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Anomalous Temperature Dependence of Local Magnetic Fields in Altermagnetic MnTe

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Altermagnets are a novel type of magnetic system that has a spin-polarized electric band structure in the absence of a net magnetic moment. Microscopically this arises from two opposite spin sublattices that are connected by a lattice rotational symmetry instead of a simple translation or inversion [1]. A ferromagnetic-like transport response makes these systems particularly interesting for potential device applications [2]. Hexagonal MnTe is a prototypical altermagnet consisting of alternating ferromagnetically ordered Mn layers [3,4]. Importantly, it exhibits the expected strong spin splittings in the electronic band structure [5]. Here we present muon spin spectroscopy (μSR) measurements on MnTe single crystals and thin films. Surprisingly, below room temperature we observe pronounced anomalies in the depolarization as well as an onset of a second, non-proportionate zero field oscillation frequency. These findings point to a more complex temperature evolution of the local magnetic environment probed by the muon.

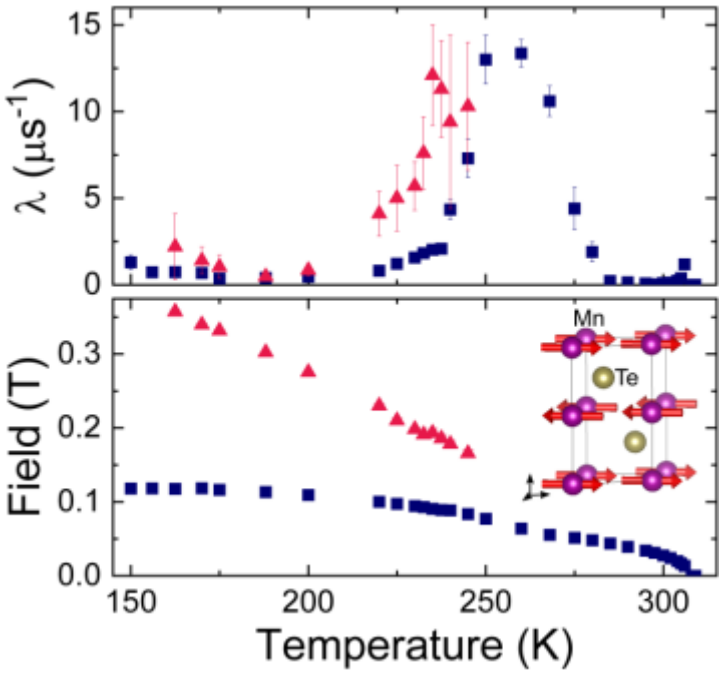

Figure 1: Figure

Figure: Depolarization rate and local field measured in zero field μSR. The inset shows the expected altermagnetic structure.

[1] L. Šmejkal et al., Sci Adv. 6, eaaz8809 (2020)
[2] L. Bai et al., Adv. Funct. Mater. 2024, 2409327 (2024)

[3] N. Kunitomi, et al., J. Physique 25, 568 (1964)
[4] D. Kriegner, et al., PRB 96, 214418 (2017)
[5] J. Krempaský, et al., Nature 626, 517–522 (2024)

Email

jonas.krieger@psi.ch

Funding Agency

Supervisors Name

Supervisors Email

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Primary authors: KRIEGER, Jonas A. (Paul Scherrer Institute); HICKEN, Thomas (Paul Scherrer Institute); AMIN, Oliver J. (University of Nottingham); DAL DIN, Alfred (University of Nottingham); DIL, J. Hugo (École Polytechnique Fédérale de Lausanne); JANKA, Gianluca (PSI); KRIEGNER, Dominik (Czech Academy of Science); LUETKENS, Hubertus (Paul Scherrer Institute); PROKSCHA, Thomas (Paul Scherrer Institute); REICHLOVA, Helena (Czech Academy of Science); Dr SALMAN, Zaher (Paul Scherrer Institute); SPRINGHOLZ, Gunther (Johannes Kepler University Linz); SUTER, Andreas; UHLÍŘOVÁ, Klara (Charles University, Prague); WADLEY, Peter (University of Nottingham); KREMPASKÝ, Juraj (Paul Scherrer Institute)

Presenter: KRIEGER, Jonas A. (Paul Scherrer Institute)

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