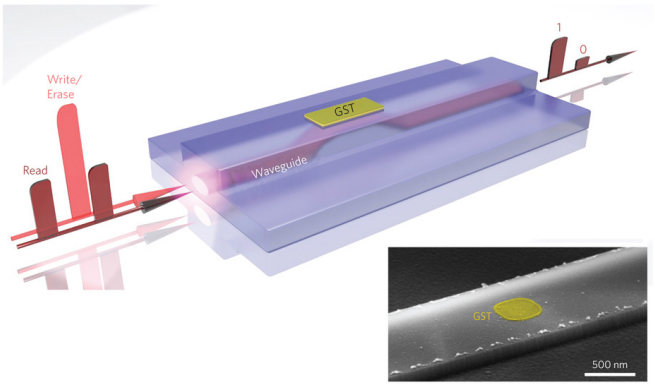
Written by Marco Attard
30 September 2015

Researchers at the Karlsruhe Institute of Technology (KIT) and the universities of Münster, Oxford, and Exeter develop the the first all-optical permanent on-chip memory-- a light-based storage technology and an "important step" in the creation of photon-based computers.



According to the researchers electronic data exchange between processors and memory limits the speed of modern computers. This is due to the electrons running through the metal wires making the logic circuits inside computer chips bumping into each other, slowing down and generating heat. Optical technology does not have such problems, as photons (the particle making light) travel well together at, well, light speed.

However such technology has serious drawbacks. Photon-based memory circuits need a steady supply of power in order to store data, and all data is lost if the power is switched off.

To overcome such issues the researchers looked at a familiar light-based storage medium-- the CD. Rewritable CDs and DVDs are made of $Ge_2Sb_2Te_5$ (aka GST), an alloy combining germanium, tellurium and antimony. GST changes its atomic structure from ordered crystalline lattice to "amorphous" jumble when hit with an intense laser pulse, and the difference between the two forms creates the the means CD and DVD drives read data off a disk.

For the optical permanent on-chip memory the researcher built a "waveguide" silicon nitride device to contain and channel pulses of lights on top of a nanoscale GST patch. To write data one channels an intense pulse of light into the waveguide, turning the GST amorphous. A second, less intense pulse turns the GST back into the original crystalline lattice, making it rewritable.

Reading the data involves measuring the light transmitted through the waveguide with weak light pulse. The technology can store data in 8 different combinations (not binary 1s and 0s), creating a dense means of storage.

Photonic memory is, of course, still at the very early stage-- but the prototype is already on par with its electronic counterparts for speed and power consumption, and as such it is a promising technology once paired with photonic logic chips.

Go Permanent Data Storage With Light