Experimental report

15/09/2019

Proposal: 5-41-1007 **Council:** 10/2018

Title: Nuclear and magnetic structure in powders and single crystals of Cr2Ge2Te6 – Stacking faults?:

Research area: Physics

This proposal is a new proposal

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Samples: Cr2Te2Ge6

Instrument	Requested days	Allocated days	From	To
D9	3	5	18/07/2019	23/07/2019
D23	4	0		
D2B	1	1	18/07/2019	19/07/2019

Abstract:

The Mermin-Wagner theorem predicts that magnetic ordering in a truly two-dimensional magnet is marginal with long-range order predicted to occur in anisotropic environments and no ordering is expected in isotropic cases such as Heisenberg type symmetries. We recently investigated the magnetic fluctuations at low energies in two dimensional Cr2Ge2Te6 using MACS finding incommensurate magnetic fluctuations forming nearly vertical rods of scattering in momentum and energy as well as localized ferromagnetic fluctuations. The high velocity nature of these incommensurate excitations is indicative of an underlying large energy scale possibly connected with the semiconducting electronic nature of this material or a more complex ferromagnetic structure. We propose to investigate the nuclear and magnetic structure using the diffractometers at the ILL. In particular, we aim to 1) search for static incommensurate magnetic peaks; 2) Measure the commensurate magnetic structure ; 3) measure the nuclear structure in powders and single crystals to search for differences.

The experiment had two goals:

1) Confirm the magnetic structure of $Cr_2Ge_2Te_6$ reported in the literature.
2) Measure the magnetic structure and nuclear structure in single crystals used for neutron inelastic scattering.

The powder experiment confirmed goal 1, however the single crystal structure found incommensurate magnetic ordering near the (003) position where previously published powder results (and ours) show commensurate (003) ordering. The magnetic nature was confirmed through a temperature dependence. We were not able to locate any other magnetic scattering.

The nuclear scattering showed a different staging of the Ge-Ge dimers than reported before. In published single crystal data, stage-3 and stage 2 structures have been reported. We found that our single crystals had a stage-1 structure. This illustrates how stacking the 2d layers can alter the bulk properties in 2D van der Waals crystals.