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# GeSn Infrared Photodetectors

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## Inventors

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## Intellectual Property Status:

*Patent pending*


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## Background

The application of silicon photonic technologies to optical telecommunications requires the development of near-infrared detectors monolithically integrated to the Si platform. Most present approaches require the bonding of the semiconductor detector material to the silicon circuitry, which can be time consuming and expensive. While approaches to integrate Ge with Silicon have also been explored, the direct absorption edge of pure Ge falls in the middle of one of the infrared optical communications windows, and provides poor absorption (hence optical signal detection) in the other two optical communication wavelength bands.

## Invention Description

To address these issues, researchers at ASU have developed infrared detectors using Germanium-Tin (GeSn) materials that may be grown with high crystalline quality on Si substrates. The researchers have demonstrated prototype *p-i-n* detectors based on $Ge_{0.98}Sn_{0.02}$ with an extended infrared absorption that covers all three telecommunications wavelength bands, and higher optical absorption characteristics than Ge.

## Potential Applications

- **Long, medium and short-distance telecommunications:** detectors integrated directly with silicon will reduce costs and may also reduce power consumption of receiver modules for apps such as Fiber to the Home and Ethernet
- **Optical interconnects**: parallel arrays of photodetectors integrated with silicon could be used to achieve ultra-fast data transfer between and within microchips
- **Infrared detectors for instrumentation:** Detectors could replace materials such as pure Ge and InGaAs in instrumentation and measurement settings

## Benefits and Advantages

- Detectors are integrated directly on Si using **low-temperature CMOS-compatible conditions**
- **Extended optical absorption response** over the entire C-, L- and U- bands for telecommunications (IR detection to at least 1750 nm, beyond 1550 nm usually offered by Ge)
- **Higher optical absorption**, when compared to Ge