# Experimental report

08/09/2022

**Proposal:** DIR-237 **Council:** 4/2021

**Title:** Topological Multi-k Magnetic Structure in SmCoIn5

**Research area:** Materials

**This proposal is a new proposal**


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**Experimental team:** David TAM

**Local contacts:** Oscar Ramon FABELO ROSA


**Samples:** Ce0.6Sm0.4CoIn5
154SmCoIn5
Smlrln5

| Instrument | Requested days | Allocated days | From | To |
|---|---|---|---|---|
| D9 | 7 | 7 | 30/08/2021 | 06/09/2021 |


## Abstract:

Our preliminary neutron scattering experiments demonstrate topological magnetic phases in SmCoIn5, the end member of a series involving a quantum critical crossover to superconductivity. However, the data quality is limited by absorption issues. We now propose hot neutron diffraction in order to fully resolve the magnetic structures.

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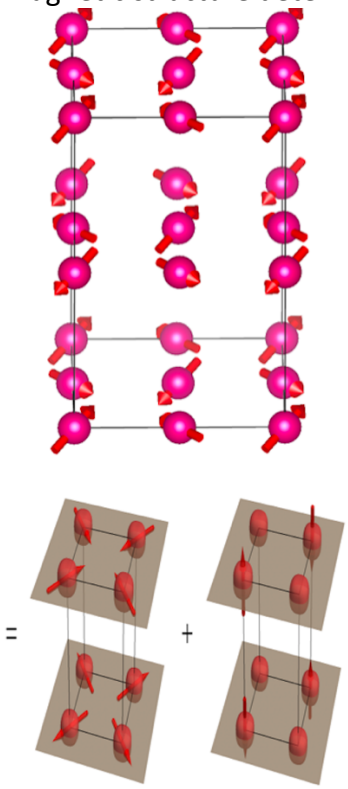
In this experiment we studied the magnetic structure of SmCoIn5 at D9. Initially we mounted the sample with too much glue, contributing both to background scattering as well as an imbalance in the magnetic twin domain populations which could have been due to either blocking part of the sample or from internal strain. Therefore after 1 day we decided to re-mount the sample, which resulted in a 25% reduction in the background and we observed nearly equal domain populations. We then confirmed the propagation vector Q=(1/2,0,1/2) and collected data in the low-temperature phase at T=2 K for most of the remaining days. We also investigated the incommensurate phase near T=10 K, however, we found that the background remained too high to make useful measurements. This could be due to short-range nature of the scattering in the incommensurate phase, but more likely just related to the high background coming from the Cu moderator, from gamma decays, and from the reactor hall.

Nevertheless we were able to solve the magnetic structure using two multi-q irreps, which indicates a high degree of frustration in the magnetic structure and we are continuing to refine our models as we prepare to publish.

Magnetic structure determined from D9 experiment:



Magnetic form factor of Sm3+ and D9 refinement: