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[Computer Science] Taiwan Researchers Unveils New Semiconductor Laser Device

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Taipei Times (2012/07/30) A research team, mainly formed of professors and students from National Tsing Hua University, yesterday introduced the latest breakthrough into research on the smallest plasmonic nanolaser ever developed, which can theoretically transmit 1,000 times faster than the present series of semiconductor lasers. The discovery was published in the week's edition of Science, one of the world's most prestigious science journals.

The team consists of 15 researchers and doctoral students, eight of whom are from National Tsing Hua University with their research being funded by the National Science Council. The others are from the US and China.

Felix GWO (果尚志), a professor at the university's department of physics, said worldwide research and development into semiconductor lasers began about 50 years ago, however, efforts to improve transmission speeds have hit a bottleneck in which its size cannot be reduced any further, due to the physical limitations of the Abbe Diffraction Limit.

"Data transmitted through fiber-optic communication can be very fast, but when it reaches the computer and is processed in the central processing unit [CPU], the computing is still reliant on electrons [which limits the transmission speed]," GWO said.

"So if we can reduce the size of optical components and make them into optical chips, the speed can be increased to about 1,000 times of current electronic chips," he added.

The team's success in going beyond the physical limitations was achieved by forming plasmonic nanolasers to overcome size limits.

However, a challenge with current plasmonic devices is that parts of the transmission mechanism gets lost as a result of the scattering which takes place within a transmission medium or from the roughness of a reflective surface.

The team's main breakthrough lies in the association of two materials — a single InGaN/GaN core-shell nanorod on an SiO2-covered epitaxial Ag film, Yu-Jung LU (呂宥蓉), the lead author of the research paper and a doctoral student at the university's physics department said, adding that "one plus one equals much much bigger than two, we were lucky to accomplish the breakthrough by adding up the long-term research results from two teams."

However, he said it will still take several years of research and experimentation before the new technology can be applied to commercial products.

Chih-kang SHIH (施至剛), professor of physics at the University of Texas at Austin, said the team's discovery is not limited to applications in the semiconductor industry, but can also contribute to other fields of science, such as improving optical microscopes used in the field of biomaterials.

Reference:
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