（ ※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。）

CROSS TOKAI Experimental Report J-PARC

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課題番号 Project No. 2016A0088	装置責任者 Name of responsible person Ryoichi Kajimoto
実験課題名 Title of experiment Magnetic excitations in chiral magnetoelectric Ba3Fe2O5Cl2	装置名 Name of Instrument/（BL No.） 4SEASONS（BL1）
実験責任者名 Name of principal investigator Nobuyuki Abe	実施日 Date of Experiment 2016/11/24 9:00pm – 2016/11/30 9:00am
所属 Affiliation University of Tokyo	

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.

Name of sample: $Ba_3Fe_2O_5Cl_2$
Physical form: 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.

$Ba_3Fe_2O_5Cl_2$ is a cubic chiral magnet with space group $I2_13$. This material undergoes a antiferro magnetic phase transition upon 560 K. Below the magnetic transition temperature, Fe^{3+} spin moments form a simple antiferromagnetic structure with spin moments align along the <111> direction. In a magnetic field applied along the [100], Fe^{3+} spin moments should be rearranged perpendicular to the magnetic field. Simultaneously, the electric polarization appears along the [001] direction, which may originate from the spin-direction dependent metal-ligand hybridization. Additionally, this material undergoes a weak ferromagnetic transition at 140 K triggered by a structure transition from $I2_13$ to $P2_12_12_1$. In this research, we focus on magnetic excitations of $Ba_3Fe_2O_5Cl_2$.

The inelastic neutron scattering measurements were performed BL01 4seasons. The four single crystals were co-aligned in the Al sample

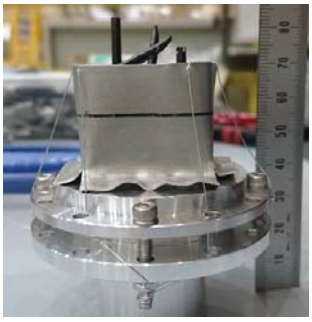

Fig. 1 Sample holder

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

holder with [hh0] and [00k] axes in the horizontal plane, as shown in Fig. 1. Sample was cooled down to 200 K by using refrigerator. In the measurement, samples was rotated about a phi axis from -50° to 90° with 0.25° steps. We utilized incident neutron energies E_i = 120, 40, and 20 meV.

Figures 2 show the magnetic excitation spectra along the [hhh] direction at (a) E_i =120meV and (b) E_i =40meV, respectively. The contour map shows clear dispersion relation from the (333) magnetic Bragg reflection. The observed magnetic dispersion is consistent with the antiferromagnetic ordering of Fe^{3+} spin moment in this material.

Figure 3 shows inelastic intensity contour map around (333) from 40 meV to 80 meV. The magnetic dispersion seems to isotropic in [hh0] - [00k] plane, which indicates the magnetic dispersion originate from typical Fe^{3+} acoustic spin wave with cubic symmetry.

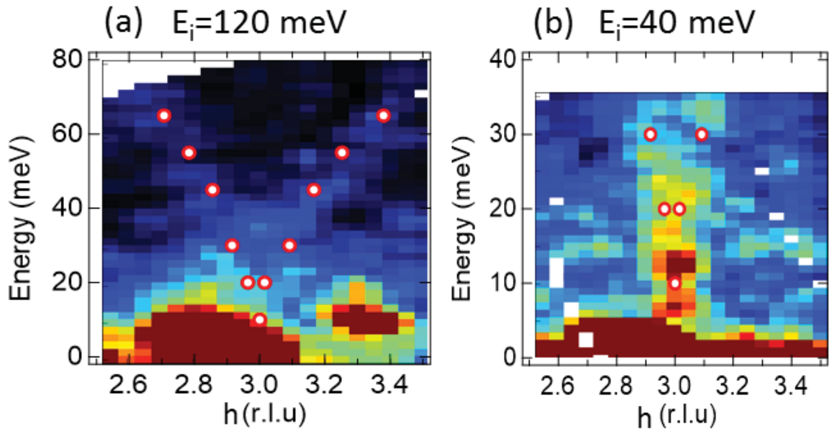

Fig. 2 Magnetic excitation spectra around (333) at (a) E_i =120meV and (b) E_i =40meV. Circles are peak position of the magnetic dispersion.

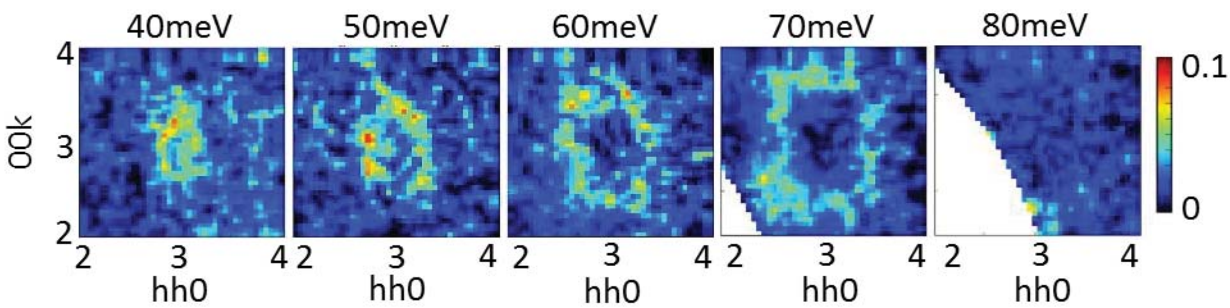

Fig.3 Inerastic intensity contour map around (333) at E_i =120meV