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μSR Observation of Anisotropic Skyrmion and Meron Spin Dynamics in Centrosymmetric Gd_2PdSi_3

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Skyrmion lattices (SkLs) are intriguing vortex-like spin textures with non-trivial topology [1,2]. While they are typically stabilized by antisymmetric interactions in bulk noncentrosymmetric materials, centrosymmetric SkL hosts, such as Gd_2PdSi_3 [2–4], have recently been discovered. There, both the SkL stabilization mechanism under applied fields and the zero-field ground states (GSs) remain controversial.

To address these questions, we have investigated the spin dynamics in Gd_2PdSi_3 using μSR [5]. We find highly anisotropic spin fluctuations in its SkL phase [Fig. 1(a)], suggesting a prominent role of anisotropy in SkL stabilization. Intriguingly, we also observe anisotropic dynamics in the GS [Fig. 1(b)], implying that it is a complex meron spin texture, confirming Ref. [4] and refuting other predictions.

Our μSR study Ref. [5] highlights the importance of spin anisotropy even in centrosymmetric SkL hosts and strongly constrains possible SkL stabilization mechanisms.

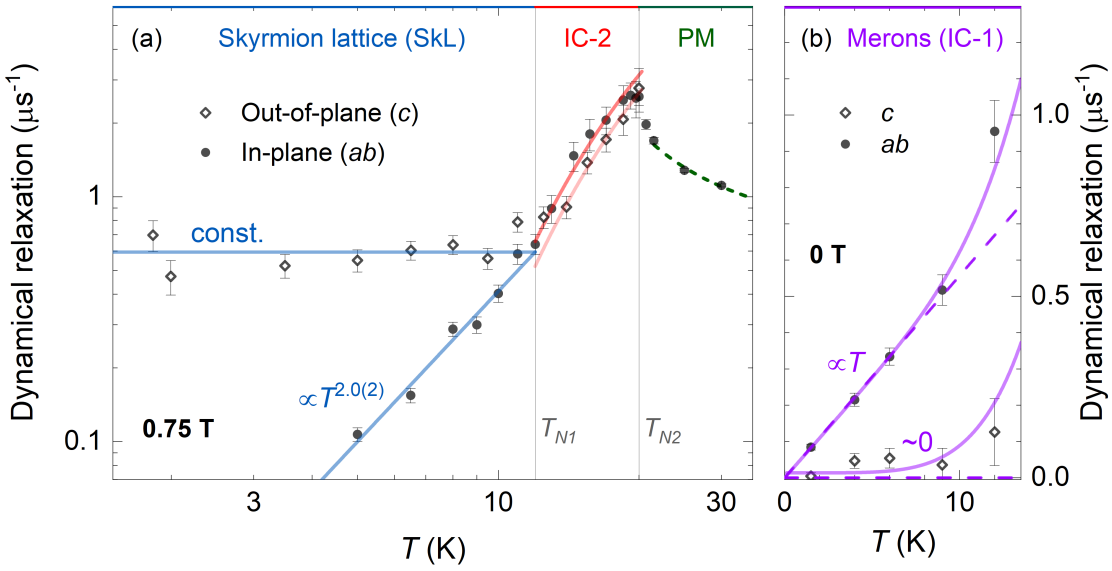

Figure 1:

Fig. 1. Muon relaxation in Gd_2PdSi_3 in (a) the SkL, fanlike (IC-2), and paramagnetic (PM) phases in 0.75 T; and (b) in the meron GS.

[1] T. Lancaster, Contemp. Phys. **60**, 246 (2019).
[2] J. Khatua *et al.*, Phys. Rep. **1041**, 1 (2023).
[3] S. Li *et al.*, Interdiscip. Mater. **2**, 260 (2023).

[4] T. Kurumaji *et al.*, Science **365**, 914 (2019).
[5] M. Gomilšek *et al.*, Phys. Rev. Lett. **134**, 046702 (2025).

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