Department of Physics
Condensed Matter Physics
Clarendon Laboratory, Parks Road, Oxford OX1 3PU

UNIVERSITY OF OXFORD

CONDENSED MATTER PHYSICS SEMINAR

Thursday 5 March at 14:30
Simpkins Lee Seminar Room, Department of Physics
(https://maps.app.goo.gl/WjG71uLF2D48n85B6)

Strain Control of Unconventional Quantum Magnets

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Quantum magnets host a wide range of collective states that emerge from the interplay of strong correlations, competing interactions, and topology. Identifying and distinguishing these states experimentally requires tuning parameters that can be applied in a precise, controlled and reversible manner.

Uniaxial pressure and strain are particularly promising tuning parameters for quantum magnets, as they directly modify lattice symmetries and frustrated interactions. However, only recent technical developments have made it possible to apply strain in a controlled way at low temperatures. These advances now enable systematic experimental studies of the phase diagrams of frustrated and other exotic quantum magnets.

In this talk, I will outline the concept of strain and the experimental tools used to apply it, and then focus on frustrated Mott insulators, for which uniaxial pressure offers a particularly effective way to tune the frustration. Using a triangular-lattice magnet as an example [1], I will show that the levels of strain achievable in current experiments are sufficient to significantly influence frustration in real materials. These experimentally derived phase diagrams provide an important, new benchmark for comparison with theoretical models.

Time permitting, I will also touch on how applying symmetry-breaking strains in a controlled manner plays a crucial role in probing and tuning unconventional multipolar orders [2], such as altermagnetism.

[1] Lieberich, …, EG, Science Advances **11**, eadz0669 (2025).
[2] Ohlendorf, …, EG, to be submitted.

Host: Professor Amalia Coldea