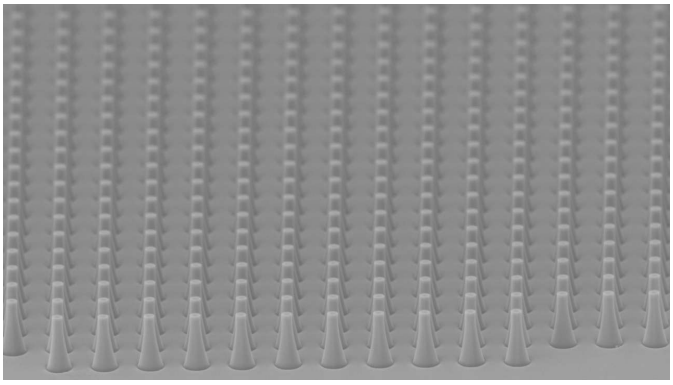
QuantumCore Inc.

Single-photon detector

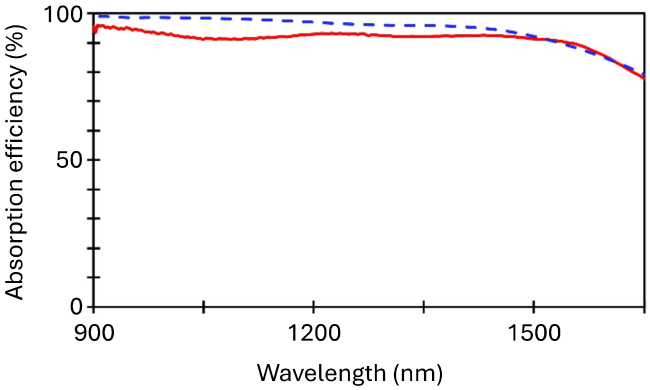
Semiconductor metasurfaces with demonstrated near-unity absorption efficiency and precise timing resolution

Product Overview

We are developing the next generation of single-photon detectors based on semiconductor metasurfaces. At the heart of our detectors is a carefully engineered semiconductor metasurface — an array of nanostructures whose shape and geometry are optimized to absorb incoming photons with near-perfect efficiency while enabling precise timing resolution required for quantum computing, communication, sensing, and imaging. TEC cooled to 200 K – no cryogenics, no helium for a wider range of applications requiring portability such as in space or remote areas.



Semiconductor metasurface – array of nanostructures



Near-unity absorption efficiency over broad wavelength range from 900 nm to 1600 nm

— Red solid line (measured) --- Dashed blue line (calculated)

Small footprint without cryogenic cooling



The devices are cooled with a TEC hermetically sealed package to 200 K. No cryogenics.



Contact:
Michael Reimer, PhD
mreimer@qncor.ca
www.qncor.ca

Key specifications	Target specifications
Core Technology	InGaAs/InP single-photon avalanche diodes with patterned metasurfaces for near-unity absorption efficiency in the active region
Operating wavelength	900 nm – 1700 nm
Peak detection efficiency[1]	> 75%
Timing jitter[2]	< 50 ps
Dark count rate[3]	< 1000 Hz
Optical coupling	Free space (fiber coupling optional – FC/PC or FC/APC)
Active area	Ø10–50 μm diameter
Output pulse height	≥ 1 V
Output pulse interface	SMA

[1] The wavelength corresponding to the peak detection efficiency depends on the geometry of the nanostructured array. The target specification is based on the measured absorption efficiency and the calculated impact ionization probability required to initiate the avalanche process in our device design

[2] 20 ps timing jitter measured in an InP nanostructure array. S. Gibson *et al.*, *Nature Nanotechnol.* **14** (5), 473–479 (2019)

[3] To be determined. Note that a dark count rate of < 100 Hz was measured in InGaAs/GaAs nanostructure arrays at 125K. A.C. Farrel *et al.*, *Nano Lett.* **19** (1): 582–590 (2018)

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