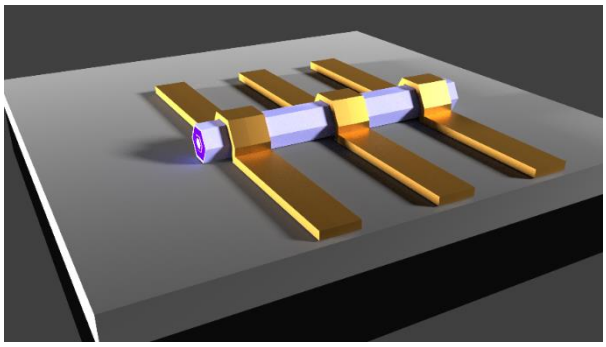
Master Thesis

Advanced Nano-Thermoelectrics using III-V based Nanowires

At the Walter Schottky Institute (WSI-TUM) we currently conduct an extensive research program on the realization of high carrier mobility III-V semiconductor nanowires and their application in next generation nanoelectronics and thermoelectric energy conversion.

An important step towards high performance nano-thermoelectric devices is the development of suitable high carrier mobility materials which simultaneously allow high electrical conductivity and large Seebeck coefficient, while minimizing thermal conductivity. In this regard, 1D-semiconductor nanowires are very promising nano-thermoelectric systems, since they exhibit reduced density of states (DOS) and complex core-multishell structure design enabling to meet all these relevant criteria.

The **goal of this M.Sc. project** is to explore novel modulation doped InAs/AlSb core-multishell nanowire heterostructures and investigate their potentials in nano-thermoelectrics by a combination of semi-classical and quantum transport experiments as well as characterization of thermal transport. Interacting closely with two PhD students you will be designing the proper InAs/AlSb nanowire materials and further transform these into 2- or 4-terminal nanowire-field effect transistor (NWFET) devices together with resistively coupled heaters using advanced nanolithography methods in state-of-the art cleanroom facilities. These nano-thermoelectric devices should be then characterized with respect to their internal structure and 1D-DOS, contact behavior, carrier density and channel length in order to identify different regimes of transport and thermopower using temperature-dependent electrical transport spectroscopy. In addition, thermal transport on these systems will also be characterized using a novel non-destructive optical technique (Raman spectroscopy).



You will learn:

- Design of low-dimensional III-V semiconductors with high carrier mobility
- Fabrication of nanoelectronic & nano-thermoelectric devices using nano-lithography
- Experience in low-noise, low-temperature electrical transport characterization
- Experience in optical spectroscopy, specifically Raman spectroscopy
- Diverse microscopy methods (AFM, SEM, He-Ion Microscopy)

Experience in the area of clean room fabrication, nanoanalytics or (nano)electronics, as well as experience using Matlab is a benefit, but secondary to motivation and commitment. Applications should be sent to Gregor.Koblmueller@wsi.tum.de Please include your CV, and a transcript of records (Bachelor & Master).

Date: May 2019