Sandia National Laboratories

Direct Detector for Terahertz Radiation

POTENTIAL MARKET APPLICATIONS

National Defense and Security

Molecular Spectroscopy

Imaging Array

Medical Imaging

Remote Sensing

Electronics

BENEFITS

Plasmons are not tied to the bandgap energy and can be excited by small THz photon energies

Plasmons can be excited at high temperatures than the THz photon energy

Detector is easier to produce and control

Easier to integrate with additional electronics

Requires lower voltage

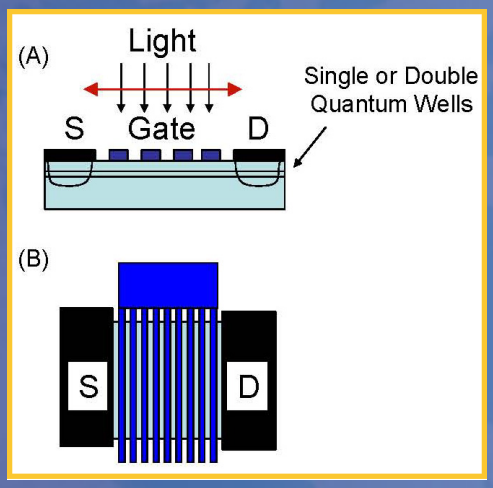
INTELLECTUAL PROPERTY

US PATENT #7,420,225
SD# 10181

TECHNOLOGY SUMMARY

There has been much interest expressed in terahertz technology due to the diverse range of applications that it applies to. However, the terahertz components have been known to perform poorly due to it lying between traditional electronic and photonic fields. Sandia National Laboratories has created a direct detector for terahertz radiation that seeks to close the “technological gap”.

The present invention is a direct detector that is a depletion mode field-effect transistor built from heterostructures and consisting of electrical contacts and a grating-gate. The grating gate tunes the electron density of the detector and adjusts the Plasmon frequency to match the THz radiation illuminating the device. The detector shows a photoresponse when the Plasmon frequency under the grating gate was turned to the frequency of the incident illumination, a capability not found in other terahertz devices.



A) The detector operating at normal incidence with electric field polarized across the grating
B) Top down view of the detector

TECHNOLOGY READINESS LEVEL

Sandia estimates this technology at approximately TRL 5. Key elements have been demonstrated in relevant environments.

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National Nuclear Security Administration

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