• physics@nature.com
content
• collections
• highlights
• looking back

First silicon laser pulses with life

Mark Peplow

Key component in optical computing unveiled.

It may be small, but it could be very influential. Scientists have created the world's first laser made from silicon. This is an important step in the effort to build computers that process information using light, rather than electricity.

Silicon lasers bring us closer to chips that can process light.

© Getty

Although much of the data in the world is now carried by light along optical fibres, the information processing and handling is usually still done after converting the signals into electrical currents, which are easier to manipulate. This conversion slows the whole process down, and also requires extra components, raising the cost of the circuitry.

So scientists have been striving to make devices that can process light directly. Silicon is preferable because it can be mass-produced using conventional chip-making techniques. Unfortunately, it is also very poor at controlling light. Conversely, materials such as gallium arsenide, which are great at dealing with light, are very difficult to make into chips.

"There have been many attempts, but no-one has been able to get silicon to lase before now," says Bahram Jalali, an electrical engineer at the University of California, Los Angeles. Jalali and his UCLA colleague, Ozdal Boyraz, have published their research online in the latest edition of Optics Express.

Making a silicon laser is widely regarded as one of the main hurdles that need to be overcome before optical computing can become a reality, says Leigh Canham, of pSiMedica, a company based in Malvern, UK, that researches the clinical applications of silicon nanocrystals.

"A few years ago people thought that any form of lasing in silicon was impossible," says Canham, who was the first to show that silicon nanocrystals could emit visible light, when he worked for the technology company QinetiQ, based in Farnborough, UK. "This work is an important proof of principle. I believe it does bring us closer to optical computing."

Dynamite with a laser beam

Lasers are useful for carrying out optical calculations because all the packets of light they produce have the same wavelength, and are precisely marshalled to maximize the amount of energy they deliver in a tight beam.

To make a good laser, you need a material that can take an energy input and turn it into light energy in a regular rhythm. But silicon has always been problematic because it loses much of this energy as vibrations within its atomic lattice. Jalali and Boyraz's breakthrough makes a virtue of this, using the vibrations themselves to generate laser light. "Our approach uses the natural atomic vibrations of silicon to create or amplify light," says Jalali.

But it will be a few years yet before laser beams are whizzing about inside your desktop computer . Rather than turning electricity directly into light, Jalali's silicon laser is powered by another laser. It's a common method of investigating new laser materials, but the jump to electricity will definitely have to be made before the silicon laser can be used in an optical computer, says Jalali. They also need to develop the laser into a self-contained component that can be incorporated on to a silicon chip.

References

1. Boyraz O. & Jalali B. *Opt. Express*, **12**. 5269 - 5273 (2004).

< previous article | all this week's articles | next article >