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Universal fluctuating regime in triangular chromate pure Heisenberg S=3/2 antiferromagnets

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The series of triangular compounds $ACrO_2$ is a model series for studying the Heisenberg model on S=3/2 (Cr^{3+}: half-filled t_{2g} orbitals) triangular antiferromagnets and the impact of interlayer couplings on the dynamics. For this, we report μSR measurements on α-$HCrO_2$ and $KCrO_2$ [1] which complete former studies on the series of triangular compounds $ACrO_2$, A = Li , Na [2, 3]. Coupled to ^{1}H and ^{39}K nuclear magnetic resonance (NMR), we establish the static character at low-T, as expected for a near neighbour Heisenberg model, yet displaying a broad and remarkable regime with slow fluctuations extending from T_N down to 0.2 T_N. This regime is marked by a maximum in the μSR relaxation rate occuring at 0.7 T_N, associated with an NMR wipe-out .
The scaling of the NMR and μSR data with respect to J or T_N supports a scenario where a crossover from 2D to 3D correlations sets in around 0.7 T_N preceded by a typical 2D regime of the TLHAF which appears to be a hallmark of the TLHAF with ABC stacking. We discuss the role of interlayer frustration which may bear implications to recent spin-liquid candidates with the triangular geometry and exclude a scenario à la Berezinskii-Kostelitz-Touless of vortex-antivortex topological excitations in that regime. In turn, this underlines the crucial need of further neighbour interactions, anisotropy typical of rare earth or even disorder to stabilize a quantum spin liquid state in triangular antiferromagnets such as $YbMgGaO_4$.
[1] K. Somesh et al. Phys. Rev. B 104, 104422 (2021).
[2] A. Olariu et al. Phys. Rev. Lett. 97, 167203 (2006).
[3] A. Olariu et al. Phys. Rev. B 79, 224401 (2009).

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