Better lasers for optical communications

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A new laser procedure could boost optical fiber communications. This technique could become essential for the future expansion of the Internet. It also opens up new frontiers in basic research.

Long-distance, high speed communications depend on lasers. But when information is transmitted down fiber optic cables, it's critical that the signal be clear enough to be decoded at the other end. Two factors are important in this respect: the color of the light, otherwise known as the wavelength, and the orientation of the light wave, known as polarization. A team from EPFL and the Swiss Federal Laboratories for Materials Science and Technology (EMPA) has developed a technique that improves control over these two parameters.

"All indications are that this technology could be useful at both industrial and scientific levels," explains Eli Kapon, head of EPFL's Laboratory of Physics of Nanostructures. More than fifteen years of research were required to arrive at this result, work that "has caused many headaches and demanded significant investment."

To obtain the right wavelength, the EPFL researchers adapted the lasers' size. In parallel, the EMPA scientists designed a nanometer-scale grating for the emitter in order to control the light's polarization. They were able to achieve this feat by vaporizing long molecules containing gold atoms with a straw-like tool operating above the lasers. Using an electron microscope, they were able to arrange and attach gold particles to the surface of each laser with extreme precision. Thus deposited, the grating serves as a filter for polarizing the light, much like the lenses of

sunglasses are used to polarize sunlight.

Industrial and scientific advantages

This technique, developed in collaboration with EMPA, has many advantages. It allows a high-speed throughput of several gigabits a second with reduced transmission errors. The lasers involved are energy-efficient, consuming up to ten times less than their traditional counterparts, thanks to their small size. The technique is very precise and efficient, due to the use of the electron microscope.

"This progress is very satisfying," adds Kapon, who also outlines some possible applications. "These kinds of lasers are also useful for studying and detecting gases using spectroscopic methods. We will thus make gains in precision by improving detector sensitivity."

More information: Ivo Utke, Martin G. Jenke, Christian Röling, Peter H. Thiesen, Vladimir Iakovlev, Alexei Sirbu, Alexandru Mereuta, Andrei Caliman and Eli Kapon, Polarisation stabilisation of vertical cavity surface emitting lasers by minimally invasive focused electron beam triggered chemistry, *Nanoscale*, 2011. pubs.rsc.org/en/content/articl … g/2011/nr/c1nr10047e

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