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[Invited] Multi-pixel superconducting nanowire single-photon detectors with cryogenic signal processors using single-flux-quantum circuits

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Superconducting nanowire single-photon detectors (SSPDs) with the system detection efficiencies (SDEs) over 80%, which are implemented in compact Gifford-McMahon (GM) cryocooler, are realized and used in a wide range of areas, such as quantum information, quantum optics, optical space communication, fluorescence microscope, and so on. However, in many applications, not only high SDE but also total performance including low dark count rate (DCR), high maximum count rate (MCR) and/or low timing jitter are important to determine the system performance. A multi-pixel SSPD is a promising approach because it enables higher MCR, larger detection area without reducing the MCR, pseudo photon-number resolution and also spatial resolution. We have developed multi-pixel SSPDs combined with cryogenic signal processors based on single-flux-quantum (SFQ) circuits. By employing cryogenic signal processing using SFQ circuit, the number of readout cables and resulting heat load to a cryocooler via the readout cables can be reduced [1]. And also the SFQ circuits can provide a wide variety of functions as post signal processors for multi-pixel SSPDs. In this talk, we will review our recent progress in multi-pixel SSPDs combined with cryogenic signal processors based on SFQ circuit technology.
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[1] H. Terai et al, IEEE TAS 19, 350 (2009).

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