From dark matter detection to artificial intelligence: uses for superconducting nanowire single photon detectors

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Single-photon detectors are an essential tool for a wide range of applications in physics, chemistry, biology, communications, computing, imaging, medicine, and remote sensing. Ideally, a single photon detector generates a measurable signal only when a single photon is absorbed. Furthermore, the ideal detector would have 100% detection efficiency, no false positive (dark counts), and transform-limited timing resolution. Since the first reported detection of a single photon using a superconducting nanowire in 2001[1], steady progress has been made in the development and application of superconducting nanowire single photon detectors (SNSPD or SSPD) with ideal properties. The performance of these detectors is fundamentally related to characterizing and understanding the materials used in these quasi-1D wires that are able to detect photons. I will briefly describe progress in detector developments, use of these detectors in new applications, and opportunities for future work.

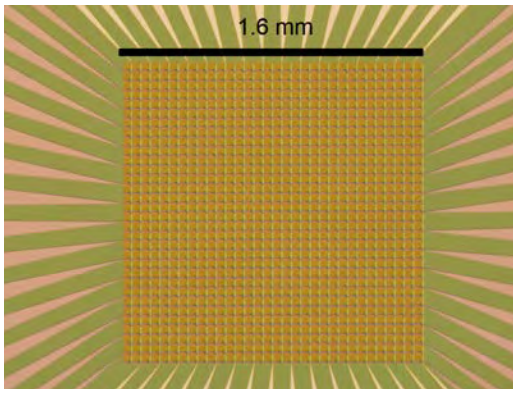

Figure 1 : Optical micrograph of a 32 x 32 array of SNSPD detectors

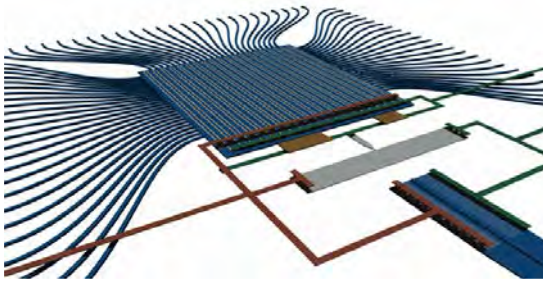

Figure 2 : Sketch of an artificial neuron using a single photon detector (SNSPD) and a weak

References

[1] Gol'tsman, G. N., O. Okunev, G. Chulkova, A. Lipatov, A. Semenov, K. Smirnov, B. Voronov, A. Dzardanov, C. Williams, and Roman Sobolewski. "Picosecond Superconducting Single-Photon Optical Detector." *Applied Physics Letters* 79, no. 6 (August 1, 2001): 705–7. https://doi.org/10.1063/1.1388868.

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