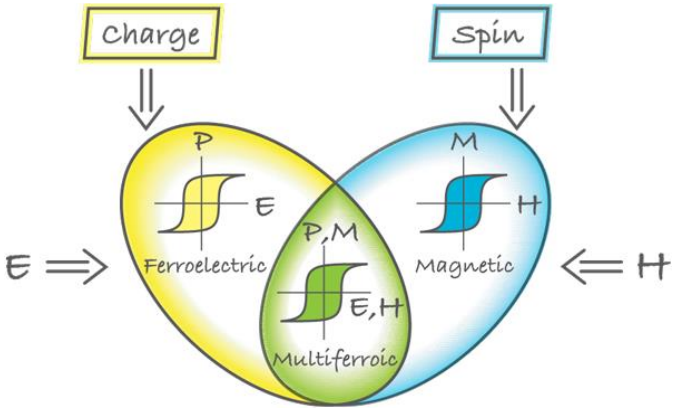
Probing Magneto-Electric Materials at Cryogenic Temperature

Magnetic and electric phenomena are generically intertwined, hence electromagnetism. Nevertheless, it is not trivial to find materials where electric and magnetic dipoles are strongly coupled to each other (magneto-electric) or magnetic and electric order coexist (multi-ferroic). It is an interesting issue, from fundamental physics point of view, to find the microscopic origins for the presence/absence of magneto-electric coupling. Moreover, controlling magnetic order by an applied electric field (or vice versa) is of great technological interest for possible application for future memory devices.



The aim of this project is to implement a dielectric property measurement system, and use it to characterise model magneto-electric materials at cryogenic temperatures. The student will explore the material's dielectric response in a wide range of temperature and a magnetic field, e.g., down to 1.5 kelvin and up to 18 tesla, or even in a three-dimensional vector magnetic field. The project will include typical training for hands-on laboratory works for quantum materials and solid-state physics research, which comprises low-temperature thermometry and electric wiring and measurements, instrument programming and handling of cryogenic liquid.

Depending on the student's interest, the contents and approach of the project is adjustable. This project is a part of our group's research activities, and can be extended into a Specialization or Master project.

For those interested, feel free to contact Prof. Henrik M. Ronnow (henrik.ronnow@epfl.ch) for further information and discussion.

Reference: Y. Tokura, Science, **312**, 1481 (2006) (access allowed at EPFL)