

Nanowire superconducting single photon detectors

28 November – 1 December 2016 Lorentz Center@Oort

The goal of this workshop was to bring together theorists and experimentalists studying the detection mechanism in nanowire superconducting single photon detectors, a type of photodetector which is particularly promising for the near-infrared, in applications where high efficiency and high speed are paramount. There has been strong technological and theoretical progress in this field recently, however there are still open questions regarding the working mechanism of these devices.

To achieve our goal, we have brought together not only theorists and experimentalists in the SSPD field, but also condensed matter physicists studying thin-film superconductivity, to make a synthesis of the available evidence and to learn from the progress made in the other connected fields. In total, 55 persons participated in the workshop, of which about 10% did not have a strong connection to the SSPD field. All worldwide groups working on SSPD physics were represented and presented their results.

We have chosen to have the scientific talks given preferably by the junior researchers in the field, whereas the *eminences grises* of the field were asked to moderate the sessions. This approach had two major advantages: first, it gave junior scientists the opportunity to present themselves, but more importantly, it gave leeway to more profound discussion about the experimental data, since the junior scientists were less prone to present a totally discussion-free talk. All 4 workshop days were ended with a general discussion session, where the presented data of that day was discussed, and put into perspective.

The discussion sessions were actually particularly useful in advancing the field. It helped to have prolonged discussion between theorists and experimentalists to understand details about theory and experiment, that could be essential for answering the open questions. In hindsight, we would have perhaps added even more discussion sessions, as the fact that we had only a discussion at the end of the day meant that we had about five-seven talks to discuss in a one-hour session.

As an example of the increased understanding of the field, all experts on the polarization response of SSPD devices were present at this workshop. Prior to this meeting, there were two proposed effects to explain this polarization response. At the workshop, we were able to collate the evidence and conclude that both effects must play a role.

The discussion sessions also led to ideas for new experiments. From the talks of the condensed matter community, it became clear that we have insufficient knowledge of the material properties of the system, in particular the role which disorder plays in weakening superconductivity. This led to a plan from NIST – one of the major groups in this field – to perform a series of experiments there to investigate this effect.

Also for the “visiting scientists” from the condensed-matter community, new possible experiments were extensively discussed. For instance, it was proposed that the absorption of a single photon could be mimicked in an STM experiment where a single electron with a comparable energy as the observable photons can be injected in a superconducting nanowire.

In short, the workshop was a great success. This is even more reflected by the fact that already halfway through the workshop, an initiative was undertaken to organize a similar workshop in two years’ time.

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