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Nanolaser May Lead to New Breakthroughs

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UC Berkeley scientists have unveiled the world's smallest laser, made from lab-grown tubes thousands of times thinner than a human hair and packing more than 100 times more information than conventional lasers.

The invention has enormous implications for the computing industry, as the smaller high-energy lasers could lead to the development of smaller, cheaper and faster technology.

A team of scientists from the university's Lawrence Berkeley National Laboratory developed the new technology that could lead to compact discs with a memory capacity of hundreds, if not thousands, of times more information, said Samuel Mao, one of the scientists specializing in lasers who worked on the invention.

"In general, it is indeed the smallest laser," Mao said.

The new laser uses ultraviolet light—the same energy that can cause sunburns—and packs hundreds of times more energy and information than can conventional lasers, which are infrared.

The nanolasers can also be used to detect possible signals of tumors and cancers with more precision, in a miniaturized sensor called "lab on a chip," Mao said.

The scientists' invention is the first time a laser has been observed from a wire only nanometers thick.

"It's not very expensive," said Peidong Yang, who is the lead scientist on the invention, which was announced in last Friday's edition of Science magazine.

The team's major achievement was growing a "nanowire" in a laboratory, which is about 100,000 times smaller than one-hundredth of an inch, and using it as the tube for the laser.

"That's never been done before in a nanowire, which is a very unique building block for nanotechnology," Yang said.

Much like the way the first computer scientists experimented with the idea of making the transistor 50 years ago, this trend toward nanotechnology is another step toward making even smaller and faster computing devices.

Richard Russo, a co-author of the study who works in the Advanced Laser Technologies Division, said he hopes the lab's nanolaser will have the same impact on computing technology that the transistor had on modern electronics.

The electronically based transistor led to the microchip, which paved the way for modern appliances, such as cellular phones, garage door openers and microwave ovens. Russo hopes that the nanolaser too will be a forerunner for new technologies.

"I don't know if the nanolaser will be that revolutionary, but with something that small, it'll make

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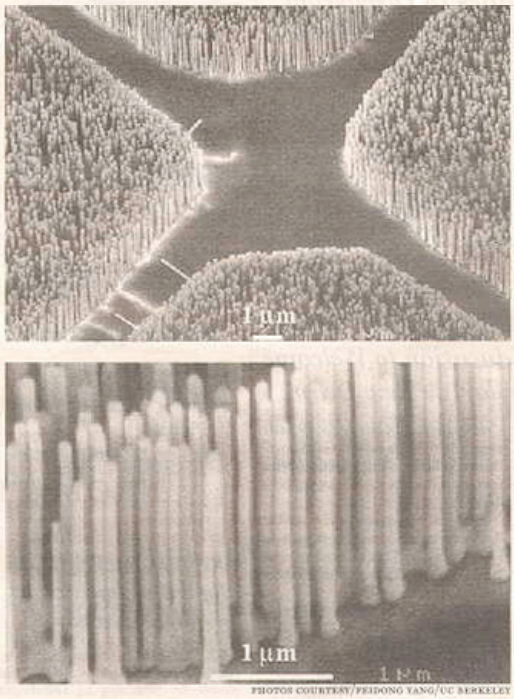

PHOTOS COURTESY/PEIDONG YANG/UC BERKELEY

ARRAYS OF NANOWIRE NANOLASERS *grown on a sapphire substrate can be seen with the help of a scanning electron microscope.*

New Technology Faster, Smaller

LASER, *from front*

people think of the applications," Russo said.

When the laser was invented in 1960, no one understood its potential applications, Russo noted. Since then, lasers have been utilized in many applications, from reading and creating CDs to performing delicate surgical procedures.

It is difficult, however, to predict the vast consequences that new inventions like the nanolaser could bring. In a highly infamous prediction, scientists in 1949 estimated that the computers of the future would—at best—weigh only 3,000 pounds, Mao said.

The nanolaser could also potentially affect the development of "photonics," a technology which uses light to transmit information, rather than the slower and more conventional electronics used in today's devices. Similar to the way fiber optics work, photonic-based transistors would be much faster than current electronic-based ones.

"I don't want to say it's as significant as the invention of a transistor, but when you have something that's functional at (the nanolevel), it opens up a lot of applications, including photonics," Russo said.

For instance, the nanolaser could become the highly refined light source needed in photonic-based transistors, Mao said.

The team's scientists said they will next focus on being able to tune the nanolaser and determine its efficiency.

Investigations into nanotechnology—or the science of objects one-billionth the size of a meter—have become more prominent in the past decade. Japanese scientists were first able to create a tube on the nanolevel in 1991, and a Dutch team made transistors based on nanotubes three years ago. The U.S. government has since launched the National Nanotechnology Initiative, investing upward of $45 million in research.

"In all materials, the foundation (lies) at the nanoscale level," Mao said. "If we can control the fundamental processes at that scale, roughly speaking, nanotechnology could impact technology of every man-made object."