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Modulated magnetic ground state and complex phase diagram in the chiral helimagnet $Cr_{1/3}NbS_2$ EM CLEMENTS, R DAS, Univ. of South Florida, L LI, Univ. of Tennessee, P LAMPEN-KELLEY, Univ. of Tennessee, Oak Ridge National Lab, MH PHAN, Univ. of South Florida, VEERLE KEPPENS, Univ. of Tennessee, D MANDRUS, Univ. of Tennessee, Oak Ridge National Lab, H SRIKANTH, Univ. of South Florida — The chiral helimagnetic ground state of noncentrosymmetric $Cr_{1/3}NbS_2$ originates from competition between coexisting symmetric ferromagnetic (FM) exchange and the antisymmetric Dzyaloshinskii-Moriya (DM) interaction. Previously, it has been shown via Lorentz microscopy that a field induced chiral soliton lattice (SL) exists followed by an incommensurate-commensurate metamagnetic transition to a FM state. The high crystalline anisotropy as well as magnetic and temperature control of the c-axis oriented spin spiral has generated interest for spintronic applications. Currently, only a preliminary phase diagram has been proposed and details of the phase evolution, specifically from the paramagnetic (PM) to the helicoid HM and SL states, have not yet been determined. In this study, we exploit the magnetocaloric effect (MCE) to construct a phase diagram by determining the magnetic entropy change (ΔS_M) under the influence of applied field and temperature variations. Well below the Curie temperature (T_c $\sim$131K) we see the onset of SL formation at $\sim$1kOe and a FM transition $\sim$1.2kOe. A negative ΔS_M value indicates that the system also shows weak FM behavior in a narrow region just below T_c, where thermal fluctuations destabilize the weaker DM coupling, before transitioning into the HM phase at lower temperatures.

Eleanor Clements
Univ. of South Florida

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