Magnetic resonance experiments on micrometre sized uniaxial chiral helimagnet crystals

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In a magnetic crystal with structural chirality, chiral spin soliton lattice (CSL) emerges as the ground state when a magnetic field is applied perpendicular to helical axis (Fig. 1(a)). The CSL is a spin object consisting of a nonlinear periodic array of 2π kinks and exhibits phase coherence over macroscopic length scale [1]. Materials with such properties are excellent candidates for spintronics applications [2] as the CSL phase may be seen as a 'naturally occurring nanostructured system whose spin texture is reconfigurable and topologically protected by the crystalline structure [3, 4].

In this talk, I will present results on broadband frequency magnetic resonance experiments performed on micrometre sized crystals of the chiral uniaxial helimagnet $CrNb_3S_6$. The resonance behaviour was examined in two distinct excitation configurations, as illustrated in Fig. 1(b)-(c): (I) where the helical axis is parallel to the microwave field (h_{MW}) and (II) where the helical axis is perpendicular to h_{MW}. On both (I) and (II) the magnetic field was applied perpendicular to the helical axis. The resonance response in the collinear ferromagnetic state was the same on both configurations. Remarkably, a clear difference in the resonance frequency is found in the CSL regime ($H < H_C$) in the configurations (I) and (II). This result suggests that resonant absorption largely depends upon the polarization of the microwave excitation field with regards to the helical axis [5].

Keywords: Nanostructured materials, helimagnetism, chirality, magnetic resonance

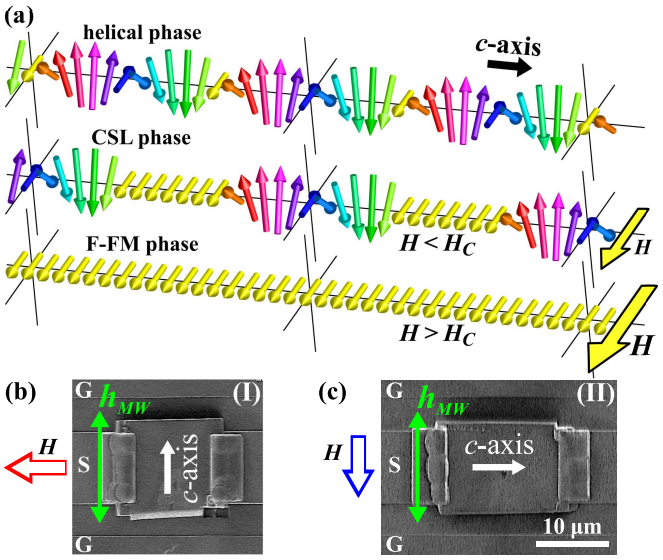

Figure 1: (a) Illustration of the spin textures associated with the chiral helical, CSL and F-FM phases. SIM images showing the orientation of the helical axis (c-axis), H and h_{MW} with regards to the ground (G) and signal (S) of the co-planar waveguide in configurations (I)-(b) and (II)-(c).

References

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