MICROPHOTON

Mon, 2016-07-11 10:15 - Minna Günes **Full Name:** Measurement and control of single-photon microwave radiation on a chip
Coordinator: Antti Manninen

Location

VTT MIKES Metrology Tekniikantie 1
Espoo Finland
60° 10' 47.4852" N, 24° 49' 30.4968" E
Running time: 2013-06-01 - 2016-05-31

We now have the ability to build electronic devices at the nanoscale and operate them at millikelvin temperatures, and this has opened up the possibility to design, operate and utilise devices based on quantum physics. Quantum devices have been used in electrical metrology for decades and now nanoscale single-electron current sources are about to take their place in the realization of the ampere. A wider range of applications includes, e.g. cosmic background radiation detection, terahertz imaging for homeland security, and brain research. An active and important field of research is the development of quantum information processing and communication (QIPC) using quantum bits based on, e.g. superconducting devices and other cryoelectronic components. This new field may radically change the Information Technology landscape over the next decade.

In quantum device technology, the development of microwave photon detectors and sources at the single-photon level is a key issue. The development of any future superconducting quantum computing technology will necessarily depend on the availability of on-chip single-photon and few-photon microwave components, especially detectors. Furthermore, amplifier development for wireless communications and radiation metrology would greatly benefit from ultra-low-signal sources and ultra-sensitive detectors. There is also a urgent need for microwave photon detectors in characterising and minimising the background microwave radiation in cryogenic environments, in order to improve the performance of quantum devices. However, currently no detector can reliably resolve single microwave photon events. This has been a major limitation for research on QIPC based on cQED. Also, development of cryonanoelectronic devices needs ultrasensitive microwave sensors to tackle the problem of the detrimental effect by residual microwave photons.

The objectives of MICROPHOTON include development of novel microwave detectors and sources on single-photon level, and improvement in the performance of cryoelectronic quantum devices by understanding and eliminating the detrimental effects caused by microwave radiation:

- Development of single-microwave-photon detectors which give spectral information of radiation. Sensors will be developed to cover a wide frequency range from below 10 GHz up to about 300 GHz. The methods will be based on superconductor and semiconductor nanodevice technologies.
- Development of cryogenic sources of microwave photons to cover frequencies between 4 GHz and 300 GHz and their use in characterization of the developed photon detectors.
- Characterization and minimization of background microwave radiation in cryogenic measurement systems of nanoelectronic devices.
- Demonstrations of improved performance of cryoelectronic quantum nanodevices such as SINIS-SET-based components and other devices in which perfectness of superconductivity is important.

- Quantum Communication
- Quantum Engineering

- Quantum Computation
- Quantum Metrology, Sensing and Imaging
- Other
- Other

Source URL: http://qurope.eu/db/projects/microphoton