

Nanoelectronics comprises the study of the electronic and magnetic properties of systems with critical dimensions in the nanoregime, i.e. sub  $\sim 100$  nm. Hybrid inorganic-organic electronics, spin electronics and quantum electronics form important subfields of nanoelectronics. The research goes above and beyond the boundaries of traditional disciplines, synergetically combining aspects of electrical engineering, physics, chemistry, materials science, and nanotechnology

## Nanofabrication



### Fabricate your own structures

Facilities in the cleanroom are used to fabricate structures at the nanoscale. The goal is to give students the possibility to fabricate their own devices.

### The Cleanroom

The cleanroom offers a dust free environment, where different equipment is available to make your process. Techniques like E-beam lithography and thin-film evaporation allow the fabrication of devices with structure sizes down to tens of nanometers.

### Support

You will get special training by technicians so that you are able to work independently.



## The coolest place of Twente

### Measuring at low temperatures

To investigate Quantum Phenomena in nanostructured devices, low temperatures are required. Therefore, the NanoElectronics Group has setups which can cool down to the lowest temperatures in town.

### The coolest place of Twente

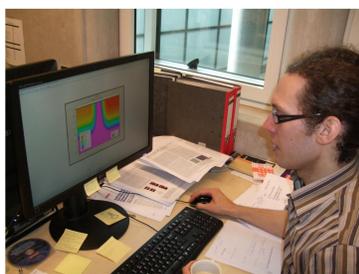
The Heliox is a setup which can cool down to 300 mK. To measure some quantum phenomena, the thermal energy has to be decreased even further. The Triton refrigerator can cool down to 10 mK with a special  $He^3/He^4$  mixture. Additionally, magnetic field dependent measurements can be performed.



## Theoretical insights

### Theory as basis

Physical properties measured in the devices are based on the laws of physics. To understand your experiments it is necessary to relate the results to models. Therefore, application of models, calculation and simulation are a fundamental part for your understanding.



### Discussions

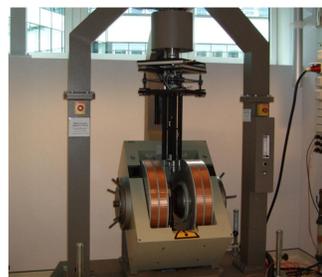
To help you to understand the theory and the results, you discuss with group members who are always willing to support you. Furthermore the group also collaborates with theoretical groups inside and outside the university.



## Characterization

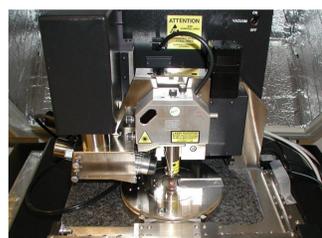
### Need to characterize

After fabrication, you are able to characterize your samples, for example measure magnetic and electronic properties of your devices with sensitive equipment available in our group.



### The facilities

In NE we have the possibilities to test (electro)magnetic and electronic properties by scanning probe techniques, several low temperature setups and large magnetic field systems. Next to that, the group is part of MESA+, which means that you are able to use the common facilities in the institute.



## Interaction

### Discussions

You will participate in our weekly group meetings. Biweekly you will have a progress meeting with your supervisor(s).

### Collaborations

Different projects involve rather different materials, for example molecules and/or nanoparticles. We have very good collaborations with several groups within MESA+ with complementary expertise. Shared Master projects are possible.

### Conferences and Publications

Good results are published in international top journals and at conferences. Once a year we all visit the "Physics@FOM" conference in Veldhoven and the MESA+ meeting.



## Social activities

### The NanoElectronics group

The NanoElectronics Group is a young group with currently about 30 members. Next to science, social events are important in the group. As a student, of course, you are encouraged to take part in the activities.

### Activities

Every year there is a NEEvent, where you will join the group outing, and have a day of activity and fun. Next to this yearly event, members of the group organize other events, to enlarge the social binding in the group.



## Graduation

Doing your Master assignment in the NanoElectronics group means that you will work with a PhD student or PostDoc who will be your daily supervisor. You will also participate in our weekly group meetings where you present your progress and discuss problems.

Finally, you will summarize and discuss your results by writing your Master thesis. After submission of your thesis you will defend your work in front of your supervisors, research group and family. This includes a presentation of your results followed by questions from your supervisors and the audience. Based on your thesis, presentation and defense you will receive your final grade. Afterwards it is time to celebrate!



### Interested to graduate in the NE group?

Feel free to contact:



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NanoElectronics (University of Twente)

