Aachen Graphene & 2D Materials Center

2D Materials and Quantum Device Group | RWTH AACHEN UNIVERSITY

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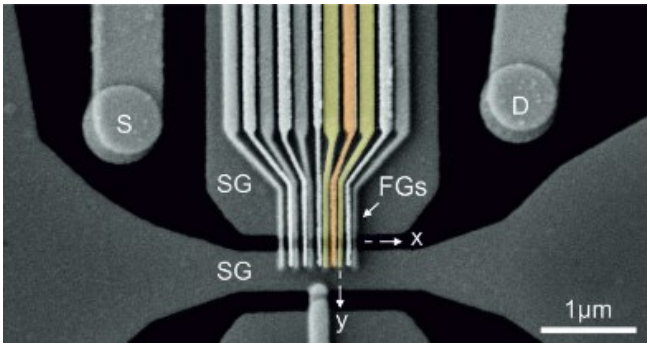
Bachelor Thesis:

Fabrication and characterization of gate-defined nanostructures in twisted bilayer graphene



Motivation: Research in the field of two-dimensional (2D) materials such as graphene and hexagonal boron nitride (hBN) is among the most exciting and fastest growing fields in modern solid state physics. Recently, the idea of twisting individual 2D materials against each other lead to the discovery of an unknown plethora of correlated quantum phases in graphene-based systems. By twisting two layers of single-layer graphene against each other, we are able to create a geometric effect (called moiré pattern) which leads at certain twist angles to gate-tunable superconductivity in this system. Advances in nanotechnology make it possible to study diverse effects in such systems. These include, for example, the realization of Josephson junctions or an Anderson-Josephson quantum dot.

Aim of this thesis: This project focuses on the development and fabrication of advanced nanostructures for twisted bilayer graphene devices and their characterization. The devices will be characterized by Raman spectroscopy, atomic force microscopy and electrical transport measurements in a dilution refrigerator at temperatures below 20 mK.

Your task: Your task includes the fabrication of quantum devices and their characterization. The focus is on fabrication and process development. In this project, you can broaden your knowledge in:

- Work with modern semiconductor fabrication technology
- Manipulation and readout of quantum devices
- Low temperature experimental setups
- Deeper understanding of basic quantum physics, electronic band structures, 2D materials and quantum devices.

Furthermore, you take part in group seminars and journal clubs where you follow current developments in this field of research and discuss recent experiments.

Contact us: For further information, pleases contact Alexander Rothstein (alexander.rothstein@rwth-aachen.de) or Christoph Stampfer (stampfer@physik.rwth-aachen.de). More information about our work you can find at www.stampferlab.org and www.graphene.ac.

Reference:

1. Cao et al., *Nature* **556**. 43-50 (2018)