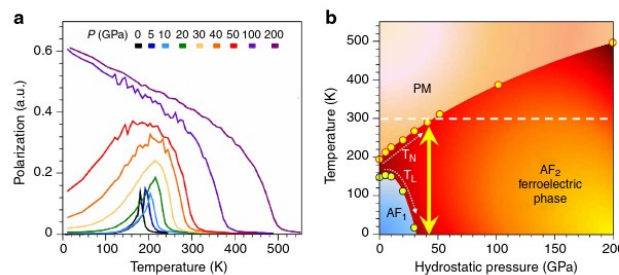


**Pressure as a way to control the coupling between magnetic and electric properties**

**General Scope:** The magneto-electric effect couples the magnetic and electric properties of a compound. It thus allows to control one type of property while acting on the other one. For instance, it is possible to modify a system polarisation using an applied magnetic field or to control the system magnetisation by the application of an electric field. These multifunctional compounds are called multiferroics and are attracting a lot of attention both in the field of fundamental research (one need to understand the fundamental mechanisms) and in the field of applied physics (for instance in microelectronics, componants design, data storage, spintronics, micro-wave componants, etc.). The magneto-electric compounds are few, the coupling often weak and working at below room temperature. It is thus of utter importance to understand the fundamental mechanism at the origin of both the coupling and its amplitude. Recent work showed that the application of external constraints such as pressure may strongly modify the magneto-electric properties of a system. THis work opened numerous fundamental questions. Why? How? Can we control this effect? Does pressure acts only on the magneto-electric coupling amplitude or on its existence itself? etc...



Temperature–pressure phase diagram of the magnetic model of CuO. Nature Com. 4, 2511 (2013).

**Research topic and facilities available:** The objective of the present theoretical internship will be to contribute to answer these questions by the calculation of the magneto-electric coupling as a function of pressure on a typical system. The student will

- learn the theoretical foundations of the magneto-electric coupling calculation
- learn the basis of electronic structure calculations
- learn how to extract the important information from the calculation in order to built a model.

For this purpose the student will have access to national and/or regional computer centers.

**Possible collaboration and networking:** The student will collaborate with other theoreticians from several French labs (ILL Grenoble, ISCR Rennes, CINAM Marseille) and to discuss with the experimentalists working on the subject.

**This internship can possibly be extended as a PhD.**

**Required skills:** The student should have a good knowledge of quantum mechanics, as well as knowledge of computers usage.

**Starting date:** between January and March 2019

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