Master-thesis in nanotechnology: theory.
Supervisor: Associate professor Jacob Linder (jacob.linder@ntnu.no)

The successful applicant is a highly motivated and ambitious student with very 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 international journals of physics.

Quantum transport in hybrid structures
Introduction: 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, and is presently being actively investigated in e.g. the field of spintronics. As an example of how the interplay between different material properties opens new perspectives with regard to quantum transport, a system consisting of superconducting and ferromagnetic elements suggests the exciting possibility of combining the spin-polarization of a ferromagnet with the lossless flow of a current offered by a superconductor.

Scope: The candidate will theoretically investigate quantum transport properties in hybrid structures which are experimentally relevant. Emphasis will be placed on revealing novel phenomena and to develop models which lead to a better understanding of the transport properties of such systems. Important topics include the role of spin-active interfaces, the influence of inhomogeneous magnetization textures, and novel spin-dependent transport phenomena.

Requirements: Having completed the course "Anvendt Kvantemekanikk TFY4210" will be advantageous, and the candidate should also complete the course "Kvanteteorien for faste stoffer FY8302" during the project/thesis. Basic programming skills are preferable (e.g. MATLAB).