PURDUE INNOVATES | Office of Technology Commercialization

All-optical Single-photon Detector

A room-temperature photodiode system that detects and modulates single photons optically, enabling ultrafast photonic switching for telecom and quantum optics.

Researchers at Purdue University, including Dr. Demid Sychev, Peigang Chen, Morris Yang, Dr. Colton Fruhling, Dr. Alexei Lagutchev, Prof. Alexandra Boltasseva, and the group leader Prof. Vladimir M. Shalaev have developed a proof of concept for an all-optical single photon detector that demonstrates optical modulation at room temperature enabled by an electron avalanche in a photodiode. Current methods for optical modulation require cryogenic temperatures, vacuum conditions, and/or large cavities. The Purdue researchers believe their system has the capability to reach switching speeds in the THz range and is a critical component of the development of an all-optical transistor. This technology has applications in telecommunications, microscopy, and quantum optics.

Advantages:

- All-optical modulation of a light beam at the single photon level

- Room temperature operation

Applications:

- Telecommunications

- Quantum optics

- Microscopy

- Photonic transistors

Technology Validation: This technology was validated by demonstrating the optical modulation of near infrared light (NIR) with a visible wavelength beam with an estimated mean photon number of ~0.05 per pulse.

TRL: 3

Intellectual Property:

Technology ID
2022-SHAL-69602

Category
Computing/Quantum Technologies
Semiconductors/Devices & Components
Computing/Photonic & Optical Computing Technologies

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