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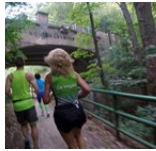
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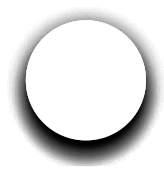
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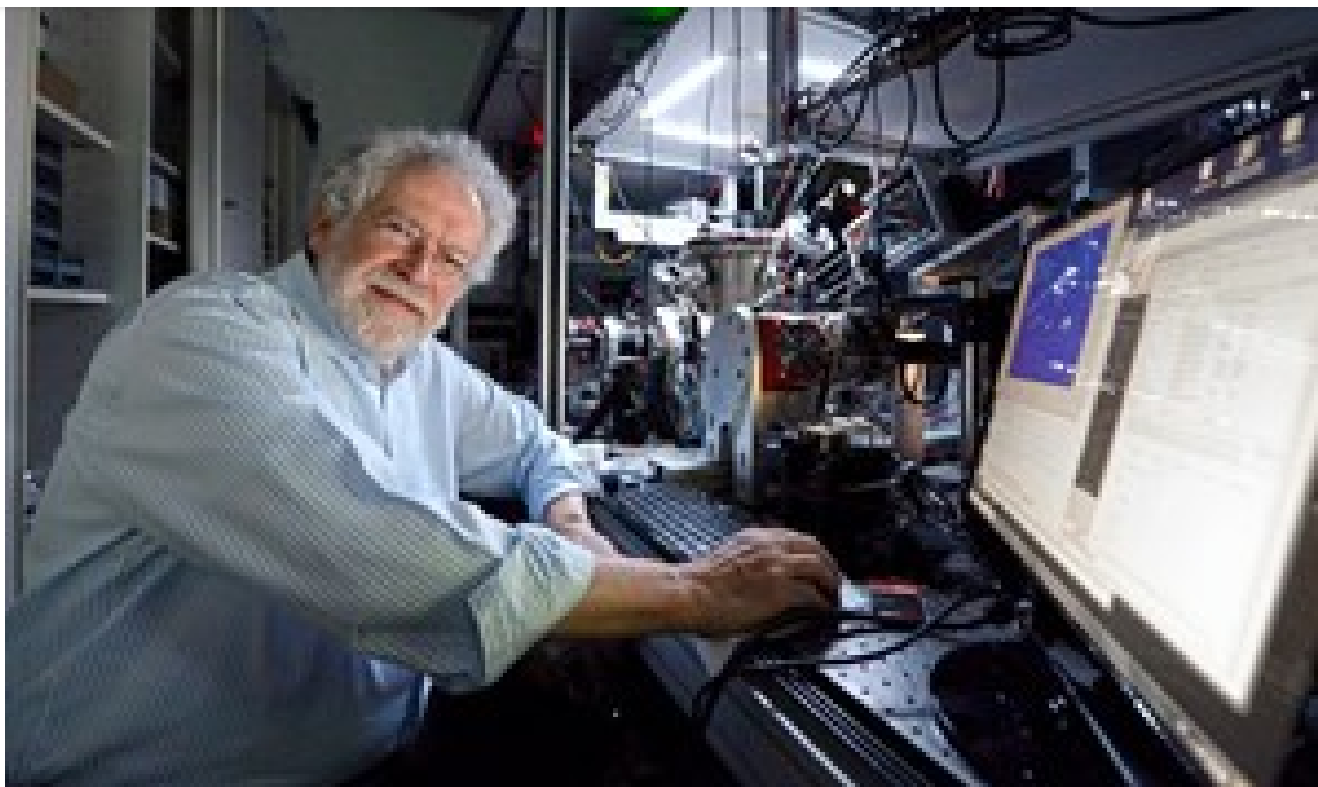
**COSMIC BELL TEST**

# Billions of years old quasar light confirms quantum entanglement

**Anton Zeilinger: Theoretically conceivable influencing of the measurement would have had to take place long before the formation of the earth**

August 21, 2018, 15:13      31 postings





Anton Zeilinger and his team conducted the "Cosmic Bell Test".

Photo: APA / HANS KLAUS TECHT

**V**ienna - Eight or twelve billion years ago, the light of two quasars on Earth was on the way, which researchers from Anton Zeilinger have now used to once again prove the validity of quantum mechanical phenomena. With such extremely distant sources, a distorting influence on the measurement results of quantum-physically entangled particles can practically be ruled out, the researchers report in the journal Physical Review Letters.

## background

Entangled particles can not physically be described as single particles with defined states, but only as a whole system. Even if they are very far away from each other, changes to a particle - such as a measurement - instantly affect the partner, even though no information is exchanged between the two particles. Because this can not be explained with classical physics, Albert Einstein considered the phenomenon extremely skeptical. Nevertheless, the effects of entanglement have already been demonstrated in countless experiments.

Theoretically, loopholes can be found, how the entanglement could be explained classically, that is, not by quantum physics - for example, through unknown influences. For example, the particles or the measuring devices could have been influenced before the experiment in order to achieve this result. This could affect the random number generators used in interlacing experiments, for example. They provide a random sequence of zeros and ones to unpredictably switch between two different measurement arrangements.



set the fair - so an influence would have had to happen 800 years ago.

### Extremely far away light sources

Now Zeilinger's team went one step further in cooperation with international colleagues. For their "Cosmic Bell Test" they caught the light of two quasars with two telescopes on the Canary Island of La Palma. These brightly glowing nuclei of active galaxies are located in two opposite directions in the universe about eight or twelve billion light-years from Earth. The color of the individual light particles, which was determined during the formation of the quasars and varies between red and blue, controls the measurement settings of previously generated entangled particles.

With the billion-year-old light of the two quasars, physicists wanted to make sure that the decision about how the entangled particles are measured is completely independent of the researchers and their environment. "The light from space, which is completely independent of humans, the earth and almost our entire past, is ideally suited for this," said first author Dominik Rauch of the Institute of Quantum Optics and Quantum Information of the Austrian Academy of Sciences and the University of Vienna.

It is the first time that billions of years of light has been used to demonstrate quantum entanglement. "The likelihood that there are hidden influences that provide an explanation of entanglement that is alternative to quantum mechanics is close to zero, and the choice of measurement setup would have had to be made long before the Earth came into existence," says Zeilinger. (APA, red, 21. 8. 2018)

### Abstract

[Physical Review Letters: "Cosmic Bell test using random measurement settings from high-redshift quasars"](#)

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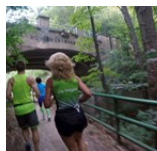
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