Master/Project Thesis - Quantum Condensed Matter Theory
Prof. Jacob Linder

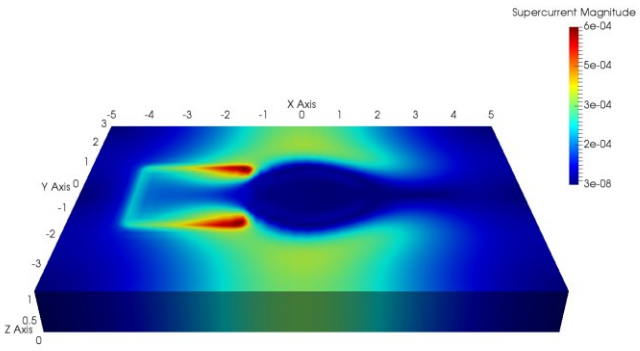
Qualifications

The successful applicant is a motivated and ambitious student with good grades. The student should preferably have a solid background in quantum mechanics and some familiarity with software such as MATLAB and Maple.

Description

It is of considerable fundamental interest, and potentially of great technological importance, to investigate the transport of charge, spin, and heat on the nanometer scale. On such small length-scales, the laws of quantum mechanics governs 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 prospect of generating electric currents without energy loss is of high interest when it comes to technologies ranging from computers to 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 present M.Sc student Morten Amundsen depicting the theoretical prediction of supercurrent flow in a superconductor/ferromagnet structure. Through hard work, he has managed to submit his work to one of the Nature-journals, which are among the most prestigious scientific peer-reviewed journals in the world.

At first glance, this might seem like a contradiction: didn't we just state that superconductors expel magnetic fields? If so, how can one combine superconductors with magnetic materials and as a result obtain superior quantum transport of charge, spin, and heat?

I invite you to take a journey into the fascinating world of quantum condensed matter physics, which is the largest of all fields in physics. What makes this exciting is that you will not only find answers to questions such

the one above, but you will discover new questions that we don't know the answer to yet. And maybe – just maybe – you will be able to find the answer and thus move the frontier of what we know about the universe forward.

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 hard work managed to publish their thesis work in highly prestigious journals of physics and some students have also been offered to continue with a Ph.D degree. If you are hardworking, ambitious, and passionate about discovering new physics, 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.
You can also read more on our group webpage http://folk.ntnu.no/jacobrun/master.html to see which topics previous master students worked on and what they accomplished.