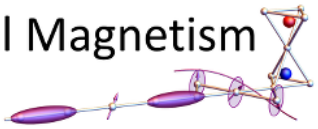
Unconventional Magnetism
Seminars



Thursday 4 April, 2 pm

Seeing beyond the light:
Vison and photon electrodynamics in quantum spin ice

Claudio Castelnovo

University of Cambridge, UK

Understanding the nature and behaviour of excitations in quantum spin liquids, and in topological phases of matter in general, is of fundamental importance and has proven crucial for experimental detection and characterisation of candidate materials. Current theoretical and numerical techniques, however, have limited capabilities, especially when it comes to studying gapped excitations.

In this talk, I will discuss a semiclassical numerical method, based on a large-S path integral approach, to study systems whose spin liquid behaviour is underpinned by perturbative ring-exchange Hamiltonians. The method can readily access both thermodynamic and spectral properties. I will focus in particular on quantum spin ice and its photon and vison excitations. After benchmarking the method against existing results on photons, I will show how it can be used to characterise visons and their thermodynamic behaviour. We find that visons form a weak electrolyte -- in contrast to spinons in classical spin ice. That is, vison pairs are the dominant population at low temperatures. This is reflected in the behaviour of thermodynamic quantities, such as pinch point motifs in the relevant correlators. Moreover, visons appear to strongly hybridise with the photon background, a phenomenon that likely affects the way these quasiparticles may show up in inelastic response measurements. I will conclude with a brief discussion of the significance of our results and an outlook on further applications of our method.