

## Development and applications of superconducting nanowire single photon detectors

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Superconducting nanowire single photon detector (SNSPD or SSPD) has recognized as promising detectors in wide range of applications such as quantum information technology, quantum optics, laser ranging, free space optical communications, fluorescence microscopes, and so on, because they can achieve broad band sensitivity from visible to mid infrared, high detection efficiency, low dark count, and short timing jitter. We have been developed practical SSPD system with GM cryocooler. Our SSPD system show the system detection efficiency (SDE) at 1550 nm wavelength of ~80 %, dark count rate of ~100 counts/sec and timing jitter of ~70 ps[1]. This high performance SPD system have employed to several applications such as quantum key distribution test [2], quantum optics experiments [3], and fluorescent correlation spectroscopy measurement [4], and showed its superiority to commonly used semiconductor detectors.

We also have been developing multi pixel SSPD array system toward the realization of high-speed operation, enlargement of the device area, pseudo photon number resolution, and spatial resolution. Though one of critical issue is readout technology for SSPD array, we proposed to apply superconducting single flux quantum circuit as SSPD's readout circuit. In this talk, we will also introduce the current status of the development for SSPD array system.

[1] S. Miki et. al., *Opt. Exp.* 21(8), 10208–10214 (2013).

[2] M. Sasaki et. al., *Opt. Exp.*, 19(11), 10387-10409 (2011).

[3] R.-B. Jin et. al., *Opt. Exp.*, 22(10), 11498–11507 (2014).

[4] T. Yamashita et. al., *Opt. Exp.*, 22(23), 28783-28789 (2014).