TECHNOLOGY

Deferred-multiplication Single-photon Avalanche Diode Detection System

OVERVIEW

Background:
Among the wide variety of applications of single-photon detectors, one of the most demanding is quantum communications, which puts a premium on low noise, high efficiency, and high speed. While many of these requirements can be met by cryo-cooled superconducting single-photon detectors, InGaAs/InP single-photon avalanche diodes (SPADs) remain convenient and practical thermoelectrically cooled alternatives for the 950 nm to 1650 nm region. Unfortunately, InGaAs/InP SPADs are also notorious for significant after-pulsing due to charge traps, an effect that generally limits them to gated-mode operation, and can require long recovery times (>1 μs) and limit the detection rate in conventional detection systems, particularly when biased for high efficiency.

Innovation:
Researchers at the University of Maryland Joint Quantum Institute have developed a method to increase the detection duty-cycle of an actively gated SPAD, allowing the device to detect the absorption of a single-photon over a period of time that is longer than the duration of the active gate that enables the detector. The invention allows fast gated SPAD detection systems to be sensitive to photons that arrive at times before a readout gate is applied, thereby increasing the detection duty cycle of the system. This allows the use of low-noise, fast gating techniques that have been shown to benefit single-photon detector performance, with single-photon signals that are not well aligned with the fast gates applied to the detector, as, for example, in the case of a continuous-wave single-photon signal.

APPLICATIONS

LIDAR
Quantum communications

ADVANTAGES

Sub-nanosecond temporal resolution
High count rates

CONTACT INFO

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Additional Information

INSTITUTION

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CATEGORIES

- Microelectronics

EXTERNAL RESOURCES

- US Patent 9,401,448

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