(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2012B0107 実験課題名 Title of experiment Chiral magnetic structures in inorganic chiral compounds $CsCuCl_3$ 実験責任者名 Name of principal investigator Y. Kousaka 所属 Affiliation Aoyama-Gakuin University	装置責任者 Name of responsible person Y. Miyake 装置名 Name of Instrument/(BL No.) D1 実施日 Date of Experiment 2013/03/20-03/24

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.

$CsCuCl_3$ (single crystal)

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.

Our aim for this experiment was to examine the interplay between crystalline and helimagnetic chirality in $CsCuCl_3$ by means of μSR measurements. This compound forms chiral helimagnetic ordering due to the competition between exchange interaction and D-M interaction, The pitch angle of the helix is determined by the ratio of ferromagnetic exchange interaction and D-M interaction.

The cm-ordered single crystalline samples can be grown by conventional spontaneous crystallization technique, but all of them form racemic twinned. To make the samples with the single crystallographic chirality, the sample size must be as small as sub-mm. To grow larger enantiopure single crystals enough to perform the muon measurements, we developed a unique crystallization technique as spontaneous crystallization with stirring. By use of the crystallization method, we succeeded in controlling the crystallographic chirality and obtaining the mm-ordered single crystals of $CsCuCl_3$.

We have performed ZF-μSR measurements on left-handed single crystals of $CsCuCl_3$ at D1 port in J-PARC/MLF MUSE. Figure 1 shows ZF-μSR time spectra obtained at various temperatures.

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

The relaxa-tion at high temperature is predominantly due to static and randomly oriented nuclear magnetic moments. As temperature decreases, muon spin relaxation develops and the initial asymmetry, which is the asymmetry at t = 0 μs, decreases below T_N. This is a clear indication that the sample is in a magnetically ordered state. It is consistent with the results of temperature dependence of magnetization. Here, we would like to note that the time spectra observed below T_N (for example, the spectra at 10.3 K and 5.4 K in Fig. 2) show slow re-laxation even in the system becomes magnetically ordered state. LF-μSR reveals that this slow muon spin relaxation observed below T_N is recovered by the external field of ~10 mT. It suggests that muon senses the internal field like nuclear dipolar field even in the magnetic state. It indicates that the dipolar fields due to electronic spins seem to be canceled out at muon sites. It is suspicious that the observed behaviors, which suggest the cancelation of the internal field due to electronic moments, might be explained if we assume the chiral magnetic structure. In order to study this assumption, we are planning to perform additional experiments using dc muon beam at TRIUMF.

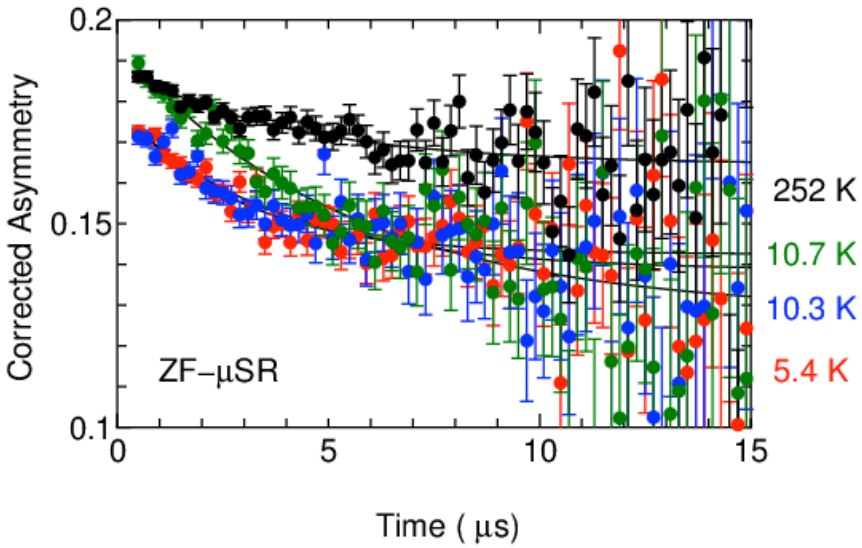

Fig. 1 ZF-μSR time spectra in left-handed single crystals of $CsCuCl_3$ obtained at various temperatures.

In conclusion, we have performed μSR measurements in left-handed $CsCuCl_3$ single crystals. The decrease of initial asymmetry was observed below T_N, consistent with the result of magnetization.