（ ※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 2014/08/08
課題番号 Project No. 2013B0278 実験課題名 Title of experiment Spin current on garnet ferrite Y3Fe5O12 induced by temperature gradient 実験責任者名 Name of principal investigator Shin-ichi Shamoto 所属 Affiliation Japan Atomic Energy Agency	装置責任者 Name of responsible person Kenji Nakajima 装置名 Name of Instrument/（BL No.） AMATERAS(BL-14) 実施日 Date of Experiment 2014/03/06-13

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.

a garnet ferrite single crystal Y3Fe5O12

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.

Large temperature gradient was applied to a ferromagnetic single crystal of Yttrium iron garnet Y3Fe5O12 along [111] direction at low temperature. Spin current is expected to dominate the thermal flow at low temperatures, although umklapp scattering process disturbs the thermal flow by spin current. Under this inequilibrium state, population of spin wave may be unbalanced between forward and backward directions along the thermal flow. The spin thermal conductivity depends on the energy (or frequency). The temperature gradient may produce the spin current only at low energy due to the large number of excited spin waves, especially at low temperature. Therefore, we focused on the inelastic neutron scattering at low energy, where AMATERAS has advantages of energy resolution and low background. Spin wave was observed with high S/N ratio as shown in Fig. 1. Thermal flow goes from left to right hand sides in Fig. 1. The inelastic scattering intensity is plotted in Fig. 2.

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

Regardless of the large temperature gradient of 34 K, the intensity difference is within the error. In order to observe the small directional difference, the crystal and thermal gradient geometry was inversed, corresponding to the change from +G to –G position in the reciprocal lattice. The small misorientation of crystal axis in the rod leaded to a change in the excitation energy from 2.4 meV to 1.9 meV. The measured inelastic scattering intensity is plotted in Fig. 3. The intensity difference is again within the error.

In conclusion, we think that the measured energy range is too high to produce the spin wave by thermal gradient especially at the low temperature.

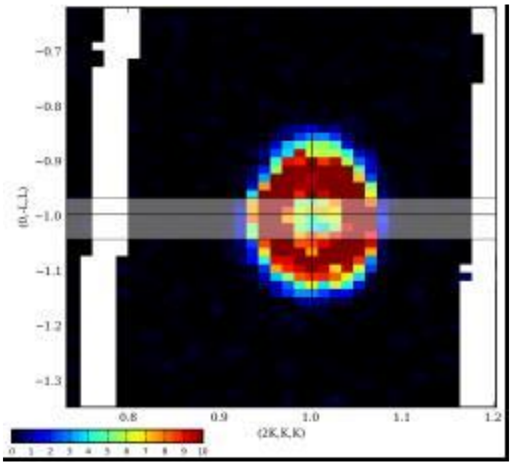

Fig. 1. Observed spin wave excitation at ΔE=2.4 meV and Q=(211). Thermal flow goes from left to right hand sides.

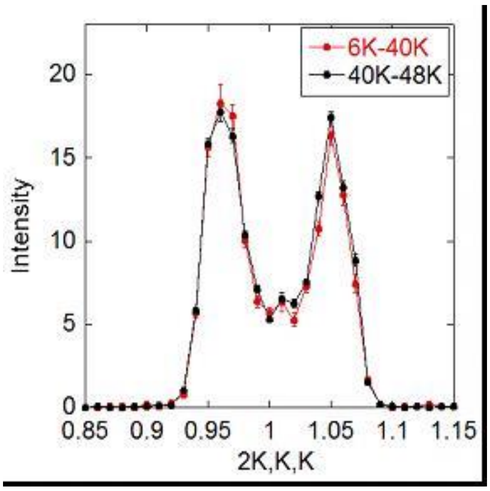

Fig. 2. Constant-E cut along Q=(2K,K,K) direction.

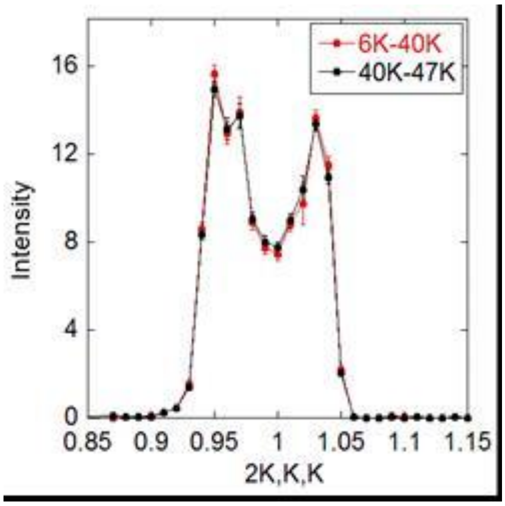

Fig. 3. Constant-E cut along Q=(2K,K,K) direction after inverse of the crystal from Fig. 2 configuration,