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Superconducting Nanowires Detecting Single Photons for Integrated Quantum Photonics

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Quantum information processing with photons relies on single-photon sources, passive circuit elements and single-photon detectors. In order to take advantage of quantum physics in advanced quantum technologies such as quantum simulation and quantum computing, tens of photons must be generated, manipulated and detected. However, when the number of photons exceeds a few, bulk optics becomes complex and difficult to scale. Integrated quantum photonics offers a solution to these formidable challenges. Quantum photonic integrated circuits (QPICs) may enable the scalable generation, manipulation and detection of single photons on a chip, thereby opening the way to quantum information processing. Superconducting nanowire single-photon detectors (SNSPDs), on the other hand, are a promising enabling technology for single-photon detection due to their fast response, low dark count rates, low jitter and scalability. The integration of SNSPDs with waveguides is therefore of primary importance for the realisation of a scalable and fully-integrated quantum photonic technology. In this talk, we will first describe the deposition of NbN thin films on semiconducting substrates, the nanofabrication of detector structures and the measurement techniques needed to characterise detectors. We then discuss the design of waveguide single-photon detectors and their electro-optical characteristics.

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