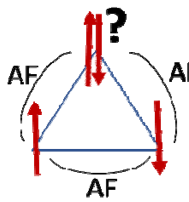
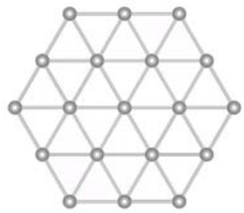
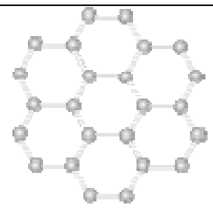
NÉEL INSTITUTE Grenoble

Master 1 internship – Academic year 2024-2025

FRUSTRATED MAGNETIC OXIDES: characterization of new compounds using optical spectroscopy

General Scope:

One of the major interests in quantum materials with magnetic degrees of freedom are frustrated magnets[1]. There, all the present magnetic interactions cannot be satisfied simultaneously, and exotic phases are predicted, either with a complex magnetic order or with liquid like behavior. The building block of magnetically frustrated lattices are triangles (see figure), the simplest one being the triangular lattice. A more sophisticated one is the honeycomb lattice. Other ingredients for magnetic frustration include the sign and anisotropy of the present magnetic interactions. As an example, on the honeycomb lattice, Kitaev [2] has solved exactly the properties of the spin liquid that arises for bond dependent magnetic interactions but very few experimental realizations exist. Studing new compounds and understanding their magnetic properties is the subject of this project.

		
Spins on a triangle coupled by antiferomagnetic interaction: frustration occurs.	2-dimenional triangular lattice	2 -dimensional honeycomb lattice

Research topic and facilities available:

Oxides are a wonderful playground when looking for new magnetic quantum materials. Among them, we have already started studying honeycomb-based compounds. These oxides contain magnetic ions from the 3d elements. Understanding their magnetic properties from the description of their electronic state is important since it allows the determination of the involved magnetic moments and their anisotropy. In this internship, the student will measure their electronic transitions in the Infrared and visible range. She/he will also characterize the lattice by measuring the associated optical phonons.

Possible collaboration and networking:

The student will interact with the other researchers from the MagSup team involved in this topic. She/He will collaborate also with the technical platforms at Institut Néel mostly for optical measurements. Comparison with complementary measurements performed on large scale facilities (Neutron and synchrotron sources) will give the student a larger view on state of the art experimental studies.

Required skills: Prerequisite in Solid Physics and electrodynamics.

Starting date: Spring 2025

Contact:

Name: Sophie DE BRION
Institut Néel - CNRS
e-mail: sophie.debrion@neel.cnrs.fr

[1] See as an example 'Spin Ices' edited by Masafumi Udagawa & Ludovic Jaubert
Springer Series in Solid-State Sciences https://link.springer.com/book/10.1007/978-3-030-70860-3
[2] Al. Kitaev. Annals of Physics 321.1 (Jan. 2006), pp. 2.