

# DIRECT DETECTOR FOR TERAHERTZ RADIATION

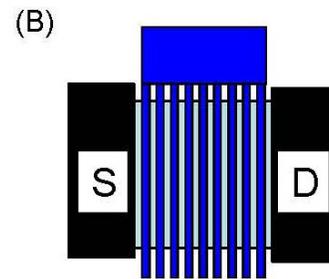
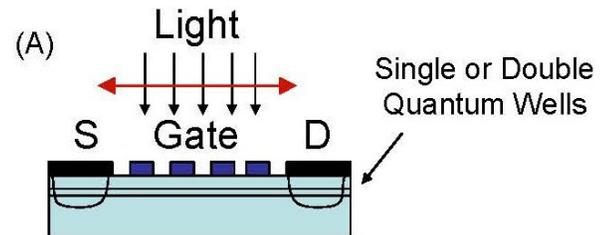
US Pat. No.: 7,420,225; 7,376,403; 8,482,739

Technology Readiness Level: 5

*Key components have been demonstrated in a relevant environment*

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 electricfield polarized across the grating

(B) Top-down view of the detector

## TECHNICAL BENEFITS

- Plasmons are not tied to the bandgap energy and can be excited by small THz photon energies
- Detector is easier to produce and control
- Easier to integrate with additional electronics
- Requires lower voltage

## INDUSTRIES & APPLICATIONS

- National defense & security
- Molecular spectroscopy
- Imaging array
- Medical imaging
- Remote sensing
- Electronics