

Postdoctoral position in numerical approaches to low-dimensional disordered systems

Description: The research groups of Annica Black-Schaffer at Uppsala University, Uppsala, Sweden and Adrian Kantian at Heriot-Watt University, Edinburgh, U.K. invite applications for a joint postdoctoral position in many-body physics in low-dimensional disordered systems with a special focus on numerical approaches.

Project: The aim of the project is to advance the theory of many-body quantum systems realized in especially two-dimensional disordered systems, where disorder causes an enhanced non-interacting zero-energy density of states. A special focus will be on finding and characterizing potential superconducting instabilities in these systems and their competition with alternative orders. A major tool in this project will be the use of quantum Monte Carlo (QMC) simulations, as well as advanced analytical mean-field techniques. Extensions to one-dimensional systems and the use of density matrix renormalization group (DMRG) methods is also possible.

Profile: Scientific curiosity, a strong drive for original research, scientific rigor, and self-initiative are vital requirements for this position, as is a collaborative nature. The work will involve substantial use of and some modifications to existing QMC codes. This project thus seeks an applicant with a solid background and experience either in QMC methods and/or other types of numerical many-body techniques, complemented by an extensive understanding of the physics of strongly correlated systems in general. On the technical side, substantial programming abilities and experience in the use of Linux/Unix-based HPC computational clusters are essential. Knowledge of and experience with Fortran would be a major asset.

Team and environment: This position will be embedded within the research groups of the two joint PIs, with base in Uppsala and frequent visits to Edinburgh. The two groups have extensive research activities on many-body systems in both solid state matter and ultracold atomic gases, especially with a focus on unconventional superconductivity in bulk as well as in low-dimensional systems. Techniques used range from analytical Green's functions techniques and many-body dynamics in and out of equilibrium to DMRG, QMC, and dynamical mean-field theory (DMFT) calculations. Together, the groups currently comprise 9 postdoctoral researchers and 4 Ph.D. students.

Uppsala University is a comprehensive research-intensive university with a strong international standing. Our ultimate goal is to conduct education and research of the highest quality and relevance to make a long-term difference in society. Our most important assets are all the individuals whose curiosity and dedication make Uppsala University one of Sweden's most exciting workplaces. Uppsala University has over 54,000 students, more than 7,500 employees and a turnover of around SEK 8 billion. The research conducted at the Department of Physics and Astronomy encompasses a wide range of physics topics, distributed over ten divisions. The department is located in the Ångström laboratory and employs nearly 400 people, around 100 of whom are doctoral students. It offers a broad physics curriculum to undergraduate and graduate students to around 2 500 students per year, participation in nationally and internationally leading projects for researchers, and opportunities for partnership with

industry and various outreach activities. More information can be found at www.physics.uu.se

The School of Engineering & Physical Sciences at Heriot-Watt University has an international research reputation and close connection with the professional and industrial world of science, engineering and technology. We have around 150 full-time academic staff who drive this research activity and are based in 5 research institutes, which includes the Institute of Photonics & Quantum Sciences. Heriot-Watt is ranked in the top 25% of UK universities, with 82% of its research ranked as world-leading or internationally excellent. Heriot-Watt ranked 9th university in the UK and 1st in Scotland for research impact.

More information on the groups and their activities can be found on <http://materials-theory.physics.uu.se/blackschaffer/> and <http://materials-theory.physics.uu.se/kantian/>

Prerequisites: A Ph.D. degree in theoretical physics, condensed matter theory, or equivalent. Fluency in both written and spoken English is an absolute prerequisite. Ability to communicate results clearly and concisely, directly with colleagues, as well as with outside collaborators and at conferences.

Position: This position is provided in the form of a tax-free postdoctoral scholarship stipend for 2 years, with the possibility of an additional third year. Comprehensive healthcare is provided with only a small co-pay (<2 000 SEK/year).

How to apply: The application file should contain:

- (1) Letter describing the applicant and her/his qualifications and research interests
- (2) CV
- (3) Full publication list
- (4) Contact information for at least three references
- (5) Copies of relevant degrees

Please direct all queries regarding this advertisement, as well as the application package in the form of a single PDF to disorderphysics.uppsala@gmail.com

Uppsala University is striving to achieve a more even gender balance and women are especially encouraged to apply.

Starting date: Fall 2023 or as otherwise agreed.

Review of applications will begin September 11th, 2023 and continue until the position is filled.