in this respect is, according to Wallraff, smaller than winning the lottery jackpot 190 times in a row.



Teleportation

Quantum spook in the urban fiber optic network

By Christian J. Meier / 19.9.2016, 17:15

Teleportation is the art of "beaming" the state of a particle from one place to another without moving the particle.



Trickery with quanta

Entanglement of particles that have never coexisted

By Christian Speicher / 28.5.2013, 16:07

Even Albert Einstein had been disturbed by the fact that the entanglement of particles caused a haunting distance in space.

Einstein's split relationship with quantum theory

« . . Not the true Jacob. . . »

29.3.2005, 15:41

One of the contradictions of Albert Einstein is that he was both a pioneer and a keen critic of quantum theory.
