Electrical transport in graphene nanoribbons bridging carbon nanotube gaps

We are looking for highly motivated students with a strong background in nanoscience, physics, or material science. We provide state-of-the-art facilities in a cutting-edge research field. For more information, please contact Dr. Jian Zhang (jian.zhang@empa.ch). For applications, please send a short motivation (including educational background and exam grades).

Graphene nanoribbons (GNRs) are nanometers-sized have attracted a strong interest from researchers worldwide as they constitute an emerging class of quantum materials. They exhibit novel physical properties beyond graphene such as a largely tuneable bandgap, optical, magnetic and topological effects, all tailorable by their edge structure. Recently, a few GNR devices with metallic electrodes or graphene gaps system have been reported. However, the integration of individual GNRs into electronic devices remains a significant challenge.

In this project, we will use single-walled carbon nanotubes (SWNT) as quasi-one-dimensional electrodes to construct individual GNR field-effect transistors. This project will open an opportunity to investigate the electronic properties of single GNR by on-chip measurements. The nanogaps in SWNTs will be fabricated using the state of art He-FIB or electrical breakdown. The temperature-dependent charge transport measurements will be carried out in probe station under vacuum. In addition, Raman spectroscopy will be used to characterize the SWNTs and GNRs. The GNRs will be provided by the group of Prof. Roman Fasel at Empa. The student will learn:

- Nanofabrication
- Nanogap creation using various methods
- Electrical transport measurements
- Raman spectroscopy
- Physics of GNR-based quantum devices