Postdoctoral positions in many-body quantum theory for superconductivity, topology and quantum geometry

Aalto University is a community of bold thinkers where science and art meet technology and business. We are committed to identifying and solving grand societal challenges and building an innovative future. Aalto University has six schools with nearly 11 000 students and nearly 400 professors. Our campuses are located in Espoo and Helsinki, Finland.

The Quantum Dynamics (QD) Group at the Department of Applied Physics is looking for two postdoctoral researchers to work on quantum many-body theory, in particular on the connection between quantum geometry, topology and superfluidity/superconductivity, in bosonic and fermionic systems. The position is part of the current programs of the group funded by Academy of Finland. The QD research group is located on the university campus near Helsinki and offers a motivating and state-of-the-art research environment. For more information on QD research activities, see http://physics.aalto.fi/en/groups/qd/.

Research topics and major responsibilities

Your research will be directed towards understanding the significance of quantum geometry and topology on the macroscopic quantum state of bosonic and fermionic many-body systems. The emphasis will be on superfluidity, superconductivity and Bose-Einstein condensation, ordered phases competing with these, and the corresponding normal state properties. Your main responsibility is to study superconductivity and related phases in fermionic systems, in particular in the context of ultracold gases and moire materials such as twisted bilayer graphene, and to explore the effect of quantum geometry on superfluidity in bosonic systems with a connection to the experiments done in the group. Since two postdocs will be hired, you can specialize to only a subset of these topics according to your interests. The group has a powerful dynamical mean-field theory (DMFT) code, and it is desired that at least one of the postdocs would utilize it in the research. Background for the work is given by our discovery of the connection between quantum geometry and superconductivity (Nature Communications 2015, https://www.nature.com/articles/ncomms9944) which we have recently shown to be relevant in the context of twisted bilayer graphene superconductivity (https://arxiv.org/abs/1906.06313). Concerning our experiments, see the recent observation of Bose-Einstein condensation in plasmonic lattices (Nature Physics 2018, https://www.nature.com/articles/s41567-018-0109-9). For more publications by the group on these topics, see our web-page http://physics.aalto.fi/en/groups/qd/ and follow Latest publications, Research Database, Research Outputs, or use Google Scholar Päivi Törmä (click Year for the recent articles).

Qualifications

We are looking for outstanding candidates with a strong background in quantum many-body theory, mastering both analytical and numerical skills. Experience with topological physics and/or the DMFT method are considered as key advantages. Familiarity with ultracold gases, twisted bilayer graphene and other moire materials, and/or polariton/photon condensates is an asset as well. The candidate should hold a Ph.D. degree in physics or equivalent.

The ability to collaborate and interact with other researchers and research communities are important. You should have good communication skills and ability to work independently towards the goals of the project.

Position summary

The position will initially be filled for a two-year period with the possibility of an extension for one year, depending on the progress and the availability of resources. The salary will be based on the salary system of Finnish universities. The gross starting salary amounts to about 3500 €/month.

Applications

Candidates should send the following documents (all in English) as a single pdf-file.

- Application
- CV
- List of publications
- Highest degree certificate
- Contact information of three references

Apply through the page: https://www.aalto.fi/en/open-positions/postdoctoral-positions-in-many-body-quantum-theory-for-superconductivity-topology

The deadline for applications is 23 February 2020, but the position will remain open until filled. For questions, please contact Prof. Päivi Törmä (see contact information below). Aalto University reserves the right for justified reasons to leave the position open, to extend the application period, reopen the application process, and to consider candidates who have not submitted applications during the application period.

About Finland

As a living and work environment, Finland is consistently ranked highly in quality-of-life and competitiveness studies. It is the happiest place in the world according to a 2019 World Happiness Report. Finland is the most stable, freest and safest country in the world in 2019. Helsinki is the third best city in the world to live in according to a 2016 report by Metropolis magazine. The air in Finland is the cleanest in the world and the food cleanest in Europe. Finland has also been ranked the 10th in the Global Competitiveness Index 2017-2018 of the World Economic Forum. And Finns drink the most coffee per capita in the world; by the way, coffee is free at our institute! For sources see https://www.stat.fi/ajk/satavuotiassuomi/suomimaailmankarjessa_en.html and http://www.stat.fi/tup/tilastokirjasto/itsenaisyyspaiva-2019_en.html

Aalto University offers support for moving of international staff to Finland. Some useful information is available at: https://www.aalto.fi/en/careers-at-aalto/for-international-staff

Additional information

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