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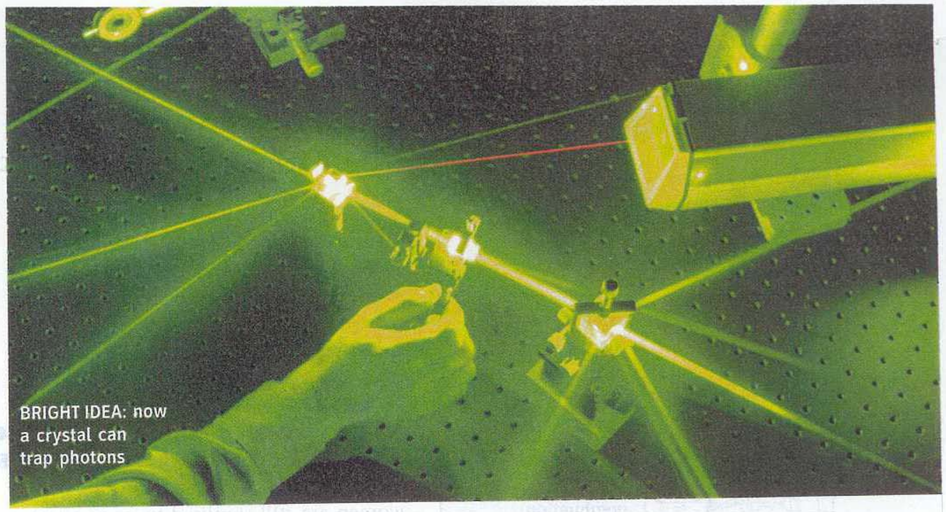
Catch the light

It just got easier to hold a light beam in your hand



BRIGHT IDEA: now a crystal can trap photons

A SOLID that can store quantum information by stopping light dead in its tracks has brought the possibility of a practical quantum computer a step closer.

Most experiments in quantum computing involve storing information in the quantum state of an atom. Such states are easily disturbed, leading to a loss of information. So stabilising quantum particles is a key step on the road to building a practical quantum computer.

Last year, two American teams looked set to solve this problem when they slowed, and eventually froze, a light beam in an atomic gas, thereby storing its information stably among trillions of atoms (*New Scientist*, 27 January 2001, p 4). But computer memories made of a gas would be too unwieldy to use.

Now Phil Hemmer of the US Air Force Research Laboratory at Hanscom, Massachusetts, and his colleagues at MIT, have done the same in a solid. "This is much closer to a device because you can manufacture a crystal," says Alexey Turukhin at MIT.

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Hemmer and Turukhin used a background lattice of yttrium silicate doped with ions of the metal praseodymium. Using a laser beam—called the coupling beam—they tuned the praseodymium ions to put their electrons into a "dark" state. In this state they were unable to jump to higher energy levels and so could not absorb light of a particular wavelength. They then sent a second beam of that wavelength into the solid.

With the energy level jumps blocked, the second beam changes the orientation of the praseodymium electrons' spin—losing energy and slowing down in the process. As the coupling beam is faded out, the secondary beam slows more and more, until eventually it comes to a complete halt, with its information frozen in the spin states of the electrons. When the coupling beam is turned back up, the second light beam springs back to life.

Ron Walsworth, who helped pioneer the approach at the Harvard-Smithsonian Center for Astrophysics, warns that Hemmer's crystal isn't quite ready to be plugged into a quantum computer. "It is a solid, but it's not your average piece of gallium arsenide that we already know how to make devices out of," he says. **Eugenie Samuel**, Boston

Note Added: Dr. Turukhin was a post doc at MIT under the group led by Dr. Shahriar. The work reported was refers to the following article: "Observation of Ultraslow and Stored Light Pulses in a Solid," A. V. Turukhin, V.S. Sudarshanam, M.S. Shahriar, J.A. Musser, B.S. Ham, and P.R. Hemmer, *Phys. Rev. Lett.* **88**, 023602 (2002).