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Cosmic test for quantum theory

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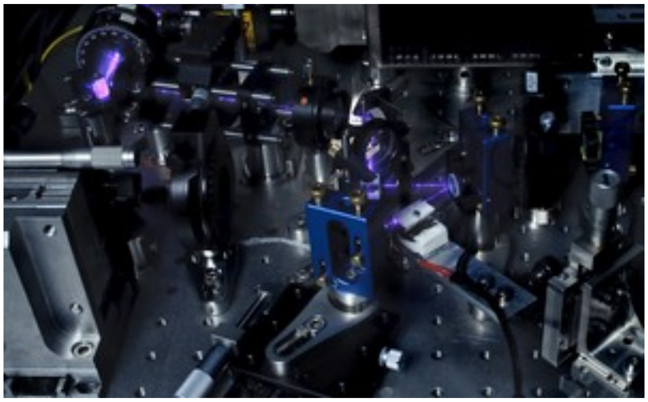

Cambridge (USA) - The light billions of light years distant quasars could provide information about how our world works in the field of elementary particles. American researchers suggest a test of the so-called entanglement, a fundamental phenomenon of quantum theory, before using the luminous objects at the edge of the visible universe. So could the evidence that reality "not local" is improved by 20 orders of magnitude, the scientists write in the journal "Physical Review Letters".

"The equations of quantum theory tell us that the world is weird and bizarre," said David Kaiser from the Massachusetts Institute of Technology in the U.S. Cambridge. "But before we believe this, we must close any conceivable logical loophole, even if we are not plausible." In quantum physics, are the properties of elementary particles - such as position, momentum, orientation of the intrinsic rotation ("spin") - not more clearly defined but only given by probabilities. Crazy and bizarre is that the properties of two particles can depend on each other, even if they are far apart, this "entanglement" lead to the measurement of the property of a particle affects the result of the measurement on the second particle.

This correlation between actually independent measurements is described by the Bell's inequality. "So far, every experimental test of this inequality has delivered results that are consistent with the predictions of quantum mechanics," said Kaiser and his colleagues - therefore, our world is not local. But there is a little-noticed logical loophole. The Bell's inequality assumes that the two measurements are independent, so the researchers at two particles are free to choose what they measure. However, it is logically conceivable, that there is a hidden effect, the linked decisions.

So far, physicists control experiments for Bell's inequality by quantum mechanical random generators. "Hidden variables could result in milliseconds before the experiment to a correlation of the random and so pretend that the predictions of quantum theory are met," note the emperor and his colleagues. Your solution: Instead of random number generators, they propose the use of the light from quasars, to decide on the type of measurement. Selects one of two quasars, which are on opposite sides of the sky, so these objects can never have influenced each other. An influence of the two measurements by hidden variables would thus be excluded for the entire history of the cosmos. The system proposed by Kaiser and his team experiment could soon be carried out: The famous quantum physicist Anton Zeilinger of the University of Vienna prepares appropriate measurements los Muchachos Observatory at the Roque de, on the Canary island of La Palma before.

Source: University of Vienna / Jacqueline Godany

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- **"Testing Bell's Inequality with Cosmic photon: Closing the Loophole Setting Independence," Jason Gallicchio, Andrew S. Friedman and David I. Kaiser; Physical Review Letters (in press)**

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