PhD position in Structure Determination (XRD) and Modelling (DFT) of topological quantum materials

Are you a highly motivated student looking forward to doing research in a collaborative, interdisciplinary setting? Are you interested in the discovery and understanding of new quantum materials using both theory and experiment?

Job description

You will conduct research on novel magnetic topological insulators in a project hosted jointly by the group Ab Initio Quantum Materials (AIQM), led by Dr. Irene Aguilera and the group Explorative synthesis of quantum materials (ESQM), led by Dr. Anna Isaeva, at the Institute of Physics (IoP) at the University of Amsterdam (UvA). As part of our collaborative effort, you will combine X-ray (XRD) and neutron (ND) diffraction techniques and density functional theory (DFT) to determine and to model the structures of these quantum materials. Applications are now open for a 4-year full-time PhD position; the starting date is foreseen as 1 September 2023. The research will be embedded in a stimulating interdisciplinary and international research environment with local colleagues and international collaborators working in the fields of physics, nanoscience, material science and chemistry. If you are interested in joining the team, or have any questions, please contact i.g.aguilerabonet@uva.nl or a.isaeva@uva.nl.

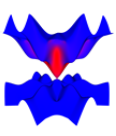
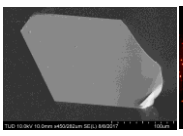
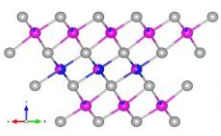
Topological insulators exhibit novel quantum properties and emergent phenomena at a macroscopic scale at ambient conditions, and possess special electronic band structures in both the bulk and at their surface, which offer exciting prospects for the development of future quantum technologies. Their exotic behaviours are governed by material's properties, such as the periodic crystal structure and atomic arrangement, spin-orbit coupling and long-range magnetic order.

The ambitious goal of this project is to get insights into the mechanisms governing the magnetic order and electron-band topology in the recently discovered magnetic topological insulators; and to design and find the best-performing candidate materials.

The QuMat consortium develops hybrid electronic, magnetic and superconducting topological materials with tailored performance, and your project will contribute essential information about their structural hallmarks. This outcome will be integrated into the continuous materials-properties-devices development cycle with other QuMat projects, in which materials of interest will be supplied by the partners and their choices and further optimization will be guided by the outcome of your project.

In this project, you will:

- Conduct original research in the field of topological matter and magnetism, focusing on the forefront family of magnetic topological insulators Mn(Sb,Bi)2Te4 and marrying the theoretical and experimental approaches.
- Perform DFT calculations of structural, electronic, and magnetic properties of topological materials.
- Collect and evaluate diffraction data from various scattering sources and determine the crystal structures of magnetic topological insulators.


- Define and analyse the mechanisms driving the magnetic order in magnetic topological insulators of the family; identify the best-performing materials with the highest Curie temperature for future applications.
- Present your research results to the international community in peer-reviewed publications and at workshops, conferences, partner meetings.
- Assist in teaching and co-supervision of undergraduates and Master's students.
- Participate in local and international collaborations on quantum materials, including the experimental groups of the Quantum Materials cluster at the IoP, Dutch national consortium "Materials for the Quantum Age" (QuMat.org), the developers of the ab initio codes from Forschungszentrum Jülich in Germany, and with magnetism and topology experts at the Leibniz IFW Institute in Dresden, Germany, and within the German Excellence Cluster "Topology and complexity in quantum matter" (ctqmat.de).
- Become a member of the leading groups in condensed matter theory and experiment and enter the vibrant, interdisciplinary community researching quantum materials in the Netherlands and EU-wide.

Qualifications

- A Master's degree in physics, materials science, chemistry or related fields.
- Background in condensed matter physics, previous experience (or strong desire to learn) theoretical condensed matter physics, diffraction techniques, crystallography.
- Desired skills or strong interest to learn them: topological matter, theoretical modelling, structure refinement, materials science.
- High motivation and ability to work in a collegial, multidisciplinary, international research environment.
- Passionate and ambitious attitude to learning and working independently.
- Excellent communication skills in both oral and written English.

Previous practical experience in performing interdisciplinary research is desirable. Additional experience with computational condensed matter techniques is appreciated, as well as some experience with DFT calculations.

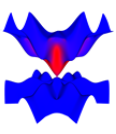
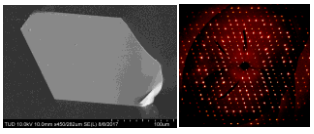
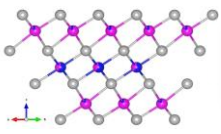
With your background in physics, and affinity for quantum materials science, you are the ideal fit to help elevate our research to the next level. The project offers you a high-level and diverse training in many aspects of modern quantum condensed matter and materials physics and will include, besides the DFT modelling, diffraction experiments and data analysis, also collaborations with the materials growers, experimentalists studying the magnetic properties and device makers.

Organisation

University of Amsterdam

The University of Amsterdam is the Netherlands' largest university, offering the widest range of academic programmes. At the UvA, 30,000 students, 6,000 staff members and 3,000 PhD candidates study and work in a diverse range of fields, connected by a culture of curiosity.

The Faculty of Science has a student body of around 8,000, as well as 1,800 members of staff working in education, research or support services. Researchers and students at the Faculty of Science are fascinated by every aspect of how the world works, be it elementary particles, the birth of the universe or the functioning of the brain.


The Institute of Physics (IoP) of the University of Amsterdam is located in the center of the Amsterdam Science Park. The IoP – as part of the Faculty of Science –is housed in a modern building with excellent labs and technical facilities. Surrounded by several national research institutes and with our partners at the Vrije Universiteit Amsterdam, the institute is part of a strong physics center of top international standing.

QuMat (qumat.org) - Materials for the Quantum Age

It is a Dutch research program under the gravity initiative. QuMat is a collaboration between researchers in Utrecht, Delft, Groningen, Amsterdam, Nijmegen, Eindhoven, and Twente. With a budget of 27 million EUR, QuMat will hire 30 PhD students and postdocs in the years 2022-2023 and another 30 PhD students and postdocs in the years 2027-2028.

QuMat will design, fabricate and characterize low-dimensional materials with electronic, magnetic or even more complex coherent quantum states. QuMat will further demonstrate materials featuring coherent transport up to room temperature and scalable, affordable materials that host robust qubit states. These materials can open the window to more efficient classic computing and upscaling of quantum computing.

To apply

If you feel that your background and interests would make a good fit, and you are interested in the job, we look forward to receiving your application. You can apply online via the link below. We accept applications until and including 30/04/2023.

Applications should include the following information (all files besides your cv should be submitted in one single pdf file):

- a detailed CV including the months (not just years) when referring to your education and work experience;
- a letter of motivation (why you think);
- transcript of grades;
- a pdf copy of your Master thesis (or a preliminary version, or at least a summary);
- the names and email addresses of two references who can provide letters of recommendation.

Only complete applications received within the response period via the link below will be considered.

The interviews will be held between the 11th and the 23rd of May, 2023.

Contact

For any further questions, please contact Assistant Professor Irena Aguilera at i.g.aguilerabonet@uva.nl or Assistant Professor Anna Isaeva at a.isaeva@uva.nl.