Department of Physics
Condensed Matter Physics
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UNIVERSITY OF OXFORD

CONDENSED MATTER PHYSICS SEMINAR

Thursday 22 January at 14:30
Simpkins Lee Seminar Room, Department of Physics
(https://maps.app.goo.gl/WjG71uLF2D48n85B6)

Emergent Excitations from Degeneracy in an Ising-Like Triangular Antiferromagnet

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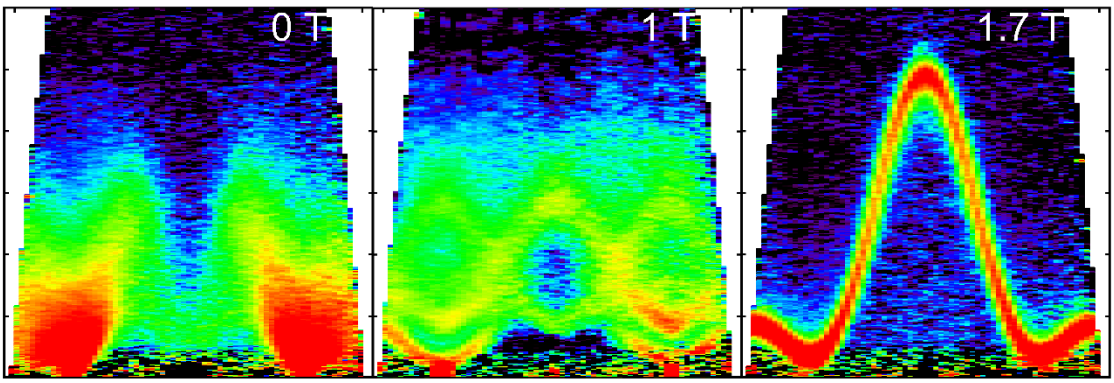
Triangular lattice spin models have been extensively studied theoretically as potential hosts of unconventional magnetism arising from strongly frustrated interactions. The triangular Ising antiferromagnet provides a canonical example of an exactly solvable classical spin liquid, with an extensive ground-state degeneracy [1]. Away from the pure Ising limit, but still in the strong easy-axis regime, nontrivial behaviour is expected due to the persistence of a sub-extensive classical degeneracy. This regime remains experimentally rather unexplored, as only recently has it become possible to synthesize suitable material realizations.

Here we report high-resolution inelastic neutron scattering (INS) measurements of a disorder-free spin-1/2 triangular lattice antiferromagnet in the Ising-like regime, tracking the evolution of its excitation spectrum as a function of transverse magnetic field [2]. Essential for this work has been the development of a flux-seeded growth technique, which produced large, centimetre-size, high-quality single crystals. In zero field, we observe a dominant excitation continuum, which evolves through an intermediate-field phase with broadened magnons and ultimately into sharp magnons in the high-field polarized state. We propose that the zero-field continuum of excitations is related to the existence of a manifold of mean-field degenerate ground states within each triangular layer, with frustrated interlayer couplings selecting a complex three-dimensional magnetic order. We compare the experimental results with expectations based on this picture.

[1] G.H. Wannier, *Antiferromagnetism. The Triangular Ising Net*, Phys. Rev. 79, 357 (1950).
[2] Leonie Woodland, Ryutaro Okuma, J. Ross Stewart, Christian Balz, and Radu Coldea, *From continuum excitations to sharp magnons via transverse magnetic field in the spin 1/2 Ising-like triangular lattice antiferromagnet $Na_2BaCo(PO_4)_2$*, Phys. Rev. B 112, 104413 (2025).



Host: Professor Amalia Coldea