**PhD student in spin and orbital electronics**

The research conducted at the Department of Physics and Astronomy encompasses a wide range of physics topics, distributed over nine divisions. The department is located in the Ångström laboratory and employs nearly 400 people, 100 of whom are doctoral students. It offers a broad physics curriculum to undergraduate and graduate students, participation in nationally and internationally leading projects for researchers, and opportunities for partnership with industry and various outreach activities. Read more at www.uu.se/physics.

Here, the program Condensed Matter Physics of Energy Materials conducts research to understand electronic properties at the atomic level and to develop new functional materials for energy and environmental applications. As a part of this program, the QMD group (Quantum Material Device Group) is dedicated to researching quantum materials, developing cutting-edge quantum material devices, and exploring quantum phenomena related to charge, spin, and orbital degrees of freedom of electrons. The purpose is to harness these phenomena for applications in energy-efficient spin memories and logic circuits, flexible spintronic devices, exotic quantum sensors, and intelligent spin-integrated and neuromorphic circuits. The research focuses on two-dimensional (2D) materials like graphene, MoS2, MoSe2, or hBN and their van der Waals heterostructures, as well as quantum heterostructures using conventional thin films. The group develops custom-built experimental setups to investigate spin transport, orbital phenomena, and magneto-optical effects at low temperatures (down to 10 millikelvin using a dilution refrigerator), unraveling new charge and spin ordering forms, and emergent physics.

**Project description**

Harnessing both spin and orbital angular momentum, electrons offer two powerful properties for advancing spintronics and orbitronics—fields poised to revolutionize information technology. This holds enormous potential for breakthroughs such as ultrahigh-density memory and precision quantum sensing. The discovery of graphene and other 2D materials has sparked innovation in these areas. This project seeks to understand and develop new charge, spin, and orbital devices, such as efficient spintronic devices using 2D materials, moving toward spin-integrated circuits, or realizing new quantum phases for advanced quantum sensors. It involves cutting-edge nanofabrication at Ångström Laboratory and precision measurements using newly established experimental setups in the QMD group.

**Duties**

The successful candidate will have the opportunity to engage in cutting-edge research, utilizing state-of-the-art nanofabrication and experimental facilities. As part of the dynamic QMD team, which specializes in devices, instrumentation, advanced measurements, and diverse characterization techniques, the candidate will have the following responsibilities:

* Actively participate in group research projects.
* Conduct nanofabrication of 2D quantum heterostructures and related devices.
* Perform precision measurements and lead experiments on materials and devices.
* Drive experimental advancements in the laboratory and support broader research efforts.
* Contribute to manuscript writing and the dissemination of research findings.
* Ensure timely progress and take ownership of research milestones.

This role offers a unique chance to contribute to pioneering research in a collaborative, high-impact environment.

**Requirements**

To meet the entry requirements for doctoral studies, you must:

* hold a Master’s (second-cycle) degree in physics, or have completed at least 240 credits in higher education, with at least 60 credits at Master’s level including an independent project worth at least 15 credits, or
* have acquired substantially equivalent knowledge in some other way.
* have specialized in solid-state physics, condensed matter physics, materials science, or in another appropriate discipline.
* be fluent in spoken and written English.

Additional qualifications: Earlier experience with graphene and 2D materials, nanodevices, flexible electronics, and cleanroom work will be considered a merit.

Further, we desire that you are: enthusiastic for ground-breaking experimental research in an international research group in a highly competitive field.

professional, independent, result-oriented, and adaptable in your work, with strong problem-solving and time management skills.

open, creative, responsible, proactive, inclusive, and mature as a person.

skilled in design, scientific writing, and project organization.

able to effectively communicate inside and outside the group.

We attach great importance to personal suitability.

Rules governing PhD students are set out in the Higher Education Ordinance chapter 5, §§ 1-7 and in Uppsala University's rules and guidelines.

**About the employment**

The employment is a temporary position according to the Higher Education Ordinance chapter 5 § 7.

 **Scope of employment:** 100 %.

**Starting date:** 1 January or as agreed.

**Placement:** Uppsala

For further information about the position, please contact: Venkata Kamalakar Mutta, +46 728731687, venkata.mutta@physics.uu.se.

Please submit your application by 18 November 2024, UFV-PA 2024/3304.

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