

Experimental report

19/08/2024

Proposal: EASY-1148

Council: 10/2022

Title: Magnetic structure of Gd₃Fe₃Sb₇ as a function of temperature

Research area: Physics

This proposal is a new proposal

Main proposer: Henry FISCHER

Experimental team:

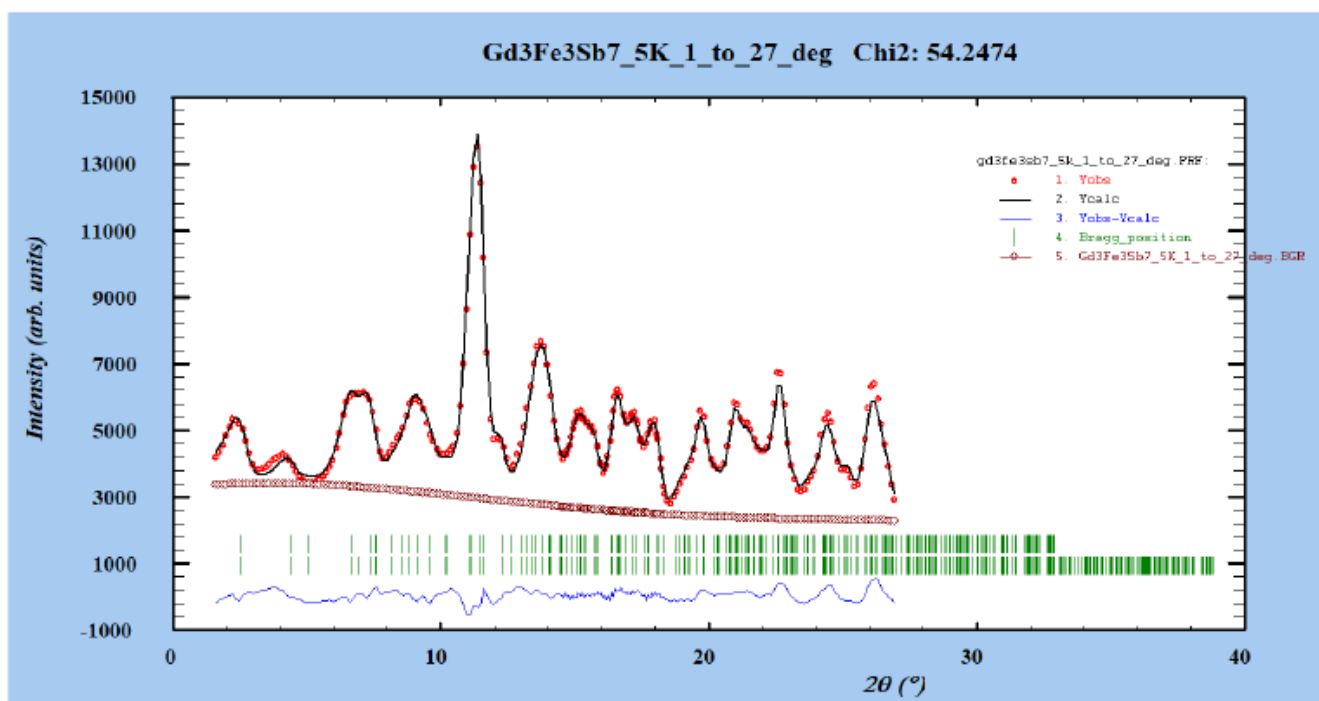
Local contacts: Henry FISCHER

Samples: Gd₃Fe₃Sb₇

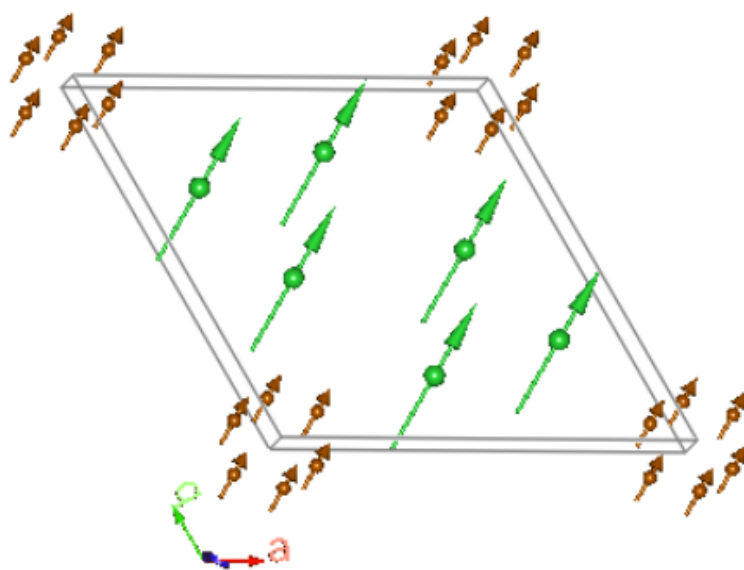
Instrument	Requested days	Allocated days	From	To
D4	24	24	22/09/2023	23/09/2023

Abstract:

Preliminary magnetization studies suggest that Gd₃Fe₃Sb₇ exhibits ferromagnetic ordering, i.e. with Gd moments parallel to Fe moments, despite the fact that Gd is a heavy-rare earth metal. This would contradict the common rule, whereby the magnetic moment of a light rare-earth metal orders parallel to the magnetic moment of a 3d transition metal (ferromagnetic structure), whereas the magnetic moment of a heavy-rare earth metal orders antiparallel to the magnetic moment of a 3d transition metal (ferrimagnetic structure). The previous magnetic measurements indicating ferromagnetism in Gd₃Fe₃Sb₇ are however only indirect proof. Neutron diffraction data are needed to make any conclusions about its magnetic structure.



I took all parameters (U, V, W, bow, atom coordinates, etc) from 500 K and only varied lattice parameters, scale and magnetic moment in different magnetic structures. This is magnetic structure with best R-factors:



magnetic moment of Gd = 5.29694 μ_B
 magnetic moment of Fe = 1.71371 μ_B

This magnetic structure corresponds well with data from magnetic measurements: Gd₃Fe₃Sb₇ has in-plane magnetic anisotropy, spontaneous magnetization is $5.3 \times 3 + 1.7 \times 3 = 21 \mu_B$ and later it reaches its saturation at $7 \times 3 + 1.7 \times 3 \sim 27 \mu_B$.