

Fundamental physics in the complex material CoNb₂O₆

Ribhu Kaul (University of Kentucky)

The phenomena of magnetism was known to humans of the ancient world. Yet a microscopic understanding of magnetism only began a century ago with the advent of quantum mechanics and statistical physics and specifically with the introduction of the iconic Ising model in 1920. The deceptively simple Ising model has turned out to host remarkably rich phenomena central to many sophisticated ideas of modern theoretical physics. In this talk I will introduce some of these profound ideas and explain how they come together beautifully in THz spectroscopic and neutron scattering experimental and theoretical studies of the insulating magnetic material, CoNb₂O₆. At a microscopic level in our recent work we have shown that spin-orbit coupling leads to bond dependent interactions which in turn is observed to play an essential role in the rich domain wall dynamics observed in this material. The bond dependent interactions opens up the possibility of realizing Kitaev like models in Co²⁺ 3d⁷ magnets.

<https://arxiv.org/abs/2009.14189>