Latinamerican Webinar of Magnetism- ALMA Latin-American Magnetism Association



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"Investigating the nature of a geometrically frustrated material: spin-ice"

Geometrically frustrated magnetic materials, where the symmetry precludes the possibility of satisfying every pairwise interactions, are extremely interesting systems from a statistical mechanical point of view. The competition between different ordering tendencies can induce complex and novel phenomena. A particularly notable example of this type of systems are the so-called 'spin-ice' materials, which are an experimental example of fractional magnetic excitations and emergent Coulomb-like interactions.

Spin-ice materials owe their name to their analogy with water ice. The 'ice-rules' that the ground state must obey are the very origin of the emergent gauge structure. The theory predicts a macroscopically disordered state with Pauling's residual entropy. Additional interactions, such as a dipolar term, are expected to break this degeneracy and order the system at sufficiently low temperature. Yet, no evidence of long range order has been found, and the true nature of the ground state of spin-ice systems remains a mystery, which the extremely rapidly growing characteristic times shroud into further obscurity.

The idea of this talk is to give a general introduction to this problem and class of materials and to discuss some of the tools used to investigate their nature, including diffuse neutron scattering, heat capacity, susceptibility and noise measurements, and theoretical and computational analysis, including machine learning techniques.



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