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

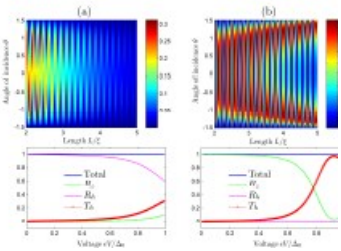
Qualifications

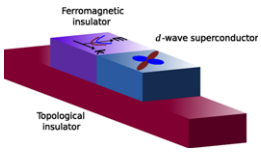
The successful applicant is a motivated and ambitious student with good grades. There may be possibilities for excellent students to continue with a Ph.D degree and also to publish their master-thesis work in prestigious journals. The student should preferably have a solid background in quantum mechanics and some familiarity with software such as MATLAB and Maple.

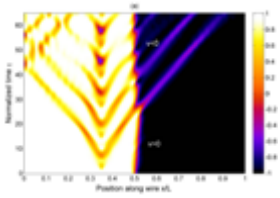
Description

Currently, it is of considerable interest, and potentially of great technological importance, to investigate the transport of charge and spin in nano-scale hybrid structures with functional properties such as superconductivity, ferromagnetism, and/or spin-orbit coupling. Besides the rich physics displayed by such systems from a fundamental physics point of view, a main goal is to achieve a tunable flow of charge- and spin-currents. This could lead to novel functionality in nanotechnological devices. For instance, such charge- and spin-currents can be used to manipulate the magnetization direction of a material, which has a direct application in the magnetoresistive random access memory technology of computers. Moreover, it has been realized that by combining superconducting and magnetic materials, it is possible to create not only charge supercurrents which flow without any resistance, but also spin supercurrents. Possible topics for the master-thesis include:

- Superconducting spintronics
- Magnetization dynamics and spin-transfer torques
- Spin and charge transport in Dirac materials







Figures

Examples of research results obtained within these topics. From left to right: superconducting transport via the proximity effect in silicene; Majorana fermions generated in hybrid structures with topological insulators; domain wall motion induced via spin-waves in ferromagnets.

Contact

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