UK HUB FOR
QUANTUM ENABLED POSITION,
NAVIGATION & TIMING

# Germanium on Silicon SPADS

Low-cost, short wavelength, high-efficiency image sensor with the potential to make fully autonomous vehicles affordable

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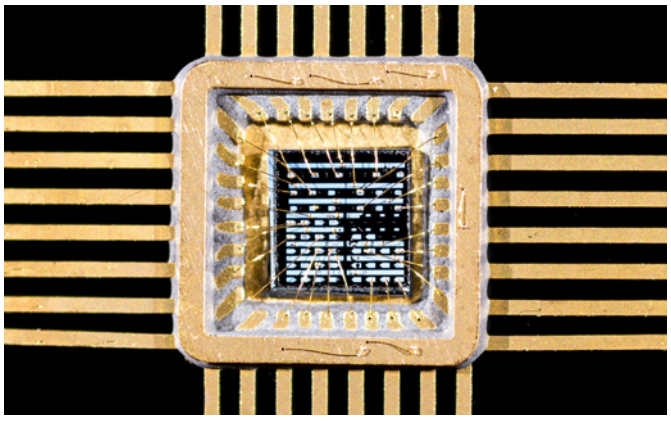
**LIDAR is a key enabling technology for the emerging autonomous vehicle industry. Single-photon avalanche diodes (SPADs) are a critical component of single-photon LIDAR systems, which have significant benefits especially for imaging through obscurants such as rain, fog, and dust.**

However, today's SPADs are expensive and need intense performance improvements before they meet the rigorous demands of fully autonomous vehicles.

This is the first SPAD in the short-wave infrared on silicon. It offers the potential for commercial products that are over 200 times cheaper than current technologies based on III-V materials. This SPAD also features high detection efficiencies and low afterpulsing. It represents a vital forward step in the commercialisation of sensors required autonomous vehicle.

## KEY BENEFITS

- Improving current LIDAR by moving SPAD technology into the short-wave infrared. This will enable LIDAR systems to operate with longer range, and with greater potential to work in the presence of atmospheric obscurants and precipitation.
- The design decouples the pixel location from any defective areas. This vastly reduces the noise in the detector compared to previous designs.
- Higher performance – the technology has the ability to perform over long distances and to measure the incidence of single photons.
- This SPAD has an extremely good surface-to-surface resolution that allows multiple surfaces to be distinguished very easily.
- Low-cost production due to CMOS compatibility.



## APPLICATIONS

Ge-on-Si devices can be used for next generation LiDAR for autonomous vehicles, improved cyber security along fibre optics and datacentres, and future medical diagnostic devices.

## MEET OUR INVESTIGATORS

Doug Paul OBE FRSE is Professor of Electronic & Nanoscale Engineering at the University of Glasgow and currently holds a Royal Academy of Engineering Chair in Emerging Technologies to develop chip scale cold atom systems. He is the principal investigator for the UK Hub for Quantum Enabled Position Navigation & Timing, and a Co-Investigator in the Integrated Quantum Networks (IQN) Hub.

Professor Gerald Buller is leader of the Single Photon Research Group at Heriot-Watt University, and Principal Investigator for the UK hub for Integrated Quantum Networks (IQN). His research interests are in single photon detection and its applications including quantum key distribution, quantum imaging, time-of-flight ranging and depth imaging.

Dr Ross Millar is a Lecturer at the University of Glasgow in the Electronics & Nanoscale Engineering Division having completed a Royal Academy of Engineering Research Fellowship. He is an investigator in the QEPNT and IQN Hubs. His research interests include Group IV avalanche devices and Group IV technologies for sensing.

## FOR MORE INFORMATION, PLEASE CONTACT

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