Magnetic susceptometer development for millikelvin temperatures

Background
At Chalmers, we investigate novel quantum materials that are relevant for future technological breakthroughs for example in information technologies and energy transfer. These materials are characterized for their physical properties, out of which magnetic susceptibility is one of the most important one and allows for pinpointing various classical and quantum phase transitions. These phase transitions often happen at extreme conditions such as at ultra-low temperatures and high magnetic fields.

Problem description
You will design and build a magnetic susceptometer tailored for a dilution refrigerator suitable to cool down to millikelvin temperatures. Along the way, you will master millikelvin cryogenic technologies, computer-aided design principles and physical property measurements. You will also be involved in setting up and benchmark the instrument, which will give you an insight on low noise measurement techniques and instrumentation control.

Activities
The project consists of mechanical and electronic design of the susceptometer insert and an assessment of the targeted sensitivity and precision based on analytical estimates or computer simulations. A successful design will be assembled and installed, and finally benchmarked using superconducting and magnetic materials. We anticipate that the new installation will be actively used for state-of-the-art research activities and therefore writing a detailed documentation in English is part of the project.

Supervision in English, report to be written in English.

Group size
3-4 students

Target group + prerequisites
Students from programs F, GU-Fysik and E are encouraged to apply. Special prerequisites: affinity to write computer code in Python, preferably prior knowledge with CAD and finite element modeling (e.g. Comsol). A good control of the soldering iron and a general practical knowledge with electronic circuitry is a must.

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