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Quantum discovery could mean faster computer chips

By Richard Stenger
CNN.com Writer

(CNN) -- Using modern quantum physics, scientists have determined that mysterious light particles could behave in a manner that smashes conventional roadblocks in the way of creating much more powerful computer parts.

Pairs of so-called entangled photons possess esoteric characteristics that could allow manufacturers to produce far superior computer chips than current technology allows, said a team of international researchers.

"This research potentially could enable us to continue upgrading computers even after traditional manufacturing procedures have been exhausted," said Johathan Dowling, a physicist at NASA's Jet Propulsion Laboratory, in a statement.

Dowling and colleagues from JPL and the University of Wales in the U.K. published a paper on their findings Tuesday in the journal Physical Review Letters.

Technicians use streams of laser light particles to sculpt transistor components on computer chips. The smaller the transistors, the



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components on computer chips. The smaller the transistors, the more they can be squeezed on a chip and the faster the chip operates.

The most modern chips have transistors as small as 180 nanometers, more than 400 times narrower than the width of a human hair.

But chip manufacturers should not be able to produce features smaller than 124 nanometers, according to a main principal of optics known as Rayleigh criterion.

Theoretically, entangled light particles would bypass the physical constraint and work twice as efficiently as conventional laser beams and produce transistors as small as 64 nanometers.

A pair of entangled photons would travel together and behave as a single unit when aimed at two possible paths. While scientists could not determine which path they take, in quantum mechanics each photon would actually travel down both.

The strange effect would give the photons the ability to cut down the size of computer chips, the scientists said.

"Entanglement has been known of before and shown experimentally with light. But it hasn't been shown before that it might be applied the manufacture of computer chips," said Barbara Wilson, chief technologist at JPL in Pasadena, California.

Quantum mechanics deal with the nature of atomic and subatomic particles or wave forces, which often exhibit bizarre behavior that conventional physics cannot explain.

For example, quantum scientists theorize that intermingling photons can influence each other despite being separated by half the galaxy, a process that Albert Einstein called "spooky action at a distance."

Quantum mechanics could eventually be used in many computer applications, including clock synchronization and the making and breaking of complex codes. But scientists still need plenty of time to conduct laboratory experiments, Wilson cautioned.

"We've just scratched the surface of quantum effects," she said.

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