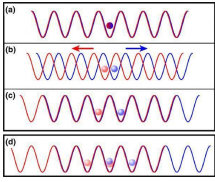


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By: Tudor Vieru, Science Editor



A single cesium atom is trapped in a grid of light. The atom has two states, red and blue
Image courtesy of University of Bonn

Cesium Experiment Demonstrates Quantum Superposition

University of Bonn experts are behind the study

Quantum physics is a remarkable field of research for new ideas and technologies that could benefit mankind, as soon as you learn how to get over the fact that just about everything in it doesn't make sense. Particles exist in two states at the same time, and they can communicate with each other over incredibly long distances, such as from one galaxy to the other. And this communication is instantaneous, which means that data between subatomic particles travels faster than the speed of light. In an attempt to make sense of some parts of quantum physics, researchers at the University of Bonn have recently managed to demonstrate superposition in cesium atoms.

This principle basically states that, if you flip a coin, one of two outcomes does not necessarily emerge. Rather, the coin can remain in "win" or "lose," "1" or "0," and "on" or "off" states at the same time, but it is forced to establish itself on just one of these when an observer looks at it. That is to say, while we have our back at the world, everything behind us could easily look a lot unlike everything we know. This principle is also the main ground on which quantum computers are to be built, which explains exactly why creating one is so hard.

In the recent experiments, the German researchers used optical tweezers, made of lasers, to keep a cesium atom (the coin) in a fixed position, and then maneuvered the lasers in a way that resembled the tossing of the coin - as in moving the atom a little to the right in case of "heads," and a little to the left, in case the coin showed "tails." If a normal person were to make about 1,000 coin tosses, and move left or right depending on the result, chances are that, by the end of the tossing streak, they would not have traveled far to the left or to the right of their original position. This is generally called a random walk.

The quantum walk, however, is completely another story. In the study, the laser beams were used to simulate superposition, and pulled the cesium atoms in both directions at the same time, so as to illustrate the changing nature of its position. "This way we were able to move both states apart by fractions of a thousandth of a millimeter," Bonn Institute of Applied Physics expert Dr. Artur Widera said, quoted by [ScienceDaily](#).

"Our curve is clearly different from the results obtained in classical random walks. It does not have its maximum at the centre, but at the edges. This is exactly what we expect from theoretical considerations and what makes the quantum walk so attractive for applications," Michal Karski, one of the other researchers involved in the new study, added.