（ ※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. 2014A0192	装置責任者 Name of responsible person 伊藤晋一
実験課題名 Title of experiment Magnetic excitation of YBaCo4O7 with kagome and triangular lattices	装置名 Name of Instrument/（BL No.） HRC (BL-12)
実験責任者名 Name of principal investigator 左右田稔	実施日 Date of Experiment 2014/4/28~2014/5/4
所属 Affiliation 東京大学物性研究所	

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.

$YBaCo_4O_7$

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.

Spin systems on the pyrochlore, triangular and kagome lattices are well-known examples of geometrically frustrated systems and expected to exhibit various interesting properties induced by strong magnetic fluctuations. $RBaCo_4O_7$ (R=Ca, Y and rare-earth elements) is one of typical examples of such systems, because it has both triangular and kagome lattices formed by CoO_4 tetrahedra, as shown in Fig. 1. In the system, there are three types of equilateral triangles in the high temperature phase, one in the triangular lattice and the other two with different sizes in the kagome lattice.

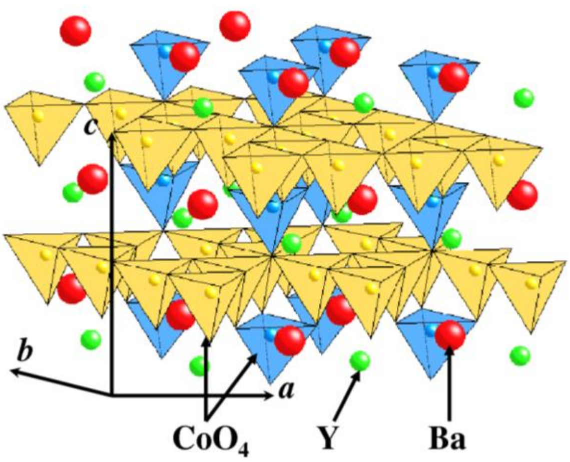

Fig. 1 Crystal structure of $YBaCo_4O_7$.

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

We carried out the inelastic neutron scattering on $YBaCo_4O_7$ using High Resolution Chopper Spectrometer (HRC) in order to clarify the magnetic excitations of the triangular and kagome lattices. The four single crystals were oriented with the [100] and [110] axes in the horizontal plane, as shown in Fig. 2. The incident neutron energy was 103.4 meV and the energy resolution is about dE/E=4.5 %. The neutron profiles were measured at T=10 K using GM-type refrigerator. By rotating the sample from k_i//[100] to k_i//[1-10], we measured the magnetic excitation in the c-plane, and the neutron intensity along the c-axis was also measured simultaneously in the vertical direction of PSD.

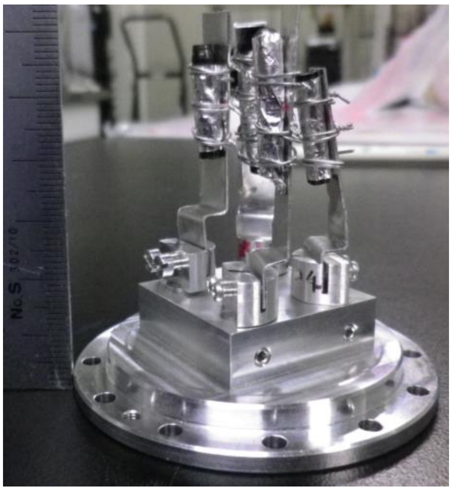

Fig. 2 Aligned single crystals.

Figure 3 shows the contour map of the inelastic neutron spectrum along (h, 0, 0) direction. The observed magnetic excitation is very broad. The magnetic excitation has the dispersion until about 40 meV both along the c-plane and the c-axis while the ***Q***-point of the zone center is different from the magnetic Bragg point (h'/2, 0, 0). These suggest that the magnetic interaction of $YBaCo_4O_7$ is complicate.

We analysed the observed neutron profiles by using the first-moment-sum rule. We found that the magnitude of the antiferromagnetic interaction in the c-plane is almost equal to that along the c-direction. This suggests that $YBaCo_4O_7$ has the 3-dimensional-geometrical frustration induced by the network of the antiferromagnetic interaction shown in Fig. 4. Non-trivial geometrical frustration is expected to induce the variety of the magnetic phase reported for $RBaCo_4O_7$.

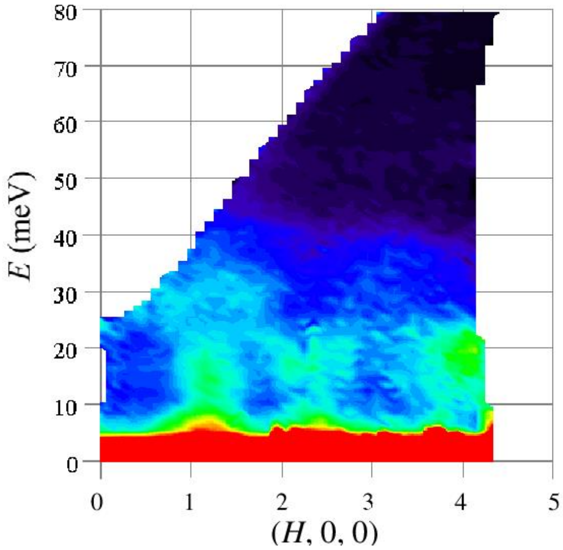

Fig. 3 Inelastic neutron scattering spectrum of $YBaCo_4O_7$ along (h,0,0).

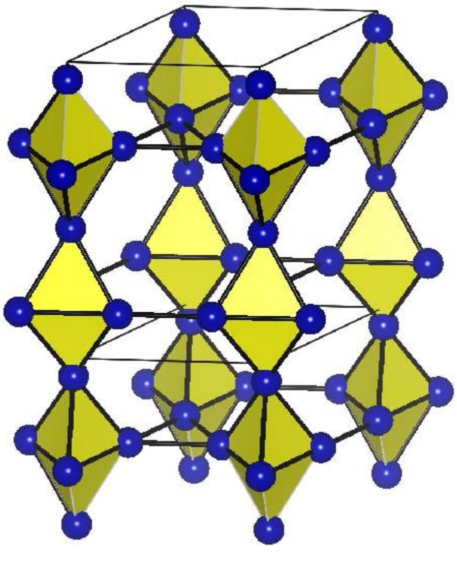

Fig. 4 Network of antiferromagnetic interactions between Co ions.