Quantum Physics Gets "Spooky"

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By Phil Berardelli
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This might be a rare case about which Einstein was wrong. More than 60 years ago, the great physicist scoffed at the idea that anything could travel faster than light, even though quantum mechanics had suggested such a condition. Now four Swiss researchers have brought the possibility closer to reality. Testing a concept called "spooky action at a distance"−−a phrase used by Einstein in criticizing the phenomenon−−they have shown that two subatomic particles can communicate nearly instantaneously, even if they are separated by cosmic distances.
Alice's Wonderland had nothing on quantum physics, which describes a bizarre state of matter and energy. Not only can the same atom exist in two locations at once, but merely attempting to observe a particle will alter its properties. Perhaps least intuitive is the characteristic called entanglement. As described by quantum mechanics, it means that two entangled particles can keep tabs on each other no matter how far apart they are. Physicists have been trying for decades to determine whether this property is real and what might cause it. In the process, they've uncovered evidence for it but not much about its properties.

Physicist Nicolas Gisin and colleagues at the University of Geneva in Switzerland split off pairs of quantum−entangled photons and sent them from the university's campus through two fiber−optic cables to two Swiss villages located 18 kilometers apart. Thinking of the photons like traffic lights, each passed through specially designed detectors that determined what "color" they were when entering the cable and what color they appeared to be when they reached the terminus. The experiments revealed two things: First, the physical properties of the photons changed identically during their journey, just as predicted by quantum theory−−when one turned "red," so did the other. Second, there was no detectable time difference between when those changes occurred in the photons, as though an imaginary traffic controller had signaled them both.

The result, the team reports in tomorrow's issue of Nature, is that whatever was affecting the photons seems to have happened nearly instantaneously and that according to their calculations, the phenomenon influencing the particles had to be traveling at least 10,000 times faster than light. Given Einstein's standard speed limit on light traveling within conventional spacetime, the experiments show that entanglement might be controlled