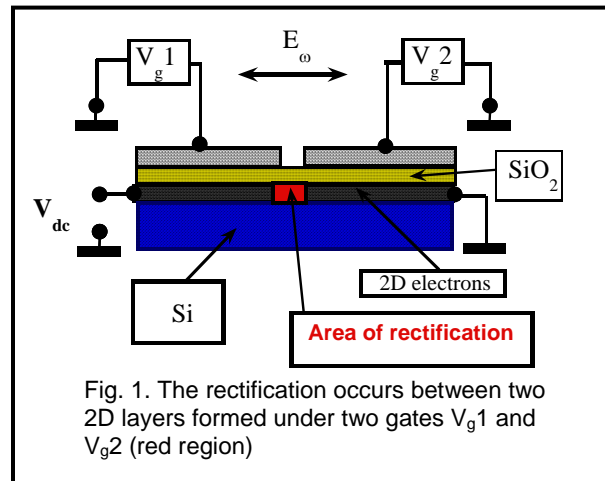


The CUNY Center for Advanced Technology In Photonics Applications (CUNY CAT)
 Designated by NYSTAR, the New York State Foundation for Science, Technology and Innovation

Ultrafast Terahertz Diode

The semiconductor diode is one of the main elements of semiconductor electronics. It is used extensively in electronic circuits to perform rectification, switching, and other operations. The rectification action appears at the boundary between two regions with differing conducting properties, for example the boundary between p-type and n-type semiconductor materials. This boundary region is a two-dimensional surface (depletion layer) with a finite electrical capacitance, which limits the high frequency / time response of these devices to 200 psec.



Our program focuses on development of 1 ps or faster diodes. Recently it has been observed that a boundary between two 2-dimensional electron systems is formed on the top of a silicon crystal demonstrates strong rectification. The device is based on Si-MOSFET technology. (See Figure 1)

There are several fundamental advantages to this arrangement in comparison with the classic schemes. The fact that the boundary between the two layers is almost a one-dimensional line causes the effective capacitance of the depletion layer to be considerably lower than in the classical 3D devices. It is expected to have picosecond response times. This lower capacitance enhances substantially the high frequency response of these structures, moving the high frequency limit of the devices into the terahertz or even optical wavelengths. Other advantages of this high-speed device are its ability to switch off abruptly and insensitivity to external radiation. This is of particular importance in time sensitive applications such as test equipment (high speed oscilloscopes, transient recorders), super-computers, radar, and time resolved spectroscopy.

Applications:

- Ultrafast Oscilloscopes
- Transient Recorders
- Super Computers
- Radar
- Time Resolved Spectroscopy
- Microwave and Terahertz Detectors and Mixers

This technology opportunity sheet describes continuing efforts in this area. Several patents may have been issued or are pending and which may be available for licensing.

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