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Billions of years old light confirms quantum haunting

Arbitrarily widely spaced particles that are linked together: this strange phenomenon of quantum mechanics has been proven many times. In a new study but especially spectacular. Viennese physicists used billions of years old light.



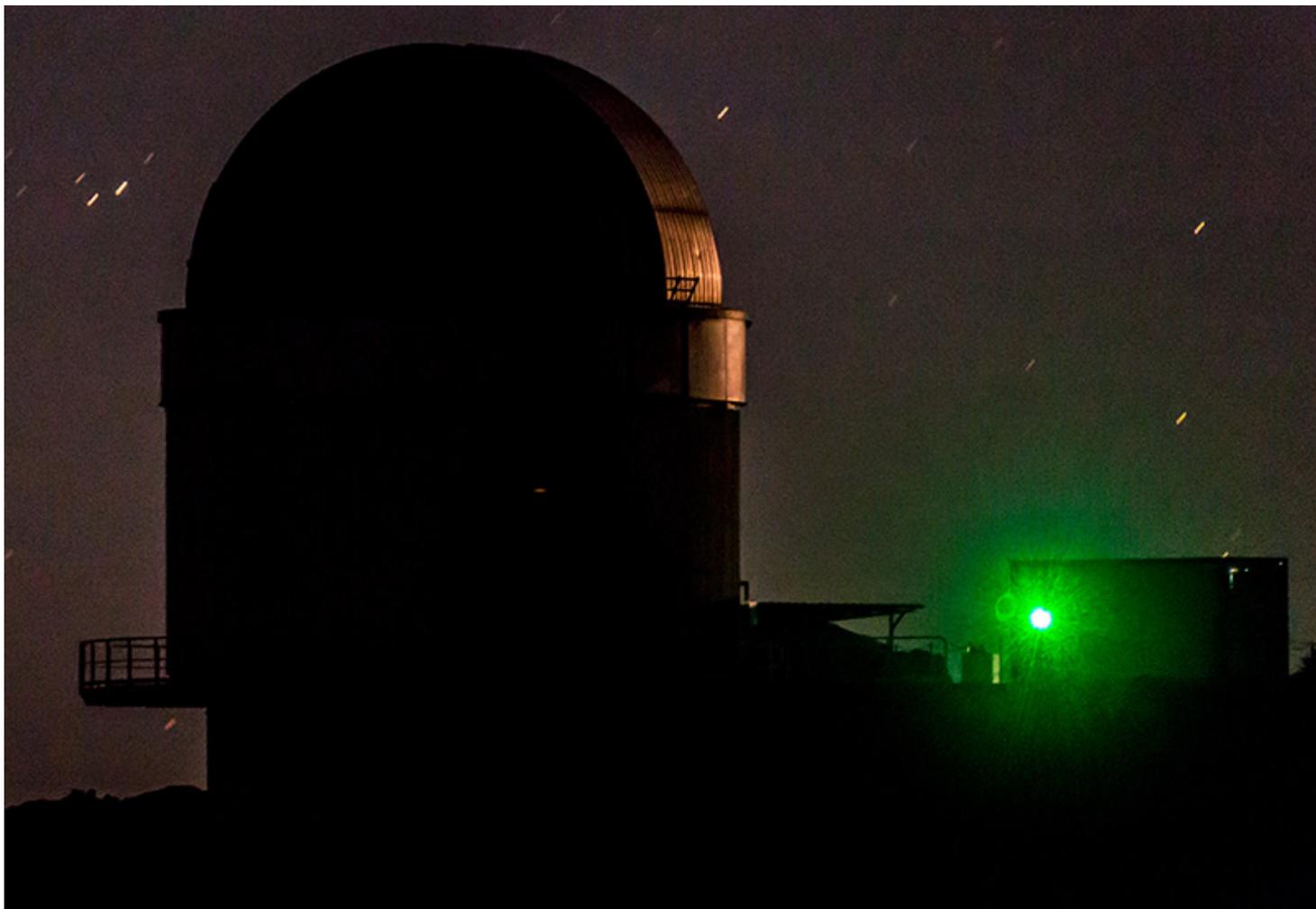
The "[ghostly long-distance effect](#)", as Albert Einstein called the phenomenon derogatory, could theoretically also be explained classically, that is, not by quantum physics - for example, through unknown influences.

For example, the interlinked particles or the measuring devices could already have been influenced before an experiment in order to achieve this result. This could affect the random number generators used in entanglement experiments. They provide a random sequence of zeros and ones to unpredictably switch between two different measurement arrangements.

Two opposite quasars

To close this "free-choice loophole," the physicists invented imaginative experiments. An international team of researchers invited more than 100,000 people worldwide [in a hands-on experiment to](#) enter a random sequence of zeros and ones that were used to tune their gauges. Last year, the Viennese physicists used light [from 600 light-years away stars](#) for the fair settings - so an influence would have had to take place already 600 years ago.

Now a team led by [Anton Zeilinger](#) , quantum physicist and president of the Austrian Academy of Sciences (ÖAW), went one step further in cooperation with international colleagues. With two telescopes on the Canary Island of La Palma they caught the light of two [quasars](#) , as they report [in the "Physical Review Letters"](#) .



Massimo Cecconi

William Herschel Telescope on 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.

No hidden influences possible

With the eight or twelve billion year old light of the two quasars, the physicists wanted to make sure that the decision on 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 for Quantum Optics and Quantum Information of the ÖAW and the University of Vienna in a press release.

It is the first time that billions of years of light has been used to demonstrate quantum entanglement. "The probability that there are hidden influences that provide an explanation of entanglement that is alternative to quantum mechanics is almost zero. The choice of the exhibition setting would have had to be made long before the formation of the earth for our experimental setup," said Zeilinger.

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Published on 21.08.2018

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