Plasmonics Research at the LSU CCT Aims for New Ways to Manipulate Light at the Nanoscale

Controlling the interaction between light and matter is fundamental to science and technology, and heretofore challenging. In conventional optics, light can only be controlled on length scales down to the order of the wavelength of light. However, a new paradigm called plasmonics has emerged—an approach based on surface plasmons, which are light waves that propagate along metal surfaces and enable light guiding and manipulation at the nanoscale.

Using metallic nanostructures to manipulate light at nanometric length scales has opened exciting opportunities. Plasmonics is being explored for its potential in subwavelength optics, data storage, light generation, lithography, microscopy, and biophotonics. Yet the exploration of functional nanoplasmonic structures and devices is still in a very early stage. The realization of such devices would enable for the first time controlling light and enhancing light-matter interactions at the nanoscale, beyond the diffraction limit, something that is fundamentally impossible to achieve with dielectric-based device components. This in turn could have profound implications for computing, communications, and energy applications.

Georgios Veronis, assistant professor of the LSU Department of Electrical & Computer Engineering and the Center for Computation & Technology, has received funding in the amount of $240,000 from the National Science Foundation to explore nanoscale plasmonic structures and devices for enhancement of nonlinear optical effects, all-optical absorption switches, ultra-compact sensors, and plasmon-enhanced thin-film photovoltaic solar cells. The project is called "Plasmonic Devices for Controlling Light at the Nanoscale."

"The development of these nanoscale devices and their integration will be challenging," said Veronis. "It is therefore important to theoretically and computationally explore this area and to identify the most promising structures for specific device applications, such as sensing, switching, and photovoltaics. We will undertake a series of large-scale simulations to explore new plasmonic structures and devices for manipulating light and enhancing light-matter interactions at the nanoscale through the excitation of subwavelength plasmonic modes. The results of the project may lead to new opportunities for device applications, which will represent important breakthroughs in integrated optics, optical information processing, and renewable energy sources."

For more information on this or other research at the LSU Center for Computation & Technology, visit: http://www.cct.lsu.edu/.

Publish Date:
10-10-2011

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