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Scalable Single Photon Detector for Terahertz and Infrared Applications BERNARD MATIS, DONG HO WU, Naval Research Laboratory/ Temple University — Recent advancements in the research areas of quantum dot (QD) and single electron transistors (SET) open up an opportunity for the development of quantum dot detector, which can respond to a single photon over microwave to infrared (IR) frequencies. Currently, single photon detection is possible by means of the photomultiplier tube, but only for photons with wavelengths shorter than 1.5 μm. For the detection of photons with wavelengths longer than the IR, a bolometer is typically used. The sensitivity of a state-of-the-art bolometer, in terms of noise equivalent power (NEP), is 10^{-17} W/Hz$^{1/2}$, which requires 10^5 photons to yield a detectable signal. In our research, similarly to Komiyama's work, we use QD and SET structures to develop single photon detectors, for which the NEP will be about 10^{-22} W/Hz$^{1/2}$. This is five orders of magnitude more sensitive than the state-of-the-art bolometer, and sensitive enough to detect a single photon at microwave and IR frequencies. The small diameter of the QD and SET, about 200 - 250 nm, can increase the charging energy and therefore the operating temperature. In this presentation we will discuss the fabrication process of small quantum dots, which includes new lithographic methods in combination with e-beam lithography, and experimental problems and promises of our single photon detectors.

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