



Physical Sciences Seminar

Contact and junction resistances in 2D semiconductors

Aleksandar Matkovic

Montanuniversität Leoben (Austria)

Host: Hryhoriy Polshyn

As the 2D materials based electronics develop towards very large-scale integrated circuits, one of the major challenges is to obtain high quality contact to 2D semiconductors. Carrier injection barriers, metal induced gap states, and consequently Fermi level pinning at the electrode interfaces hinder the integration of 2D semiconductors. Intrinsic properties of the channel 2D material are rarely accessible as usually majority of the bias intended for the carrier transport is used to overcome the contact related junctions. Further, in the case of polycrystalline films and assembled nanosheet networks also junctions between adjacent domains and nanosheets govern the macroscopic response of the devices. This talk will focus on single crystalline MoS₂, WSe₂, PtSe₂, and on liquid phase-exfoliated and liquid-liquid interface assembled MoS₂ nanosheet networks. We will review several possible electrode choices, from organic self-assembled monolayers functionalized conventional metals, to van der Waals semi-metallic contacts. The focus will be on ways to evaluate contact related losses considering macroscopic electrical measurements, device modelling, and local probing of the electrostatic potential by in operando Kelvin Probe Force Microscopy. We will see how contact engineering can enhance the properties of 2D semiconductor devices, and also tailor carrier injection into 2D channels.[1] Matkovi, A., et.al., Interfacial band engineering of MoS₂/gold interfaces using pyrimidinecontaining selfassembled monolayers: toward contactresistancefree bottomcontacts. *Advanced Electronic Materials* 6, 2000110, 2020.[2] Murastov, G., et.al., Multi-Layer Palladium Diselenide as a Contact Material for Two-Dimensional Tungsten Diselenide Field-Effect Transistors. *Nanomaterials* 14, 481, 2024.[3] Gabbett, C., et.al., Understanding how junction resistances impact the conduction mechanism in nano-networks. *Nature Communications* 15, 4517, 2024.[4] Aslam, M.A., et.al., All van der Waals Semiconducting PtSe₂ Field Effect Transistors with Low Contact Resistance Graphite Electrodes. *Nano Letters* 24, 6529, 2024.

Friday, November 8, 2024 11:00am - 12:00pm

Office Bldg West / Ground floor / Heinzl Seminar Room (I21.EG.101)



This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.
Please find a schedule of the ISTA Shuttle on our webpage:
<https://ista.ac.at/en/campus/how-to-get-here/> The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.