BBC NEWS

Scientists freeze beam of light

By Paul Rincon
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Physicists say they have brought light to a complete halt for a fraction of a second and then sent it on its way.

Harvard University staff held a light pulse still without taking away all of its energy, the journal Nature reports.

Controlling the movement of light particles - so-called photons - to store and process data could lead to the development of quantum computers.

In a 2001 experiment, light pulses were briefly stored when particles of light were taken up by atoms in a gas.

The Harvard experiment tops that achievement by holding light and its energy at a standstill.

Light speed

Light normally travels at about 299,000 kilometres per second (186,000 miles per second), but it slows down when passing through some materials, such as glass.

The team fired a light beam called a signal pulse through a sealed glass cylinder containing a hot gas containing atoms of the element rubidium, illuminated by a strong ray of light known as a control beam.

While the pulse was travelling through the rubidium gas, the researchers switched off the control beam, creating a holographic imprint of the signal pulse on the rubidium atoms.

Earlier experimental methods had then switched on a single control beam to recreate the signal pulse, which then continued on its way.

On the pulse

However, in this latest study, researchers switched on two control beams which created an interference pattern that behaves like a stack of mirrors.

As the regenerated signal pulse tries to continue on its way through the glass cylinder, the photons bounce back and forth, but the overall signal pulse remains stationary. The light beam was essentially frozen.

The researchers were able to keep the photons trapped like this for about 10-20 microseconds.

The research was conducted by Mikhail Lukin, Michal Bajcsy and Alexander Zibrov of the department of physics at Harvard University, Cambridge, US.

Quantum Leap

Mr Bajcsy said that a distant application of controlling light would be in powerful quantum computers.

"In [quantum computers] you would have to transfer the information from photon to photon to photon. And in order to do that you have to make the photons interact with each other such that you control it very precisely," he told BBC News Online.

Professor M. Suhail Zubairy, a physicist at Texas A&M University, said the Harvard team's achievement was a significant step forward in the emerging area of quantum computing and quantum cryptography.

Quantum cryptography might provide very secure forms of electronic encryption, because the process of eavesdropping on an electronic message would introduce errors in the message, garbling it.

"This would allow you to exchange a key on a public channel, but whereas any classical system can be broken by an eavesdropper, in quantum cryptography you would always find out if someone was looking at your message," Professor Zubairy told BBC News Online.