Investigation of polarization sensitivity in Superconducting Microstrip Single-Photon Detectors at 1.55 µm

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Superconducting Nanostrip Single-Photon Detectors (SNSPDs) are the current gold standard for photon-starved applications at the 1.55 µm telecommunication wavelength, offering unmatched performance in terms of system detection efficiency (SDE), dark count rates, and time resolutions [1,2]. In order to enhance the active area, SNSPDs are typically arranged in a meandered structure, leaving room for possible polarization sensitivity of the SDE. Depending on the application requirements, these devices can indeed be engineered for either high polarization selectivity [3,4], usually based on anisotropic meanders, or polarization-independent performance [5-7], where fractal or spiral meanders are deployed. Recent studies have also demonstrated that transitioning to Superconducting Microstrip Single-Photon Detectors (SMSPDs) featuring micrometric-scale strips and nanometric gaps (edge-to-edge distance between adjacent strips) ensures polarization-insensitive SDE [8,9]. However, the fabrication of these devices still relies on electron beam lithography, which remains an expensive and time-consuming approach for scaling up to large-area detectors.

In this work, we present the development of MoSi and NbRe-based SMSPDs, successfully patterned in anisotropic meandered structures via UV-lithography. All characterizations were performed at an operating temperature of 2.2 K and at the standard telecommunication wavelength of 1.55 µm, where the devices work as single-photon detectors. Experimental data highlight inherent polarization sensitivity, as shown in Fig. 1 for a NbRe-based meander. This device was fabricated from a 6 nm thick film featuring a 1.6 µm width and a 5.9 µm gap. These results indicate that large-active-area SMSPDs with micrometric gaps can be successfully manufactured to be polarization-sensitive by utilizing UV-lithography.

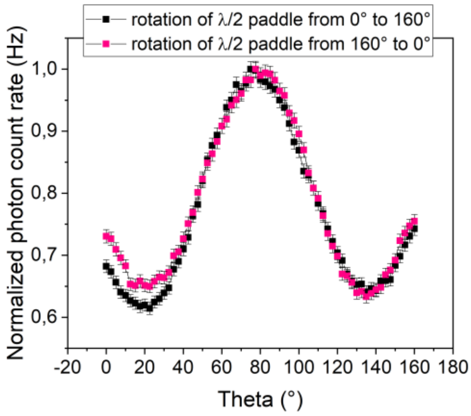

Fig. 1: *Polarization sensitivity trend of the normalized photon count rate at 1.55 µm for a 6 nm thick NbRe meander. Dimensions measured via Scanning Electron Microscopy (SEM) indicate a 1.6 µm width and 5.9 µm gap.*

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