



	<b>Experiment title:</b> <b>XMCD studies of ferromagnetic superconductors</b>	<b>Experiment number:</b> <b>HE-3019</b>
<b>Beamline:</b> ID12	<b>Date of experiment:</b> from: 22.04.2009 to: 28.04.2009	<b>Date of report:</b> 18.10.2012
<b>Shifts:</b> 18	<b>Local contact(s):</b> Dr. Rogalev Andrei	<i>Received at ESRF:</i>
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## Report:

In spite of the initial idea of the experiment was to study the ErRh<sub>4</sub>B<sub>4</sub> ternary boride, we got much more interesting results on the other system EuRh<sub>4</sub>B<sub>4</sub>, that is also ferromagnetic and superconductive at the same time.

The results were presented at the 45<sup>th</sup> PNPI School on Condensed Matter Physics (Russia, 2011), at Moscow International Symposium on Magnetism (Moscow, 2011) in the form of oral talk and are already published in Solid State Phenomena, Vol. 190 (2012), pp. 421-424 (Trans Tech Publications, Switzerland):

**NEW TERNARY BORIDE EuRh<sub>4</sub>B<sub>4</sub> SYNTHESIZED UNDER HIGH PRESSURE AND TEMPERATURE** / A. Smekhova<sup>1,2,a,\*</sup>, L. Fomicheva<sup>3</sup>, A. Tsvyashchenko<sup>3</sup>, V. Sidorov<sup>3</sup>, and A. Rogalev<sup>2</sup>

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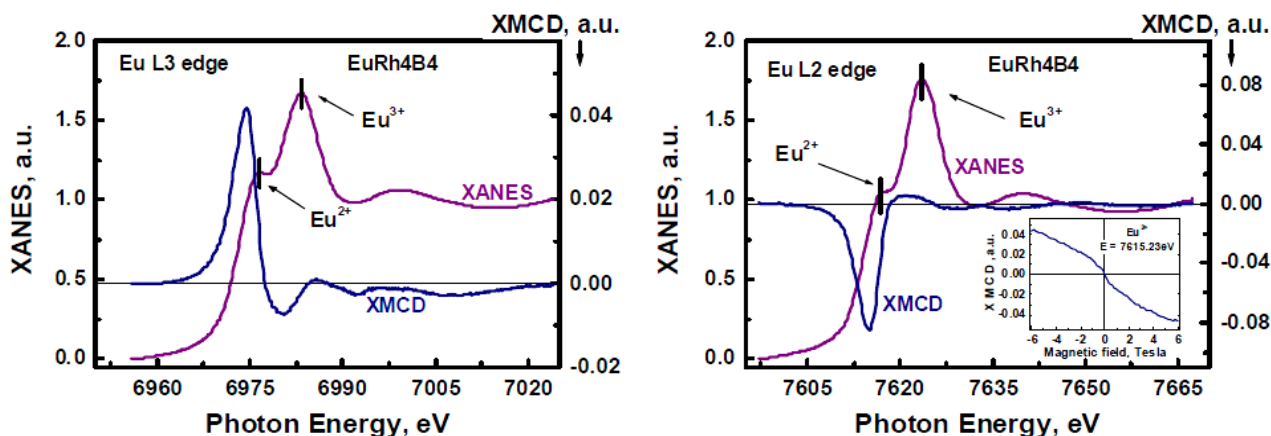
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## The abstract is:

We report the results of a detailed study of EuRh<sub>4</sub>B<sub>4</sub> compound synthesized by an uncommon method under high pressure – temperature conditions for the first time. Synthesized sample has been initially characterized by X-ray diffraction, macroscopic electrical resistivity and acsusceptibility methods. The ferromagnetic and superconducting phases were found below 83K and 5.8K respectively. Element- and shell- selective XANES and XMCD techniques have been further applied to check the possible valence transition of Eu ions and their magnetic states. XANES spectra recorded at the Eu L<sub>2,3</sub> absorption edges clearly indicate the presence of either “magnetic” Eu<sup>2+</sup> or “non-magnetic” Eu<sup>3+</sup> ions in the sample. The XMCD studies have also shown that local magnetic moments of Eu<sup>2+</sup> ions exist in the superconducting EuRh<sub>4</sub>B<sub>4</sub>, at least above the transition.



Normalized XANES (left scale) and XMCD (right scale) spectra at the Eu L<sub>3</sub> (left) and Eu L<sub>2</sub> (right) absorption edges measured for EuRh<sub>4</sub>B<sub>4</sub> at 12K and 6 Tesla. The inset: magnetization curve of the EuRh<sub>4</sub>B<sub>4</sub> sample measured by XMCD at the Eu L<sub>2</sub> absorption edge for the energy corresponded to the Eu<sup>2+</sup> state ( $E = 7615.23$  eV)

### Acknowledgements

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