

CONDENSED MATTER PHYSICS SPECIAL SEMINAR

Thursday 23 July at 14:30

Simpkins Lee Seminar Room, Department of Physics

(<https://maps.app.goo.gl/WjG71uLF2D48n85B6>)

Structure, control, and dynamics of altermagnetic textures

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Altermagnets are magnetically ordered materials that combine fast magnetic dynamics with large spin splitting of electronic bands. Both of these effects arise from strong (non-relativistic) exchange interactions between local magnetic moments and electron spins. In my talk, I will present a phenomenological theory of altermagnets that can describe their unique magnetisation dynamics and model magnetic textures in this emergent collinear magnetic ordered phase with zero net magnetisation and alternating spin polarisation in the non-relativistic electronic band structure. Focusing on prototypical d-wave altermagnets such as RuO_2 , we can intuitively explain the unique lifted degeneracy of their magnon spectra by the emergence of an effective, sublattice-dependent, anisotropic spin stiffness, which arises naturally from the phenomenological theory. I will also discuss a symmetry-based approach to describing altermagnetic textures and dynamics using the altermagnetic candidate Mn_5Si_3 as an example. The approach's key point is an altermagnetic order parameter that formalises the symmetry of the magnetic atoms' local environment and enables the altermagnetic behaviour to be distilled [1]. I will demonstrate how this concept enables us to reconstruct the equilibrium magnetic structure of Mn_5Si_3 from the field dependencies of the AHE [2–4]. Finally, I will discuss the spin wave spectra and dynamics of the altermagnetic domain wall, focusing on a comparison between the altermagnetic and antiferromagnetic phases of the material.

[1] O. Gomonay, et al, npj Spintronics 2, 35 (2024)

[2] J. Rial, et al, Phys. Rev. B, 110, L220411 (2024)

[3] M. Leiviskä, et al, Phys. Rev. B 109, 224430 (2024)

[4] R. Zarzuela, et al, Phys. Rev. B 111, 064422 (2025)