

Paul-Drude-Institut für Festkörperelektronik (PDI) - Magnetic Materials for Spintronics and Magnetoacoustics



PDI is a research institute in Berlin, Germany. We perform basic and applied research at the nexus of materials science, condensed matter physics, and device engineering.

Magnetic properties and phase diagram of large-scale layered magnets using SQUID magnetometry

Master Thesis Title

City: Berlin; Starting date (earliest): At the earliest possible; Remuneration: 13,90 €/hour; Closing date: 26/03/26

Tasks

Layered magnets can be seen as ideal platforms for exploring magnetism in the 2D limit. To establish their potential in future technologies, the realization of high-quality magnetic layered materials exhibiting ferromagnetism (FM) and/or antiferromagnetism close to room temperature is urgently needed. Recently, we have successfully synthesized at wafer-scale using molecular beam epitaxy on the one hand side a metastable α -FeGe₂ layered phase (not found as a bulk material) and on the other hand side layered Fe₅GeTe₂ as well as Fe₃GaTe₂ films. The first one shows a ferromagnetic to anti-ferromagnetic phase transition (supported by density functional theory) below room temperature and the latter ones are 2D conductors exhibiting itinerant ferromagnetism with Curie temperature values around or even above room temperature.

Objective:

The aim of the project is to investigate the magnetic properties and to establish the magnetic phase diagram of α -FeGe₂ and/or Fe₅GeTe₂ (Fe₃GaTe₂) films. In principle, there is room for two individual projects.

Methodology:

The structural properties of the films are characterized in-house by electron and X-ray diffraction as well as atomic force microscopy to confirm superior growth results. The

superconducting

quantum interference device (SQUID) is an excellent tool to study fine details of the magnetic

properties with respect to magnetic field and temperature. The recently acquired, state-of-the-art

SQUID magnetometer at PDI allows the study of samples at magnetic fields up to 7 T in a temperature range from 1.4K up to 400K.

During the project, your tasks will include:

1. Learn the principles of SQUID magnetometry and the sample preparation for the SQUID measurements.
2. Perform SQUID measurements on a variety of α -FeGe₂ and/or Fe₅GeTe₂ films prepared by different growth conditions (thickness, growth temperature)
3. Additionally the student will gain insight in the growth process and other magnetic characterization techniques such as magneto-transport.

Expected Outcomes:

The expected main results of the project are:

- Understanding of the magnetic properties and establishing the magnetic phase diagram of α -FeGe₂ and/or Fe₅GeTe₂ (Fe₃GaTe₂) films.
- Correlation of the magnetic properties with the structural properties of the films.

Requirements

Skills and Requirements

- Background in solid state physics, materials science, or related fields.
- Experience or interest in magnetism and magnetic materials.
- High motivation, excellent interpersonal and project management skills.

What we offer

Opportunities and Benefits

- Supportive environment with experts for various scientific sub-fields.
- International and culturally diverse community.
- Location in the heart of Berlin with excellent public transport connections.
- Subsidized travel ticket.

Application

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More information at <https://stellenticket.de/201906/FUB/>
Offer visible until 26/03/26

