ESRF	**Experiment title:** Resonant X-ray Scattering Studies of AFM order in $SmMn_2Ge_2$	**Experiment number**: HE1702
Beamline: ID20	**Date of experiment**: from: 31/03/2004 to: 06/04/2004	**Date of report**: 27/2/2005
Shifts: 18	**Local contact(s)**: Dr. Stuart B. Wilkins	*Received at ESRF:*

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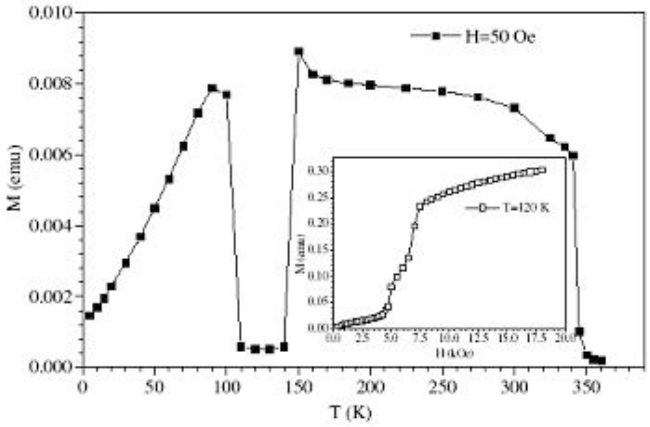
Report:

The ternary compound $SmMn_2Ge_2$ is the most unusual member of the RT_2X_2 family. It displays three different magnetic phase transitions below 350 K, including the presence of giant magnetoresistance (GMR) in an antiferromagnetic phase (AFM). In this AFM phase between 100~K and 150~K there are moments from both the Sm and Mn ions. This complicates the magnetic picture, and so far only non-element sensitive techniques have been used to study the system. Bulk magnetisation measurements have been undertaken showing such behaviour. Although many transport measurements have been made on this material, neutron experiments have been rare due to the high absorption of ^{149}Sm, making the experiments very difficult.

During March 2004 a sucsessful experiment was conducted on $SmMn_2Ge_2$ on ID20. The sample was mounted within a closed cycle refrigerator (He) on the "*Super-phi*" axis of the 4-circle diffractometer. After initial crystalographic allignment, the sample was cooled to a temperature of 130 K to coincide with the AFM region as shown in Figure 1.

Satellite peaks were located surrounding principal Bragg reflections and off-resonant magnetic scattering was observed.



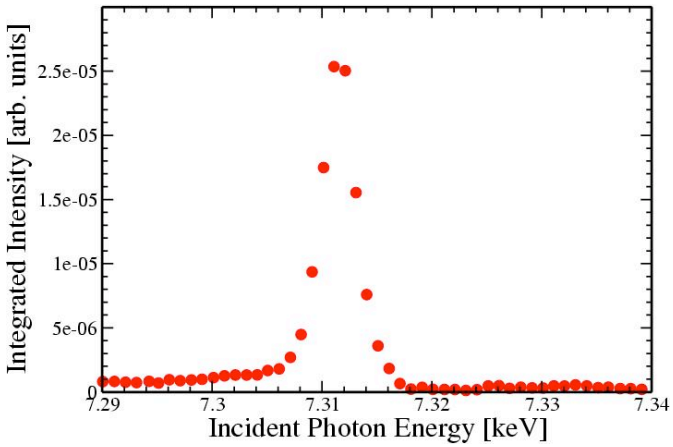


Figure 1 (left) : Magnetization as a function of temperature for $SmMn_2Ge_2$, the inset shows the hysterisis loop taken as a temperature of 120 K.

Figure 2 (right): Resonance of the antiferromagnetic reflection through the Sm L_2 edge.

The integrated intensity as a function of energy was measured for this reflection yielding a surprising result. Upon tuning to the Mn *K*-edge no change in the integrated intensity was found. However, upon tuning to the Sm L_2-edge a strong resonant enhancement was observed with a weaker enhancement at the L_3-edge (The L_2-resonance is shown in Figure 2). This is consistent with the antiferromagnetic component residing on the Sm sites, contrary to the model of Tomka[1]. In addition, upon further cooling of the sample below the re-entrant region to a base temperature of 10 K the anti-ferromagnetic component was found to persist but display a large incommensurability.

Due to the very weak (< 50 cps) of the antiferromagnetic reflection coupled with the need to integrate the reflection as a function of energy to obtain the resonances due to the high background from Mn fluorescence we were not able to finish this study. In order to prepare this for publication a further 18 shifts of beamtime will be required.

[1] G. J. Tomka *et al., Physica B* **230-232**, 727 (1997)