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Two-terminal multicolor photo-detectors (PD) and focal plane arrays (FPA)

The state of the art of two-color focal plane arrays (FPAs) are two or three terminal photo detector pixels integrated with electronic readout circuits (ROICs). However, a multicolor (> 2) photodetector pixel requires many more terminals, making it very difficult, if not impossible, to integrate multicolor pixel arrays to ROICs due to the increase in contact number and the real estate for their traces. An innovative approach has been used to connect two different wavelength photo detectors with opposite polarity in series to enable a two-color FPA. Changing the bias voltage selects which of the two diodes operates in conductive mode. However, this approach is limited for multicolor photodetectors and FPAs.

Researchers at Arizona State University have created a novel approach that enables two-terminal multi-junction photo detectors and focal plane arrays for multi-color (>2) detection. The idea behind this invention is to connect multiple photodiodes with different band gaps (or cutoff wavelengths) in series, and with the same polarization. Light sources such as LEDs can optically bias all photodiodes except the detecting photodiode, which operates under reverse bias in photoconductive mode. Using this approach, it is possible to operate the device as one single-color detector, with a spectral response determined by the detecting photodiode.

Potential Applications

- Multicolor imaging and sensing applications, including
- Environmental sensing
- Infrared surveillance
- High-resolution and high-sensitivity imaging (hyperspectral imaging)
- Chemiluminescence
- Astronomy
- Wave front sensing

Benefits and Advantages

- Two-terminal design - Multicolor detectors do not require additional space-consuming connections.
- Unlimited number of detecting colors – very broad spectral detection range possible

