Slow spin dynamics in van der Waals spin glass material

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A spin glass is a disordered magnetic state where randomly oriented spins freeze in a frustrated, non-periodic configuration. Unlike conventional magnets, spin glasses lack long-range order and exhibit slow dynamics and aging effects [1].
To date, only a few studies have reported spin glass behaviour in van der Waals (vdW) materials, such as Fe-doped Fe_3GeTe_2 and CeSiI [2,3]. Another candidate is $NbFeTe_2$ (NFT) which has previously shown signs of spin glass state [4], but its magnetic properties have varied between studies, often displaying usual ferromagnetism. Recently, it was demonstrated that the crystal structure and stoichiometric ratios significantly influence magnetic behaviour of NFT, allowing either a ferromagnetic phase or a spin glass state depending on the crystal structure [5].
In this work, the evidence and analysis of a spin glass state in the vdW material NFT will be presented through multiple methods. Magnetic Circular Dichroism (MCD) data revealing aging effect and fast and slow decay rates of magnetization in response to external field and temperature changes. Magnetic Force Microscopy (MFM) measurements showed spin dynamics at the microscale, showing clustering of the magnetic moments which further experience relaxation with times extending up to several hours. Complexity and Fast Fourier Transform (FFT) analyses further revealed the relaxation of the disordered micromagnetic structure of spin clusters.

References

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Figures

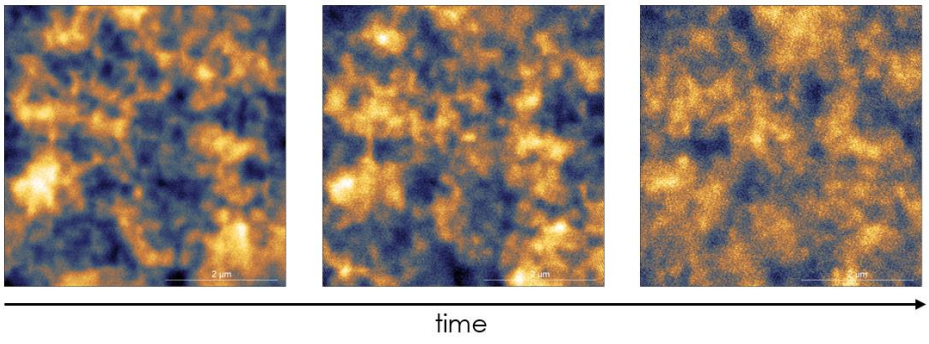

Figure 1: MFM images of time dependence of the magnetic signal of NFT flake at 1.7 K after changing magnetic field from 0 to 250 mT. Image size is 5x5 μm^2.