Invited Talk

Superconducting Nanowire Single-Photon Detectors

Karl K. Berggren (MIT)

Superconducting nanowires have been used for single-photon detector for over a decade, and in that time their performance has advanced to the point where they have demonstrated significant utility for classical and quantum communication, VLSI circuit evaluation, and recently as receivers for LIDAR imaging. These detectors have also been applied to scientific investigations of amplitude coherence, and quantum-dot fluorescent decay. Enabling these developments are the detector's nanosecond-level reset times, 30-ps jitter, and system efficiencies that now exceed 90% (suggesting that the internal efficiency may approach 100% for some of these devices). Scaling of the devices to narrower linewidths and new architectures has permitted improved signal to noise and concurrently resulted in improved infrared efficiency. Furthermore, small arrays of these detectors have recently been demonstrated, suggesting that timed single-photon imaging may ultimately be enabled. But device performance varies widely depending on device design, materials choice, and system implementation. Furthermore, aspects of the fundamental operation of the devices remain poorly understood. For example, the underlying physical limit to device jitter has not been clearly understood yet, nor has the impact of even relatively simple material parameters, such as device thickness. In this talk, I will discuss the devices and their technological development, as well as present recent results on the development of devices with improved sensitivity, read-out architectures, and easier methods of integration with integrated photonic components.