# Highlights

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## Superconducting nanowire single photon detectors based on disordered NbRe films

C. Cirillo,[1,2] J. Chang,[3] M. Caputo,[2] J. W. N. Los,[4] S. Dorenbos,[4] I. Esmaeil Zadeh,[3] and C. Attanasio[1,2]

[1]CNR-SPIN, c/o Università degli Studi di Salerno, Via Giovanni Paolo II 132, 84084 Fisciano, SA, Italy
[2]Dipartimento di Fisica "E.R. Caianiello", Università degli Studi di Salerno, Via Giovanni Paolo II 132, 84084 Fisciano, SA, Italy
[3]Optics Research Group, ImPhys Department, Faculty of Applied Sciences, Delft University of Technology, Delft 2628 CJ, The Netherlands
[4]Single Quantum B.V., Delft 2628 CJ, The Netherlands

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Superconducting Nanowire Single Photon Detectors (SNSPDs) based on 8-nm-thick $Nb_{0.15}Re_{0.85}$ nanowires are developed. The devices have a meander structure of wires 50–100 nm wide, with a detection area of about 10–16 μm in diameter. The characteristics of the detectors are extracted from flood illumination at about 3 K, and the promising performance of NbRe-based SNSPDs at an easily accessible cryogenic temperature are demonstrated. Due to both the reduced value of the superconducting coherence length and the disordered film structure, the superconducting properties are robust with respect to the nanopatterning process. The devices show saturated detection efficiency up to λ = 1.3 μm with a time resolution of 33.1 ps and recovery times of about 8-19 ns. In addition, at infrared wavelengths, simulations return an extinction parameter exceeding 6, and an absorption of more than 99% for a filling factor 0.4, which may also indicate good performance of shorter devices. This work paves the way for the optimization of future devices based on NbRe, in particular, by tuning the film microscopical properties as well as geometry, along with the experimental setup, and NbRe-based devices may represent an alternative to nitride-based SNSPDs and amorphous materials because of their improved performances in terms of time resolution and operating temperature.

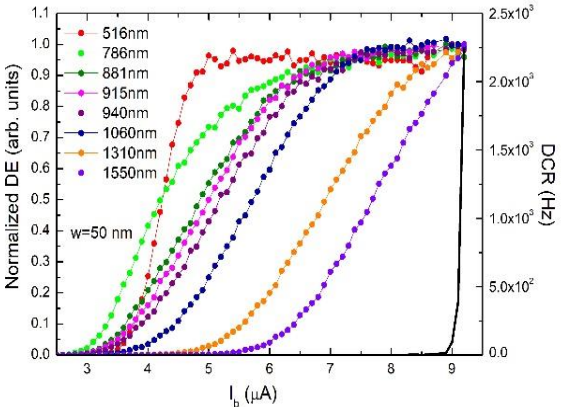


Fig. 1: Normalized detection efficiency (left) and dark count rates (right) for device 50 nm wide as a function of the bias current measured at different wavelengths at T=2.8 K.

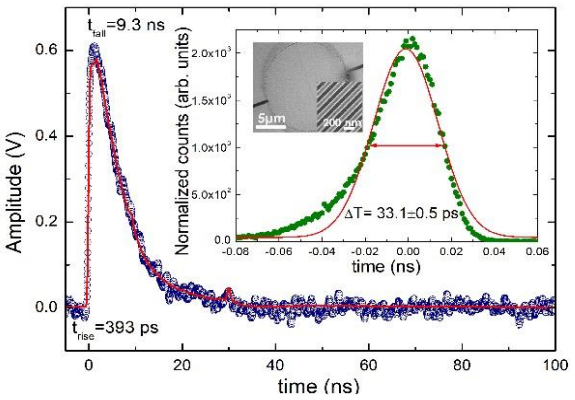


Fig. 2: Detection pulse for device 80 nm wide at T=2.8 K. The single pulse data (points) are superimposed on the averaged measurement (line). The characteristic times are indicated. Inset: Timing jitter, ΔT, for the same detector at T=3.3 K fitted by a Gaussian dependence. Δ T is evaluated evaluated as the full width half maximum. SEM image of typical fabricated devices i salso shown