

Tiny 'on-chip detectors' count individual photons

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A team of researchers has integrated tiny detectors capable of counting individual photons on computer chips. These detectors, called "single-photon avalanche diodes (SPAD)," act like mini Geiger counters, producing a "tick" each time a photon is detected.

The researchers present their findings in [Applied Physics Letters](#), a journal published by the American Institute of Physics.

"In the past, making these detectors required specialized processes, but recently there has been tremendous progress in making these devices in 'standard' integrated circuit processes—those used to make [computer chips](#)," says Ryan Field, a Ph.D. candidate in the department of electrical engineering at Columbia University. "This has dramatically decreased the cost of making detectors and enabled them to be integrated on the same chip with complex circuitry."

The team has produced such detectors with extremely low noise, which means that there's a low probability of getting a 'tick' without a photon present.

"These detectors are being used for specialized camera chips to measure fluorescence, which is extremely important to biological imaging," explains Field. "Fluorescent labels are used throughout biology to image processes in vivo and in vitro. One of the properties of fluorescence is that it decays after the excitation source has been removed, with a characteristic decay time known as the 'lifetime.' By photon counting,

we can measure this lifetime with our SPAD-based camera, forming a high-frame-rate lifetime imager that can provide further insight into the nature of biological processes."

More information: apl.aip.org/

Provided by American Institute of Physics

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