INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Uncooled, Highly Sensitive Bowtie Nano-antenna Embedded IR Detectors

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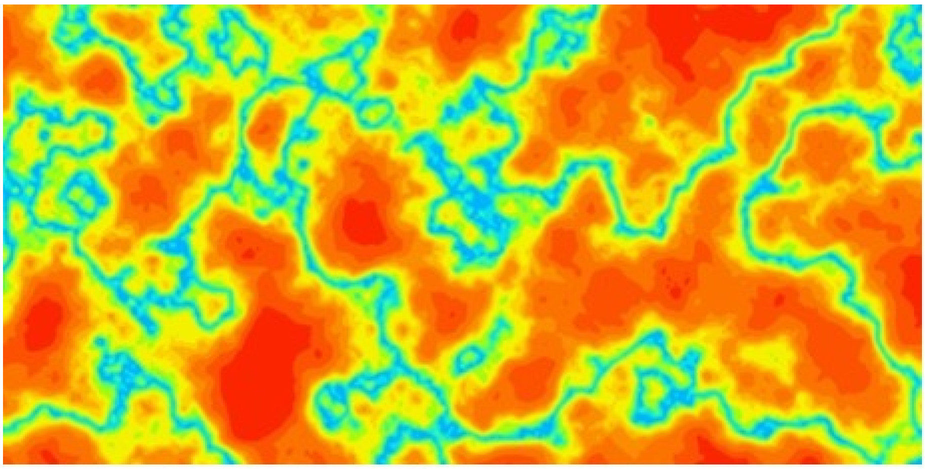

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Category
Hardware

Further information
Joohee Kim
jooheek@umich.edu

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OVERVIEW

Uncooled, highly sensitive infrared detector with embedded bowtie nano-antenna

- Reduces thermal noise without cooling; enhances sensitivity and resolution
- Applies to high-resolution IR imaging, polarimetric sensing, compact IR devices

BACKGROUND

Infrared (IR) detectors are vital for a multitude of applications including night vision, thermal imaging, and spectroscopy. Traditionally, their performance is hampered by thermal noise, requiring cooling to cryogenic temperatures to improve sensitivity. However, cooled IR detectors are often impractical due to their bulky size and high power consumption. The demand for uncooled, sensitive IR detectors has spurred research into various designs, but these often fall short in terms of sensitivity and resolution compared to their cooled counterparts. The pressing need for a detector that offers high sensitivity without the drawbacks of cooling is paramount, especially for applications requiring compact and efficient IR sensing solutions.

INNOVATION

Researchers at the University of Michigan have developed an advanced uncooled IR detector featuring an embedded bowtie nano-antenna designed to overcome the limitations of conventional and cooled IR detectors. This novel detector operates using a high-impedance nano-antenna integrated with a small low-bandgap InGaAsSb PN-junction, optimized for maximum power transfer and field enhancement. By operating at its anti-parallel resonance, the detector significantly boosts detectivity, outperforming conventional detectors by over 20 times due to the antenna's field enhancement factor. Its small pixel size, under 1 square micron, is two to three orders of magnitude smaller than current designs, making it suitable for high-resolution focal plane arrays and polarimetric imagers. This technology offers transformative potential for applications requiring precise infrared imaging and radiation source differentiation.