LNCMI-Grenoble

Development of a Faraday balance for low temperature and high magnetic field

Summary *(400 caractères maxi)*

Development of a Faraday balance magnetometer for applications at high magnetic fields and low temperatures

Detailed subject *(1200 caractères maxi dont une figure possible)*

The laboratory wants to broaden the experimental techniques offered to the (european and international) users on our resistive high field magnets (35T) to the domain of magnetization – hence a probe for the longitudinal magnetization (in absolute values) suitable for very low temperatures (50mK in a dilution refrigerator as the last step) is being developed. One possible realization is a magnetometer following the working principle of a Faraday balance, i.e. detecting the force (via a capacitance change) on a magnetized material when it is placed in a magnetic field *gradient*. So far, three prototype balances have been realized and numerous tests performed. The aim of the internship is to characterize further these setups in order to improve their performance; in particular the sensitivity needs to be increased by optimizing the field gradient (geometry) the samples are exposed to. Further on, recent progress has been made on the in house fabrication of the CuBe sample platforms (which act like a spring), so that nice quantum oscillations (deHaas-vanAlphen effect) can already be resolved at 4.2K. Next steps concern the calibration of the balance (absolute values), and further tests with different kinds of samples, especially in order to validate the performance of the balance at various temperatures (below and above 4.2K) are planned.

As a working environment, there is access to a superconducting magnet (16/18T) with a VTI (minimum temperature about 1.3K), and also some magnet time on our 10MW or 20MW magnets for tests in the resistive environment are planned.

Publications linked to the theme

Faraday balance setups developed in other laboratories:

T. Sakon, M. Motokawa, Rev. Sci. Instrum. 71, 3474 (2000)

A. McCollam et al., Rev. Sci. Instrum. 82, 053909 (2011)

Background and skills expected

Basic solid state physics

Labview programming

Enthusiasm for experiments

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