| MLF Experimental Report | 提出日 Date of Report<br>March 28, 2017 |
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| 課題番号 Project No. 2016B0233<br>実験課題名 Title of experiment<br>Study of the magnetic structures of the ferromagnetic Kondo-lattice compound $CeRh_6Ge_4$ and isostructural $YbRh_6Si_4$ with anomalous magnetic ordering<br>実験責任者名 Name of principal investigator<br>Eiichi Matsuoka<br>所属 Affiliation<br>Graduate School of Science, Kobe University | 装置責任者 Name of responsible person<br>Toru Ishigaki<br>装置名 Name of Instrument/（BL No.）<br>iMATERIA/(BL20)<br>実施日 Date of Experiment<br>February 20-22, 2017 |

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

$CeRh_6Ge_4$, powdered sample

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

(1) Experimental method

Recently, we found that the new hexagonal compound $CeRh_6Ge_4$ exhibits a ferromagnetic transition at $T_C$ = 2.5 K and its magnetic state is in the proximity of a magnetic critical point. The magnetic moments of Ce atoms in $CeRh_6Ge_4$ are affected by the Dzyaloshinskii-Moriya (DM) interaction since the crystal structure is non-centrosymmetric. We can consider two possible magnetic structures: a simple ferromagnetic structure with small DM interaction and a canted ferromagnetic structure with strong DM interaction. To distinguish these two structures, the neuron powder diffraction experiment of $CeRh_6Ge_4$ has been performed using iMATERIA.

The powdered sample of $CeRh_6Ge_4$ was packed in the thin space (0.5 mm) between the outer Al cell with inner radius of 10 mm$\phi$ and the inner V cell with outer radius of 9.5 mm$\phi$ to compensate the large absorption effect of Rh ($\sigma_a$ = 144.8b). This sample cell was set on the 1K Cryo and the sample temperature was monitored using a thermometer mounted on the bottom of the Al cell. The diffraction patters were taken using the double frame mode (12.5 Hz mode).

2. 実験方法及び結果（つづき） Experimental method and results (continued)

(2) Experimental results

The neutron diffraction patters were taken at 0.62 K (< $T_C$) and 5.0 K (> $T_C$). Almost all of the Bragg peaks appearing in these patterns can be indexed on the basis of the hexagonal $LiCo_6P_4$-type structure, although small peaks of unidentified impurity phases are discernible. Unexpectedly, we could not find any antiferromagnetic component or ferromagnetic one at 0.62 K within the experimental precision. Possible reason of the absent of a ferromagnetic component is the small ordered magnetic moment (~0.3 $\mu_B$/Ce deduced by magnetization), which makes it difficult to find ferromagnetic Bragg component on nuclear reflections. The lack of any antiferromagnetic components implies that the ordered state below $T_C$ is a simple ferromagnetic one.