Single Photon Detectors Developed for Quantum Communications and Computing

Supporting/Contributing Agencies: NIST, ARDA

NIST has developed world-leading superconducting single photon detector systems to meet the growing demands of quantum-based applications, including ultra-secure communications, quantum computing, and the verification of fundamental predictions in quantum physics. Quantum key distribution (QKD) provides a means of ultra-secure communication for which privacy is guaranteed by the laws of physics rather than by computational complexity. High-efficiency, high-speed single photon detectors are critical to the fielding, verification, and calibration of QKD systems and optics-based quantum computing systems. NIST has developed the transition edge sensor, the heart of which is a nanoscale thin film of tungsten, that retains the world record in quantum efficiency (95%) for single photon detectors at telecommunication wavelengths. NIST's unique accomplishments in cryogenics, packaging, and electronics for related superconducting NbN nanowire single photon detectors enabled the creation of state-of-the-art, compact, and efficient detection systems responsible for record-setting demonstrations of speed and length in QKD. Individual photons of light were sent over a record 200-km fiber-optic link by NIST and researchers from NTT Corp. in Japan and Stanford. In addition to the distance record, the team reached a major QKD milestone of the first gigabit-rate experiment to produce secure keys. The results demonstrated a powerful approach for making practical inter-city terrestrial quantum communications networks. NIST's single photon detector systems will enable the ultimate in security of voice and data communication for use in military communications, financial transactions, and other high-sensitivity applications.

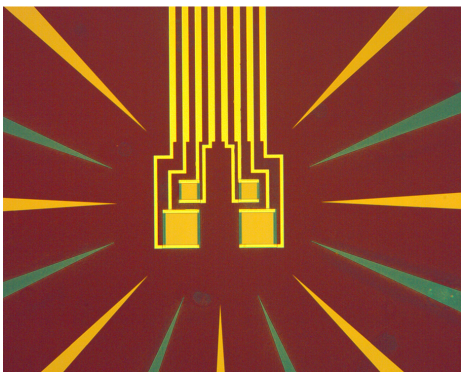

Figure 1. Superconducting transition edge sensor for record-efficiency single photon detection.

References/Publications/Patents

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