Tiny laser gives big boost to high speed data transmission

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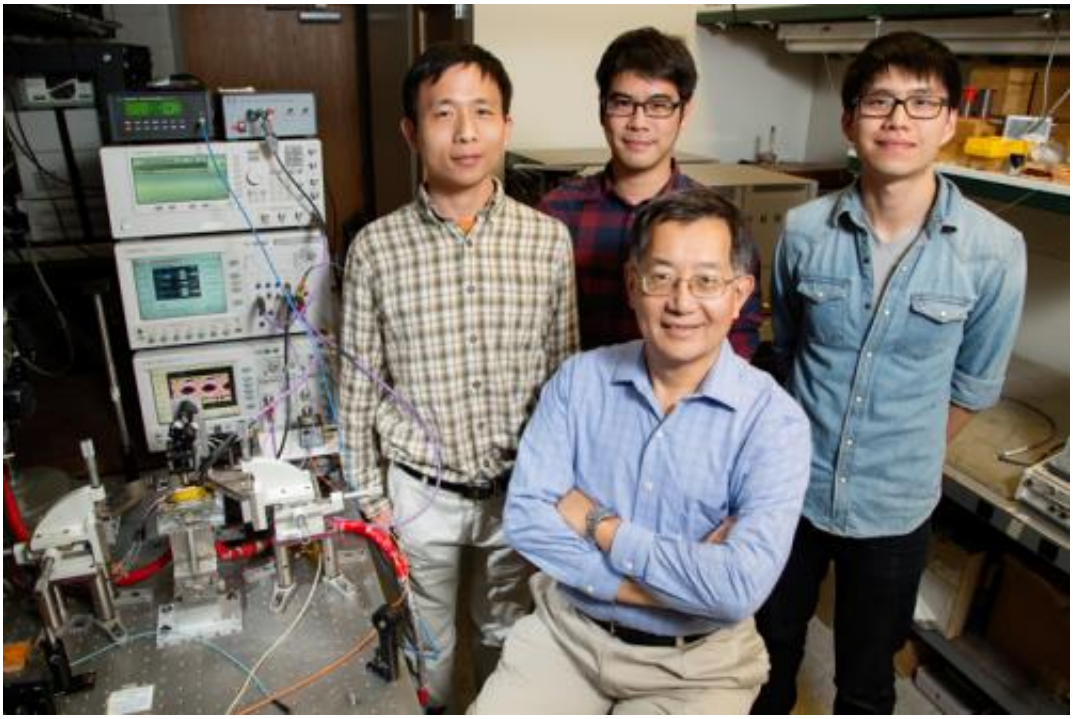

University of Illinois engineers – from left, postdoctoral researcher Fei Tan, graduate students Mong-Kai Wu and Michael Liu, led by Milton Feng, front – developed a laser that can transmit data at a blazing fast 40 gigabits per second, without errors – the fastest in the U.S. Credit: L. Brian Stauffer

(Phys.org) —High-speed communication just got a turbo boost, thanks to a new laser technology developed at the University of Illinois that transmits error-free data over fiber optic networks at a blazing fast 40 gigabits per second – the fastest in the United States.

Milton Feng, the Nick Holonyak Jr. Chair in Electrical and Computer Engineering, demonstrated the tiny, fast device along with postdoctoral researcher Fei Tan, graduate students Mong-Kai Wu and Michael Liu, and Holonyak, who is an emeritus professor. The team published its results in the journal *IEEE Photonics Technology Letters*.

As computation shifts into the petascale and beyond, processor speeds have outstripped transfer speeds, creating a bottleneck and hindering applications. Anyone who has tried to stream video over a dial-up Internet connection knows that the fastest processor won't help the file load quicker. And in the age of "big data" and cloud computing, there's a lot of information swirling among servers.

Laser devices called oxide VCSELs are used to transmit data over fiber optic cables at high speed. They can carry data faster and in greater quantities than traditional electrical cables.

"The oxide VCSEL is the standard right now for industry," Feng said. "Today, all the optical interconnects use this technology. The world is in a competition on how to make it fast and efficient, and that's what this technology is. At the U. of I., we were able to make this technology the fastest in the U.S."

How fast is it? As a comparison, home high-speed Internet connections can reach speeds of about 100 megabits per second. At 40 gigabits per second, this technology is 400 times faster. Thanks to its small size, the new oxide VCSEL also has excellent energy efficiency – using 100 times less energy than electrical wires – and transmits data very accurately, with no defects detected in an hour of operation.

Fast and accurate data transfer is crucial for personalized medicine, cloud computing and many other applications. For example, in order to harness the power of supercomputing for personalized medicine, an

enormous amount of biometric data must be collected from a patient. But the data on their own are not useful without analysis. The data have to be sent from the lab to a computing facility, where they're analyzed and sent to the patient's physician to help make a diagnosis or a tailored treatment plan.

"Information is not useful if you cannot transmit it," Feng said. "If you cannot transfer data, you just generate garbage. So the transfer technology is very important. High-speed data transfer will allow tele-computation, tele-medicine, tele-instruction. It all depends on how fast you can transfer the information."

The Illinois team's oxide VCSELs operate at room temperature, so the next step is to finesse the design so they can operate in the very hot environment at data centers.

Feng believes that researchers could push oxide VCSELs to about 60 gigabits per second, but not far beyond that because of the inherent limitations in the materials. But he's not worried about reaching the limits of VCSEL technology, because in 2004 he and Holonyak developed a new technology ready to step in where VCSEL leaves off: the transistor laser.

More information: The paper, "850nm Oxide-Confined VCSEL With low Relative Intensity Noise and 40Gb/s Error Free Data Transmission," is available online: ieeexplore.ieee.org/xpl/articl … jsp?arnumber=6589110

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