Microfiber-coupled Superconducting Nanowire Single-Photon Detector

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***Abstract*— High-efficiency Superconducting Nanowire Single-Photon Detectors (SNSPDs) have enabled numerous experiments and applications especially in modern quantum optics and quantum communication. Two types of SNSPDs have been developed so far. One is the standard-fiber-coupled SNSPD with the fiber vertically illuminating the meandered nanowires, the other is waveguide-coupled SNSPD with the nanowires fabricated on the surface of the waveguide which guides photons while the fiber is coupled to the waveguide. Here we propose a new type of SNSPD integrated with microfiber. The photons are guided by a microfiber and evanescently absorbed by the nanowire of SNSPD when the microfiber is atop of the superconducting NbN nanowires. The room-temperature optical experiments indicated a coupling efficiency of up to 90% with a 1.3-μm-diameter microfiber for the wavelength of 1550 nm. We were able to demonstrate that the microfiber-integrated detectors achieved a system detection efficiency (SDE) of ~20% at the wavelength of 1550 nm at a system dark count rate (DCR) of 100 Hz with a 2-μm-diameter microfiber. We expect the microfiber-integrated high-efficiency SNSPDs may extend to more applications such as micro-nano optics.**

***Keywords (Index Terms)*— Single photon, Superconducting nanowire single-photon detector, SNSPD; microfiber; microfiber-integrated detector, nanowire, detection efficiency.**

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