preliminary report

ESRF	**Experiment title:** Spin and orbital parts of magnetic moments in UFe2 determined by X-ray diffraction	**Experiment number**: HC-2670
Beamline: ID 12	**Date of experiment**: from: 19/10/2017 to: 24/10/2017	**Date of report**:
Shifts: 18	**Local contact(s)**: Andrey Rogalev	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Dr. Vladimir E. Dmitrienko, A.V.Shubnikov Institute of Crystallography, Moscow, Russia

Dr. Kseniya Kozlovskaya, Moscow State University, Moscow, Russia

Dr. Elena N. Ovchinnikova, Moscow State University, Moscow, Russia

Dr. Jun Kokubun*, Faculty of Science and Technology, Tokyo University of Science, Japan

Report:

Scientific Background

The greatest advantage of x-rays in magnetism research is a possibility to disentangle spin and orbital magnetic moments. It is routinely done with XMCD method, which gives an element selectivity but relies on a number of approximations: determination of the number of holes, exact knowledge of the magnetic dipole term <Tz > etc. Another approach is to use the non-resonant magnetic x-ray diffraction. It has been developed in 1972 but is rarely used due to the weakness of the signal [1, 2]. With the present performances of ID12 the signal is expected to be not so small.

We proposed to measure the ratio of spin/orbital magnetization in UFe2 using non-resonant magnetic diffraction of circularly polarized x-rays and interference with charge scattering [1, 3], and to compare data with XMCD data taken on the same crystal under exactly the same experimental conditions. In combination with the *ab initio* calculations the result will also allow us to find spatial distribution of spin and orbital moments and their possible non-collinearity.

Experimental details

Due to the inability to transport UFe_2 across the border, measurements were taken on another rare-earth crystal $CeFe_2$ with the same symmetry.

Results

We have measured the absorption energy dependence of $CeFe_2$ near the Ce L2 and L3 edges with right and left circular polarized beam and with the two opposite directions of the magnetic field directed perpendicular to the beam (fig 1-3).
Measurements of non-resonant magnetic diffraction was not done because of failure of beamline equipment.

References

[1] Gibbs D., Harshman D. R., Isaacs E. D., McWhan D. B., Mills D. and Vettier C., Phys. Rev. Let. 61 1241 (1988).
[2] Collins S. P., Laundy D. and Guo G.Y., J. Phys.: Condens. Matter 5, L637 (1993).
[3] L. Bouchenoire, S. D. Brown, P. Thompson, C. Detlefs, and M. J. Cooper, Nucl. Instr. Method A 566, 733 (2006).

Report Summary

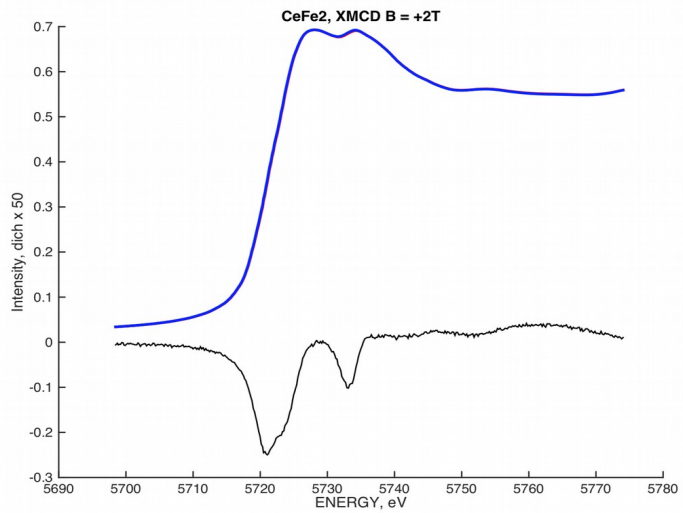

Fig.1. XANES and XNCD*50 spectrum near L2-edge of Ce in CeFe with magnetic field B = 2 Tesla.

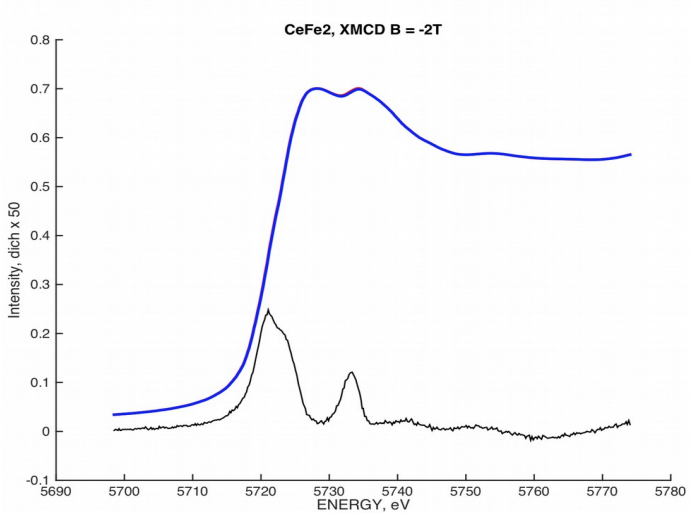

Fig.2 XANES and XNCD*50 spectrum near L2-edge of Ce in $CeFe_2$ with magnetic field B = -2 Tesla.

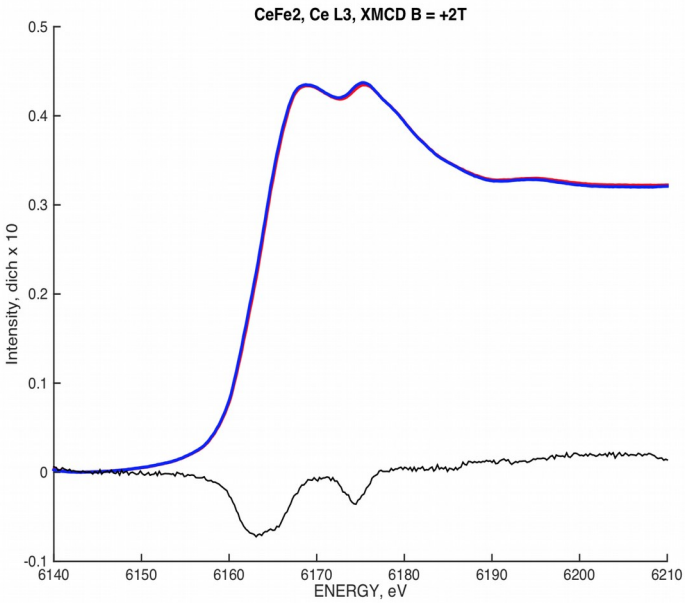

Fig.3.XANES and XNCD*50 spectrum near L3-edge

of Ce in $CeFe_2$ with magnetic field B = -2 Tesla.	