Master Thesis in Quantum Condensed Matter Theory

Linder Research Group

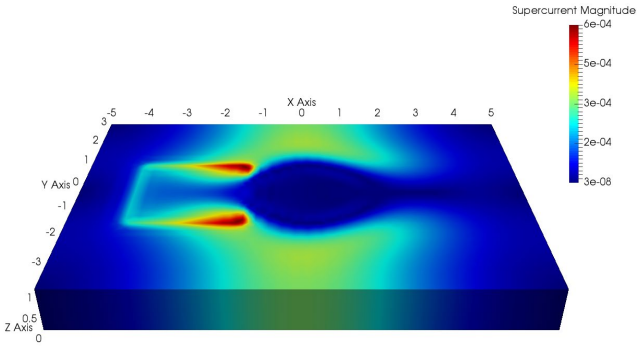
https://sites.google.com/view/lindergroup

Description

It is of considerable fundamental interest, and of technological relevance, to investigate the transport of charge, spin, and heat on the nanometer scale. On such small length-scales, the laws of quantum mechanics govern the physics and leads to surprising phenomena when it comes to how matter behaves.

One example is superconducting materials. These materials are characterized by the fact that electric currents can flow through them with exactly zero resistance and the fact that they expel magnetic fields. It goes without saying that the quantum physics behind generating currents without energy loss is not only fascinating, but also important when it comes to applications – superconductors are today commonly used for sensors, space technology, and medical imaging.

It has recently been realized that superconductors not only carry electric currents in an exotic fashion, but that they also transport *spin* and even *heat* in a way that exceeds the performance of non-superconducting materials. This occurs when they are *combined* with another type of material known as ferromagnets – systems that are magnetized.



Picture taken from the work of one of our master students depicting the theoretical prediction of supercurrent flow in a superconductor/ferromagnet structure. Through focused effort and hard work, the student managed to publish their master thesis results in one of the Nature-journals.

The research you will perform during your thesis thus be concerned with the theoretical prediction of *quantum physical effects that take place when one combines materials with fundamentally different properties*. The research is theoretical, but the goal is to make experimentally relevant predictions which can be tested in real life. The work of previous master students in our group have attracted interest from international experimental groups who have done the corresponding measurements and *verified* the outcome predicted by the student's work. It does not get much better than that for a theoretical physicist: to see the equations you have derived on paper spring to life in an experimental lab.

I invite you to take a journey into the fascinating world of condensed matter physics, which is the largest of all fields in physics. For more details regarding specific projects that I can offer, feel free to contact me.

Qualifications

The successful applicant is a motivated, collaborative, dutiful, and hardworking student with good grades. The student should have a solid background in quantum mechanics and some experience with numerical programming.

What you can expect from me and what I expect from you

You will get a supervisor who is genuinely interested in the work of his students and who will invest his time in preparing and executing supervision of your thesis work. Several of my previous master students have through dedicated work managed to publish their thesis work in prestigious journals of physics and some students have also been offered to continue with a Ph.D degree.

If you are passionate about discovering new physics and ready to write a smashing master thesis, you will find a good match in me as your supervisor.

Contact

For more information, contact Professor Jacob Linder (jacob.linder@ntnu.no), room E5-123.

Have a look at our group webpage https://sites.google.com/view/lindergroup to read more about the group members and their research.

As a member of our group, you will become part of the research center *QuSpin* where you can interact with other students in both scientific and social activities.