New technology illuminates colder objects in deep space

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Too cool and faint, many objects in the universe are impossible to detect with visible light. Now a Northwestern University team has refined a new technology that could make these colder objects more visible, paving the way for enhanced exploration of deep space.

"High performance infrared cameras are crucial for space exploration missions," said Manijeh Razeghi, the Walter P. Murphy Professor of Electrical Engineering and Computer Science in Northwestern University's McCormick School of Engineering and Applied Science. "By studying the infrared waves emitted by cool stars and planets, scientists are beginning to unlock the mysteries of these cooler objects."

Researchers have long looked to infrared waves to probe the depths of space. Infrared has a longer wavelength than visible light, so it can penetrate dense regions of gas and dust with less scattering and absorption. Current infrared detectors are typically built with mercury cadmium telluride, which works well with mid- and long-infrared wavelengths. However, this well-established technology demonstrates low uniformity and instability for infrared waves with very long wavelengths.

Published in the June 23 issue of *Applied Physics Letters*, Razeghi and her collaborators describe a new technology, which uses a novel type II superlattice material called indium arsenide/indium arsenide antimonide (InAs/InAsSb). The technology shows a stable optical response in regards to very long wavelength infrared light.

By engineering the quantum properties of the type II superlattice material, the team demonstrated the world's first InAs/InAsSb very long wavelength infrared photodiodes with high performance. The new detector can be used as an inexpensive and robust alternative to current infrared technologies.

"This material has emerged as the platform for the new generation of infrared detection and imaging," said Razeghi who leads McCormick's Center for Quantum Devices. "It has proved to have longer carrier lifetimes and promises a better controllability in epitaxial growth and simpler manufacturability."

Razeghi presented this work in a keynote talk at the International Society for Optical and Photonics Defense, Security, and Sensing conference in Baltimore in April and at the Microelectronics Workshop in Istanbul, Turkey last month.

Provided by Northwestern University

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