

## characterization of ferromagnetic material for space cryogenics

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**PhD may follow:** Yes

### Summary :

The precise knowledge of magnetic properties of ferromagnetic materials is necessary for the optimum design of space cryocoolers. Adiabatic magnetization refrigerators (ADR) achieve temperatures lower than 100 mK (-273°C), which are necessary for the space detectors to achieve a high sensitivity necessary to astrophysics observations. Magnetic fields on the order of 1 T are generated by a superconducting coil. A magnetic shield, build from ferromagnetic materials is necessary to protect the detectors from magnetic perturbation. To optimize the design of this shield, magnetic susceptibility must be well known. Very few of these values at low temperatures are available in the literature and it is therefore necessary for us to make an experimental characterization.

This work will focus on the section and characterization at cryogenic temperature of the ferromagnetic materials, including heat treatments. A dedicated test setup will be devised in addition to measurements at our partners' laboratory of CNRS/Institut Néel and INAC/PHELIQS.

The tasks will be:

- Short literature survey on available data
- Definition of a thermal bench and test campaign
- Selection of materials, ordering
- Experimental characterization of the material, with or without heat treatment
- Modelling of magnetic system and validation of elementary measurements with current data
- Analysis and report possibly with publishing the results

### Requested skills :

magnetism, experimental science