For the first time, researchers focus plasmons into nanojet

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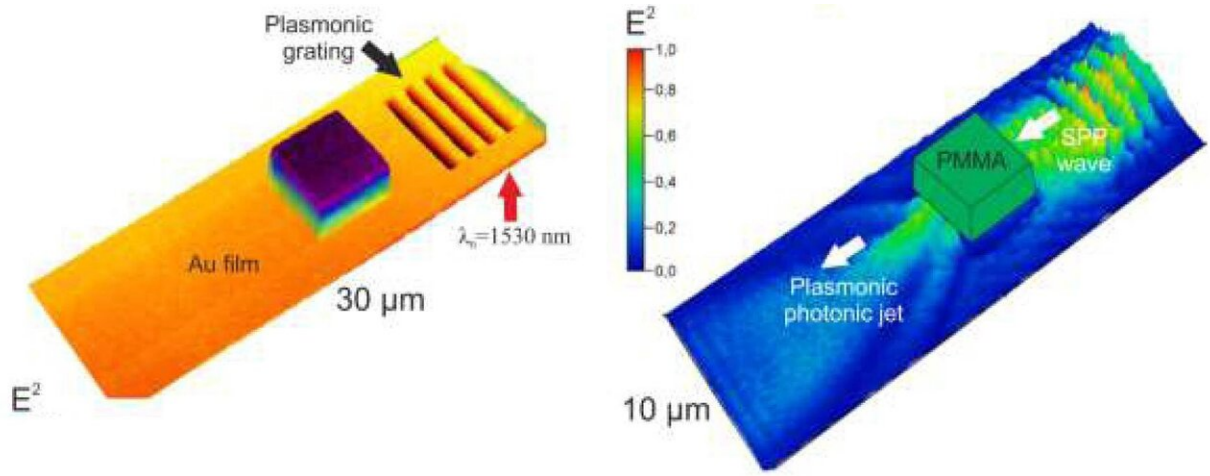

Credit: Tomsk Polytechnic University (TPU)

Researchers of Tomsk Polytechnic University with Russian and Danish teams have been able to experimentally confirm a plasmonic nanojet effect previously forecast in practice. Using a simple method, they focused surface plasmon waves into a jet and captured it with a microscope. In the future, the effect of plasmon compression can make optical electronics competitive and boost the creation of an optical computer. The study was published in *Optics Letters*.

Researchers from all around the world are working on computer technology based on optical radiation. It is not electric current that is

used to work and transmit information, but light. Optical computers should be even faster than the fastest machines that currently exist. However, today these developments remain untapped. One of the problems is the miniaturization of photonic elements since their dimensions still tend to be larger than those of electronic counterparts.

"The logical elements of conventional modern processors are tens of micrometers in size. Optical electronics can become competitive provided that we could compress light to a nanoscale," says Igor Minin, project manager, professor of the TPU Division for Electronic Engineering.

"This issue can be solved if we come from photons to surface plasmon polaritons that are special electromagnetic waves able to propagate along the boundary of metal and air or a dielectric. Earlier, we theoretically predicted the implementation of a plasmonic nanojet effect and now we have managed to prove it experimentally."

The researchers used a thin film of gold in the experiments. A 5-by-5 micrometer square particle of dielectric material was placed on its surface for a telecommunication wavelength. The particle, obtained by Danish scientists, became a microlens able to focus plasmons in a very small area in the form of a nanoscale jet.

The plasmon nanojet was captured with a microscope at the Moscow Institute of Physics and Technology.

"Unlike three-dimensional photon jet (the so-called photon nanostructure), plasmon jet is two-dimensional. Its dimensions are smaller, thus enabling future devices based on this effect to become more compact. Moreover,electromagnetic radiation can be localized in a very small area. The simplicity of obtaining localized plasmon beams provides ample opportunities for their practical application, for instance,

in superresolution microscopes, for the creation of biosensors, and in biological studies where molecular control is required. We have published just the first of a series of planned experimental results," Igor Minin says.

More information: Igor V. Minin et al. Plasmonic nanojet: an experimental demonstration, *Optics Letters* (2020). DOI: 10.1364/OL.391861

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