Workshop on Frontiers in Quantum Materials

September 1 – 5, 2025

ICTP-SAIFR, São Paulo, Brazil

Venue: Principia Institute

ID: 862 8678 4162
Password: quantum

GROUP 1 (Monday and Thursday)

- **Capelo, Gabriel** (Universidade de São Paulo – Inistituto de Física, Brazil): *Magnetization plateau in the kagome antiferromagnet*

In the context of systems with localized magnetic moments, we call frustration the inability to satisfy all constraints imposed by the minimization of the local interaction energies. Frustration is intimately related to a macroscopic degeneracy in the ground state, which can be lifted by what is known as order-by-disorder mechanisms. One example of this is found in the magnetization process of a triangular lattice antiferromagnet, where quantum fluctuations select colinear phases, giving rise to an incompressible phase of a magnetization plateau in a finite range of magnetic field [1], with 1/3 of the magnetization of the fully polarized system. More recently, magnetization plateaus have been discussed in the Kagomé antiferromagnet, both with numerical methods[2] and in experiments[3]. As our Hamiltonian, we take the Heisenberg model in the kagome lattice with antiferromagnetic interaction between nearest neighbors and ferro/antiferromagnetic interactions between next-nearest neighbors coupled with an external magnetic field. We employ spin wave theory to show how this plateau phase can be described semiclassically, in close analogy with the same description in the triangular lattice. The method is a series expansion in powers of 1/S, where S is the size of the spin. Another way to explain the 1/3 plateau is in terms of a crystalization of localized magnons[4] based on the flat band in the magnon dispersion. We investigate this picture taking into account next nearest neighbours' interactions J2, when the band acquires a small dispersion. We discuss the plateau width's dependence on the spin size and the strength of J2.