Experimental report

26/08/2022

Proposal: **INTER-546** **Council:** 4/2021

Title: Search for resonance in superconducting UTe2

Research area:

This proposal is a new proposal

Main proposer: **Stephane RAYMOND**

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Samples: UTe2 (numéro interne ILL : 1124)

Instrument	Requested days	Allocated days	From	To
IN12	5	5	30/06/2021	05/07/2021

Abstract:

PROJECT SUMMARY REPORT

This document can be found on the INTERNET at the following address:
http://www.cordis.lu/improving/
(look under "Access to Research Infrastructures" and then
under "Information for Project Managers")

Project Title	Search for resonance in superconducting UTe2
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1. Project objectives (no more than 10 lines)

Superconductivity and magnetic-field-induced superconductivity has been recently found to emerge below Tsc = 1.6-1.8 K in the paramagnetic heavy-fermion system UTe2. The upper critical field is strongly anisotropic and is near 35 T for the magnetic hard crystallographic direction b. It has proposed that spin-triplet pairing is realised. Recently, low dimensional antiferromagnetic fluctuations were observed in the normal state of UTe2 by neutron scattering.
Here, we proposed to search for the modification of the magnetic excitation spectrum in the superconducting phase of UTe2. A so-called resonance is often observed in the magnetic excitation spectrum measured by neutron scattering in the superconducting phase as seen in cuprates, iron based superconductors and heavy fermion systems. The search for a feedback effect on superconductivity on the magnetic excitation spectrum of UTe2 is important to tighten the pairing symmetry and the role of magnetic fluctuations.

2. Main achievements and difficulties encountered (no more than 20 lines)

We investigated the spin dynamics in the superconducting phase of UTe2 by triple-axis inelastic neutron scattering on a single crystal. At the wave-vector k1 = (0; 0:57; 0), where the normal state antiferromagnetic correlations are peaked, a modification of the excitation spectrum is evidenced, on crossing the superconducting transition, with a reduction of the relaxation rate together with the development of an inelastic peak at $\Omega \approx 1$ meV. The low dimensional nature and the a-axis polarization of the fluctuations, that characterise the normal state, are essentially maintained below the superconducting transition. The high ratio $\Omega = k_B T_{sc} \approx 7.2$ contrasts with the most common behaviour in heavy fermion superconductors.

work published in:
"Feedback of superconductivity on the magnetic excitation spectrum of UTe2", S. Raymond, W. Knafo, G. Knebel, K. Kaneko, J. -P. Brison, J. Flouquet, D. Aoki, and G. Lapertot, J. Phys. Soc. Jpn. 90, 113706 (2021).