Contribution ID: **182** Type: **Oral**

Insights into skymion-hosting materials from implanted muons

Monday, 29 August 2022 12:20 (20 minutes)

Low-dimensional magnetism continues to be of great theoretical and experimental interest, as reduced dimensionality supports strong fluctuations that can result in novel states and excitations. One theme in this field is the understanding of magnetism in reduced dimensions using notions from topology. Examples include topological objects such as walls, vortices and skyrmions, which can potentially exist in the spin textures of a range of systems. In recent years, the experimental discovery of skyrmions in magnetic materials and of their self-organization into a skyrmion lattice, together with their potential for use as high density, low-energy sensors and magnetic storage, has made the investigation of such magnetic topological objects particularly important[1].

Here we report insights gained from our muon-spin spectroscopy (μ^+SR) investigations of materials with topological excitations, including: (i) order and dynamics in $GaV_4S_{8-y}Se_y$, a system hosting Néel skyrmions in which μ^+SR shows how their stability is enhanced through chemical substitution and the application of pressure[2]; (ii) the skyrmion-hosting multilayer system $Ta/[CoFeB/MgO/Ta]_{16}$, where low-energy μ^+SR uniquely reveals changes in the magnetic structure with depth into the multilayer stack; (iii) $Cr_{1/3}NbS_2$, which hosts topological soliton excitations, and where we show that the magnetism is determined directly by features in the electronic bandstructure[3]. These investigations demonstrate how the combination of μ^+SR, magnetometry and electronic structure calculations, both to determine muon sites and more generally, can be used to achieve additional insights into the underlying magnetic behaviour.

[1]T. Lancaster, Contemp. Phys. **60**, 246 (2019). [2]T.J. Hicken *et al.*, Phys. Rev. Research **2**, 032001(R) (2020); Phys. Rev B **105**, 134414 (2022). [3]T.J. Hicken *et al.* Phys. Rev. B **105**, L060407 (2022).

Primary author: LANCASTER, Tom (Durham University)

Co-authors: Dr SUTER, Andreas (PSI); Dr HUDDART, Benjamin (Durham University); PRATT, Francis (STFC); Prof. BALAKRISHNAN, Geetha (Warwick University); Dr GOMILSEK, Matjaz (Duham University); Dr WILSON, Murray (Durham University); Dr KHASANOV, Rustem (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland); Dr ZHANG, Shilei (ShanghaiTech University); BLUNDELL, Stephen (University of Oxford); HICKEN, Thomas (Durham University); Dr PROKSCHA, Thomas (PSI); Prof. HESJEDAL, Thorsten (University of Oxford); Mr HAWKHEAD, Zachary (Durham University); Mr SALMAN, Zaher (Laboratory for Muon Spin Spectroscopy, Paul-Scherrer-Institute, CH-5232 Villigen PSI, Switzerland)

Presenter: LANCASTER, Tom (Durham University)

Session Classification: Oral contributions

Track Classification: Strongly correlated electron systems