

High-Performance Broadband Photodetector and Power Generator

New method for producing alternating current (AC) via the photovoltaic effect, enabling highly sensitive, unbiased optoelectronic devices

Georgia Tech researchers have discovered a method for generating alternating current using semiconductors with various junctions under a flashing light at low bias or without bias. Typically, sensors and power sources leverage the photovoltaic effect—the process by which light generates electric current—to create direct current (DC). The Georgia Tech team, however, found that AC could be produced in the transition states between periodic lighting at the junction of two materials. The production of AC is likely due to the flow of electrons in the external circuit, balancing the potential difference between electrodes as the amount of light energy changes.

The generation of AC electric power in this Georgia Tech photodetector is strongly affected by the intensity of the light source, switching frequency, and size of the illumination area. The current generated through this method is highly versatile, as the process can occur at interfaces of various types of materials and under a wide range of wavelengths. Producing AC power through the photovoltaic effect opens up new avenues for optoelectronic devices.

Summary Bullets

- **Versatile:** Adjusts for several different parameters, including light intensity, switching frequency, and illumination area
- **Efficient:** Provides voltage that is easily converted for use through a medium that is small, low cost, and easily fabricated
- **Highly sensitive:** Operates with ultra-high light sensitivity, even at very low light intensity, and fast response speeds

Solution Advantages

- **Versatile:** Adjusts for several different parameters, including light intensity, switching frequency, and illumination area
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Potential Commercial Applications

- Active sensors
- Power sources
- Medical imaging
- Thermal imaging
- Communications systems
- Environmental monitoring
- Defense technology

Background and More Information

The photovoltaic effect has been widely investigated in solar cells as a sustainable energy source that could replace fossil fuels. While the direct current generated by conventional photovoltaic technologies—like solar panels—is useful, this Georgia Tech method that produces alternating current generates significantly more current overall and broadens the potential applications of the photovoltaic effect. Additionally, this process allows for photodetector devices to operate without a voltage bias and with a high sensitivity, even at low light intensity. It could also be used to boost the power output from photocells.

Inventors

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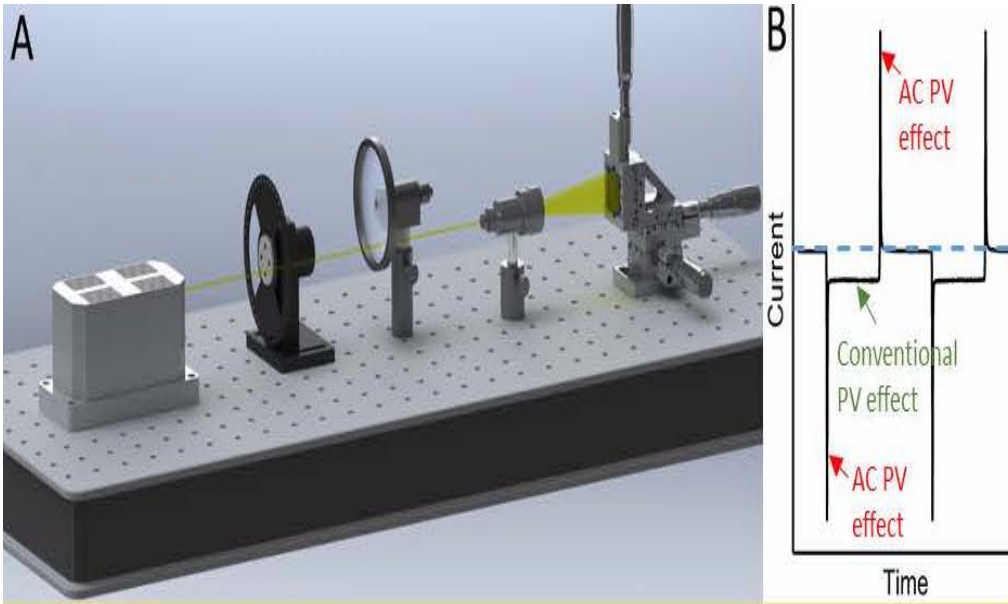
IP Status

The following patent application has published: US20210288194A1

Publications

[Alternating Current Photovoltaic Effect](#), Advanced Materials - March 19, 2020

Images



- (A) The experiment apparatus with a laser, lens, and an optical chopper in front of a semiconductor
(B) A graph showing the points in time at which AC is generated through this Georgia Tech method

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