Scientists create stationary laser light

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ANN ARBOR, Mich., March 3 (UPI) -- Scientists in Michigan have found a way to suspend light -- have it remain still inside a microscopic hall of mirrors -- a development that may one day lead to new types of batteries and better fluorescent light bulbs.

The researchers said their "random laser" technique may be used for an energy battery based on stored light, as well as for innovative microchip laser etching techniques and fluorescent light bulbs that can be as bright as the user wishes.

"The light doesn't even rattle around -- it literally doesn't go anywhere," said applied physicist Stephen Rand of the University of Michigan at Ann Arbor. "The properties of light that I'm describing are new to physics."

The scientists created halls of mirrors made of electrically insulating alumina powders laced with rare earth metals such as neodymium, praseodymium and cerium. The powder particles are only 20 to 30 nanometers -- or billionths of a meter -- wide, about 5,000 times thinner than a human hair.

When a low-energy electron beam excites the powders, they emit laser light in the visible and ultraviolet ranges. These "random lasers," unlike normal lasers, scatter their light randomly much as light bulbs do.

"We've chosen what on the face of it ought to be the world's worst laser medium -- a reflective powder that's difficult to energize -- and we've managed to get continuous ultraviolet laser activity for the first time," Rand told United Press International. "People have been trying to operate an ultraviolet laser continuously for decades."

The laser light is confined between the reflective, tightly packed dust in spaces smaller than the wavelengths of light itself. Light, which travels at over a billion kilometers per hour and is the fastest thing in the universe, simply sits confined at a point in space.

"It's light that has no velocity, which is kind of amusing," said researcher Richard Laine, a materials scientist at the University of Michigan.

Unlike similar experiments at Harvard University and the Massachusetts Institute of Technology in Cambridge, that slowed and then stopped light using far more complicated technology at temperatures hundreds of degrees below zero, the investigators at Michigan created light that was stationary from the outset at room temperature.

The research team detected this stationary light because it leaks out to a certain extent if the layer of powder is thin enough. The laser light generated is completely incoherent -- its rays do not lock together -- unlike light from every other laser known. The scientists take this incoherent radiation as evidence for stationary light.

Rand and Laine said possible applications in the short term include new fluorescent light bulbs that, unlike similar bulbs, have no limit to brightness. They also foresee using large, ultraviolet laser-emitting sheets to print microchips with improved circuit density -- random lasers produce light that is uniform over space, unlike normal lasers that have dark speckles in their output.

The scientists also are inspecting how long they can store light deep in the powder. Currently, it remains confined for only very short times.

"At the moment we don't know how to calculate how long it can last," Rand said. "It will eventually be absorbed by the surrounding medium, but for an extended period of time, it literally doesn't go anywhere. It could have some interesting implications for a new type of energy storage."

"I find the work extremely interesting and I hope there's a lot of follow-up on it," said random laser expert Azriel Genack of Queens College in New York, who is working on stopping microwaves. "There are so many open questions."

The researchers published their findings in the scientific journal Physical Review A.

(Reported by Charles Choi in New York.)