# Experimental report

24/08/2021

**Proposal:** **5-41-1095** **Council:** 4/2020

**Title:** Determining the magnetic structures of noncentrosymmetric EuPtAs in applied fields

**Research area:** Physics

**This proposal is a continuation of 5-41-1011**


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**Samples:** EuPtAs

| Instrument | Requested days | Allocated days | From | To |
|---|---|---|---|---|
| D9 | 3 | 3 | 25/03/2021 | 30/03/2021 |


**Abstract:**

We propose to probe the field-dependence of the magnetic structure of the noncentrosymmetric compound EuPtAs. Noncentrosymmetric intermetallic magnets have been found to exhibit a range of complex, non-collinear magnetic phases, including field-induced skyrmions and other magnetic states with topological spin-textures. We recently synthesized single crystals of EuPtAs, which we found undergoes two antiferromagnetic transitions in zero-field. Upon the application of a magnetic field, the system undergoes multiple transitions, giving rise to a complex field-temperature phase diagram. We recently performed single crystal neutron diffraction measurements of EuPtAs in zero-field on the D9 instrument, where we found that the magnetic structure is incommensurate along both the a- and c- axes. Here we propose to probe the magnetic structure of the field-induced magnetic phases by measuring EuPtAs on the D9 instrument in fields up to 5T along the c-axis. This will allow us to look for the presence of field-induced topological magnetic phases, and to gain an understanding of the complex magnetism in the system.

**Experimental report: Determining the magnetic structures of noncentrosymmetric EuPtAs in applied fields**

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We performed single crystal neutron diffraction measurements on the antiferromagnetic compound EuPtAs using the D9 instrument. Our physical properties measurements reveal the presence of two magnetic transitions in zero-applied field, and multiple field-induced magnetic phases. We proposed to determine the magnetic structures in different phases (both zero field and in-field) using hot neutrons on D9. In the previous experiment, we measured in the two zero field magnetic phases (with transitions at 15 K and 7 K), and in this experiment we measured in magnetic fields up to 6 T applied along the c-axis, with a normal beam geometry.

After cooling to 2 K, we first checked the accessible reflections based on the propagation vectors we found in the previous experiment. We found all the magnetic peaks related to the zero field propagation vectors (±0.52, 0, 0.56) and (0, ±0.52, 0.56). We also searched for additional peaks, especially related to ***k*** = 0 order corresponding to a possible ferromagnetic component, but additional peaks were not detected. We then performed measurements under magnetic fields, focusing on two magnetic reflections with relatively strong intensity. We find that the propagation vectors do not change up to 3.5 T, although the intensities decreased approaching the field-induced transition, while at 4.0 T, there are new magnetic peaks which do not correspond to the zero-field propagation vectors.

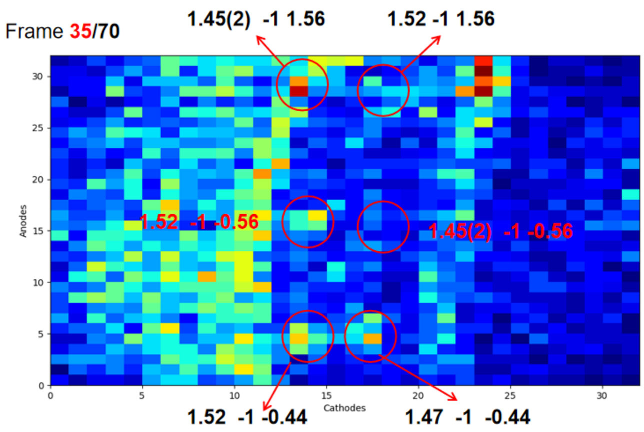


Fig.1 Magnetic peaks at 3.5 T in incommensurate positions in the vicinity of (1.5 -1 0.5). The red circles show the positions of magnetic peaks corresponding to the propagation vectors found in zero-field, which persist up to 3.5 T with reduced intensities.

For the ω-scans, we used a two-dimensional detector to record the possible peaks but centered at the nearby commensurate (*hkl*) positions, such as (1.5 -1 0.5) as displayed in Fig. 1. As a result, the magnetic peaks are not located at the centre of the detector. Moreover, for the new magnetic peaks at fields above 3.5 T, the propagation vectors still need to be determined from further analysis. A possible contamination from the $\lambda/2$ signal is to be checked in the coming cycle, with support from the local contact. Work is currently underway to analyze the possible magnetic structures, and fit the data with different models.