Experimental report

22/01/2024

Proposal: **INTER-577** **Council:** 4/2023

Title: Excitations in UCr2Si2C

Research area:

This proposal is a new proposal

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Samples: Mn5Ge3
UCr2Si2C

Instrument	Requested days	Allocated days	From	To
IN12	6	6	02/06/2023	09/06/2023
ORIENTEXPRESS	1	1	30/05/2023	31/05/2023
IN8	3	3	28/11/2023	01/12/2023

Abstract:

Aim of the test beam time

In this test beam time we investigated the ferromagnet (FM) Mn_5Ge_3 and the antiferromagnet (AFM) UCr_2Si_2C.

(1) Inelastic neutron scattering (INS) measurements were performed on IN12 on a Mn_5Ge_3 single crystal in order to obtain data for finalizing a manuscript. Part of the obtained spectra are now published in Nat Commun **14**, 7321 (2023) (DOI: https://doi.org/10.1038/s41467-023-43042-3). IN12 was set up in W-configuration. We used a double focusing PG monochromator and a PG analyzer. Data have been collected with a fixed k_f. The single crystal (with a mass of about 10g) was mounted with the [100] – [010] directions in the scattering plane of the hexagonal symmetry. We used a 2.5T vertical magnet as sample environment and data were collected at T=10K.

(2) INS measurements on IN12 were performed on a UCr_2Si_2C single crystal in order to obtain preliminary data. This helped us select the desired (**Q**,E) range we needed to obtain the lattice and magnetic excitations of this compound. We used these data to write an ILL proposal for the second round of 2023 (IN8 proposal 90714, title: Spin and lattice excitations in UCr_2Si_2C). IN12 was set up in W-configuration. We used a double focusing PG monochromator and a PG analyzer. Data have been collected with a fixed k_f=2 $Å^{-1}$. The single crystal (with a mass of about 4g) was mounted with the [100] – [010] directions in the scattering plane of the tetragonal symmetry. We used a cryofurnace as sample environment and data were mainly collected at T=10K. Using unpolarized neutrons we observed strong inelastic signal around the zone centers **G**=(1,1,0) and **G**=(2,0,0) for energy transfers E<9meV.
In the last day of the test we used polarized neutrons in order to investigate the magnetic ordering of this compound. The incident neutron beam spin state was prepared with a transmission polarizing cavity located after the velocity selector. For the experiment, a PG monochromator, a monitor, and a Heusler analyzer were used. All along the neutron path, guide fields were installed to maintain the polarization of the beam. In order to access different polarization channels Helmholtz coils were employed. The offset of the analyzer was measured with a vanadium sample. A flipping ratio of about 22 was measured on a graphite sample. We measured on NSF and SF the 6 diagonal elements of the polarization matrix at T=10K on the Bragg peak **G**=(1,0,0). By a canonical subtraction of intensities we obtained the polarization direction of the magnetic signal.

(3) INS measurements on IN8 were performed on a UCr_2Si_2C single crystal in order to investigate magnetic and lattice excitations for energy transfers E<40meV. We used these data to write an ILL proposal for the first round of 2024 (IN20 proposal 91066, title: Spin excitations in UCr_2Si_2C). IN8 was set up in W-configuration. We used a double focusing Si monochromator and a PG analyzer. The data have been collected with a fixed k_f=2.662 $Å^{-1}$. The single crystal (with a mass of about 4g) was mounted with the [100] – [010] directions in the scattering plane of the tetragonal symmetry. We used a cryofurnace as sample environment and spectra were mainly collected at T=10K. Selected scans were repeated at T=300K.