



Electronic version

PhD position at TU Delft

TANDEM: Terahertz Astronomy with Novel DiElectric Materials

Electronic Components, Technology and Materials Group and Terahertz Sensing Group
Faculty of Electrical Engineering, Mathematics and Computer Science, TU Delft

Job Description

On-chip superconducting electronics are revolutionizing the fabrication of astronomical radiation detectors and spectrometers in the far infrared (Endo et al., Nature Astronomy 2019: <https://rdcu.be/bM2FN>). In theory, superconductors have extremely low loss at very low temperatures and for frequencies up to the gap frequency. For example, NbTiN should have a loss tangent $\tan \delta < 10^{-6}$ for any frequency below 1.1 THz. These devices are now predominantly using coplanar waveguide (CPW) structures on crystalline substrates, such as intrinsic Si or Sapphire, because only these materials have losses comparable to the superconducting films. However, the radiation loss of CPW structures become too high in the submillimetre band, limiting the performance and scalability of these devices. These devices would benefit enormously from the availability of a high ϵ_r (~ 10) dielectric that can be deposited on a superconducting ground plane to form, with a superconducting top electrode, an ultra low-loss microstrip.

The aim of the PhD project is to develop superconducting microstrip lines with losses of $\tan \delta < 10^{-5}$, by combining the dielectric deposition, characterization, material expertise and facilities of the ECTM group and Else Kooi Laboratory, and the submillimeter wave device fabrication and measurement capability of the Terahertz Sensing group and SRON. The aim is not only to realize low loss dielectrics, but also to understand the underlying physics that govern these losses. If successful, these microstrips will be immediately applied to enhance the scientific performance of the DESHIMA spectrometer on the ASTE telescope (see <http://deshima.ewi.tudelft.nl>).

Location

The research will take place in the microelectronics department (<http://microelectronics.tudelft.nl>). To stimulate interdisciplinary research, this cross-section PhD position has two direct supervisors for the PhD candidate: **Dr. Sten Vollebregt** from the ECTM Group will supervise the fundamental material-science research, whereas **Dr. Akira Endo** from the THz Sensing Group will provide guidance in the application to astronomical instrumentation. The two supervisors are located in the same faculty building and have co-supervised students in the past. The research will be performed in collaboration with **SRON** (Netherlands Institute for Space Research).

Requirements

- Master's degree or equivalent in physics, electrical engineering, or astronomy (or expected to obtain such a master's degree soon).
- Experience in at least one of the following areas: micro/nanofabrication, material characterization, microwave design/measurements, or cryogenic measurements

Condition of employment

The position is available immediately and will be for 4 years. The starting date is December 2019 at the latest. The salary will be in accordance with the Collective Labor Agreement for Dutch Universities. (In the Netherlands, a PhD candidate is regarded as a "job" and not a "student.")

Contact

To apply or for more information, please send an e-mail with your personal CV to Akira Endo (a.endo@tudelft.nl) and Sten Vollebregt (s.vollebregt@tudelft.nl)

