EE Researcher Receives DARPA Young Faculty Award

Assistant Professor of Electrical Engineering Michael Vasilyev has been identified by the Defense Advanced Research Projects Agency (DARPA) as one of 39 rising stars in university microsystems research to receive its Young Faculty Award. As part of the award, Dr. Vasilyev will receive as much as $150,000 to further develop and validate his research project, "Coherent Nonlinear-Optical Image Processing in Plasmonic Metamaterial," over the next 18 months.

Recipients of DARPA's Young Faculty Award are selected through a three-stage, competitive process. More than 275 young faculty researchers from universities across the country submitted proposals to the agency; only 39 were selected for funding. The funded researchers will focus on concepts that are innovative, speculative and high-risk.

Dr. Vasilyev plans to develop a device that converts mid-infrared into visible light without loosing critical information. Mid-infrared light is of particular interest in optical sensing, because it is eye-safe and is not absorbed by the atmosphere and is capable of detecting the spectral "fingerprints" of a variety of chemicals. However, reception of mid-infrared light currently requires the use of slow, bulky, liquid-nitrogen-cooled detectors with poor sensitivity.

The device designed by Dr. Vasilyev will convert the mid-infrared signal into visible light that can be easily measured by a variety of silicon-based detectors similar to those used in camcorders, providing high-speed, high-sensitivity and room-temperature operation.

The mid-infrared-to-visible conversion will be done by means of nonlinear-optical interaction in an artificial material with properties not found in nature (metamaterial). This metamaterial will reduce the amount of power needed to achieve nonlinear-optical interaction for the device. Traditional nonlinear-optical materials require large amounts of power, on the order of tens of kilowatts per pixel. The device proposed by Dr. Vasilyev will take advantage of strong light localization in the metamaterial to lower the power requirements down to a few milliwatts, enabling future integration of the entire mid-infrared sensing system on a chip.

Coherent optical imaging sensors are important for both military (Laser Detection and Ranging, or LADAR) and biomedical (tissue imaging) applications.

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