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Studying Altermagnetism with Muon-Spin Spectroscopy

Altermagnetism has recently emerged as a third fundamental class of magnetism [1], with spin-spilt bands but no net magnetisation. As well as being of fundamental interest, this magnetic state has some properties of both ferromagnets and antiferromagnets which are particularly interesting for spintronic applications [2]. Key to altermagnetism is rotational symmetry between flipped magnetic moments, which makes understanding the precise magnetic structure of utmost importance. Further, it has been suggested that altermagnets may have unique dynamic fluctuations [3]. Given these pressing questions, muon spin spectroscopy (μSR) measurements can provide information that is complementary to, and unique from, other probes. In this talk I will present how we are using μSR to probe altermagnets. I will discuss a number of materials, including $Co_{1/4}NbSe_2$ [4], a proposed g-wave altermagnet. Our measurements, combined with muon stopping site calculations, have confirmed the magnetic structure, and tested some of the key predictions of altermagnetism.

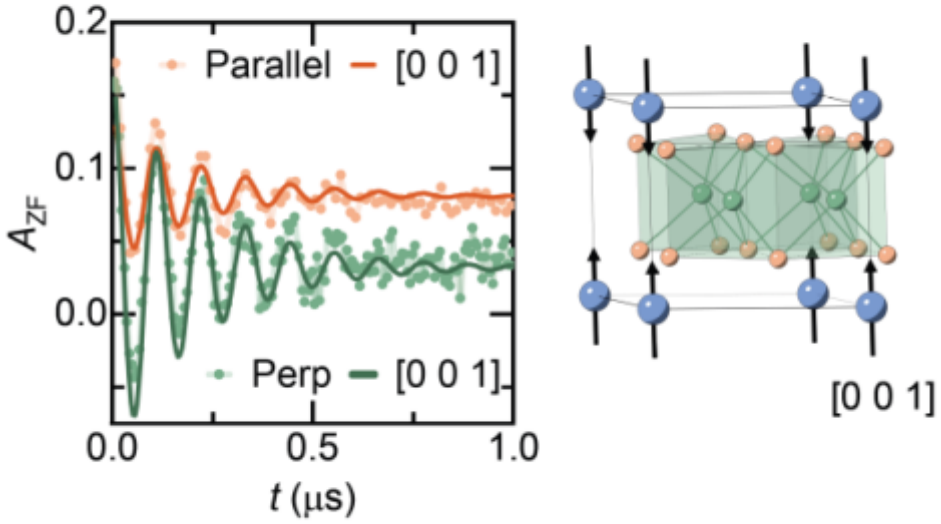

Figure 1: F1

Fig 1: Our μSR measurements of $Co_{1/4}NbSe_2$ have verified the altermagnetism-consistent magnetic structure, and tested how the state responds to a magnetic field.

[1] L. Šmejkal et al., Sci Adv. 6, eaaz8809 (2020)
[2] L. Bai et al., Adv. Funct. Mater. 2024, 2409327 (2024)
[3] N. Dale et al., arXiv:2411.18761 (2024)
[4] J. N. Graham, T. J. Hicken et al., arXiv:2503.09193 (2025)

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