MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2014A0164 実験課題名 Title of experiment Magnetic and Crystal Structures of Honeycomb Lattice systems $Li_3Ni_2AO_6$ (A=Sb, Bi) 実験責任者名 Name of principal investigator Yasui, Yukio 所属 Affiliation Meiji University	装置責任者 Name of responsible person Ishigaki, Toru 装置名 Name of Instrument/（BL No.） iMateria (BL-20) 実施日 Date of Experiment 2013/5/10-5/12

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.

$^7Li_3Ni_2SbO_6$

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.

We have investigated the magnetic structure of honeycomb lattice system $Li_3Ni_2SbO_6$, which has the Ni^{2+} ions (spin S=1). $Li_3Ni_2SbO_6$ is composed of Ni_2SbO_6 layers and Li layers, and Ni_2SbO_6 layers consist of edge-sharing NiO_6 and SbO_6 octahedra, which form the Ni^{2+} honeycomb lattice. The magnetic susceptibility and the specific heat data indicate that $Li_3Ni_2SbO_6$ exhibit the antiferromagnetic transition at T_N=15 K. On the other hand, the Curie Weiss temperatures Θ=2 K (ferromagnetic) has been obtained from the temperature dependence of the inverse magnetic susceptibility of $Li_3Ni_2SbO_6$. These results indicate that the magnetic structure and magnetic intractions between spins are not simple. We used ^{7}Li isotope in the preparation of powder sample for neutron scattering to avoid the large neutron absorption of Li. We have carried out the powder neutron diffraction measurements by using neutron diffractometer (iMateria BL20).

First, we analyzed the obtained nuclear Bragg peaks at room temperature by Rietveld refinement. As a results of having analyzed it, we confirm that the crystal structure of $Li_3Ni_2SbO_6$ is consistent with the reported crystal structure by E. A. Zvereva *et al*. (Dalton Trans. 41 (2012) 572).

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

Next, we have analyzed the magnetic Bragg peaks at 4K ($<T_N$) in order to investigate the magnetic structure. The part of the neutron poder patterns of $^7Li_3Ni_2SbO_6$ are shown in Fig. 1. All the observed peaks at 30 K correspond to the nuclear Bragg reflections of $^7Li_3Ni_2SbO_6$. At 4 K, in addition to the observed peaks at 30 K, the super-lattice peaks derived from the magnetic ordering are observed as shown in Fig. 1. We found that all the observed magnetic reflections can be assigned $h\pm\delta\ k\ l$ indices (δ~0.165). In Fig. 1, the arrows indicate the d-position of the magnetic reflections of $^7Li_3Ni_2SbO_6$ with a displayed index. Figure 2 shows the temperature dependence of the Bragg peak intensity at δ 1 0 (δ~0.165) magnetic reflection. With decreasing T, the Bragg peak intensity rapidly increases at T_N. These results indicates that $Li_3Ni_2SbO_6$ has incommensurate complex magnetic structure. Now, we are quantitatively analyszing the detailed magnetic structure.

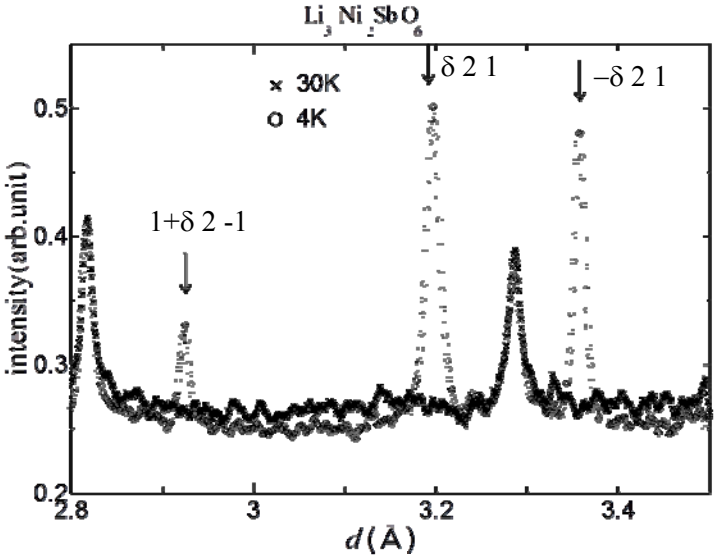

Fig. 1: Neutron powder diffraction patterns of $Li_3Ni_2SbO_6$ taken at T =4 K and 30 K. The arrows indicate the d-position of the magnetic reflection peaks at T=4 K. The indices of the observed magnetic reflections of $^7Li_3Ni_2SbO_6$ are found to be $h\pm\delta\ k\ l$ (δ~0.165).

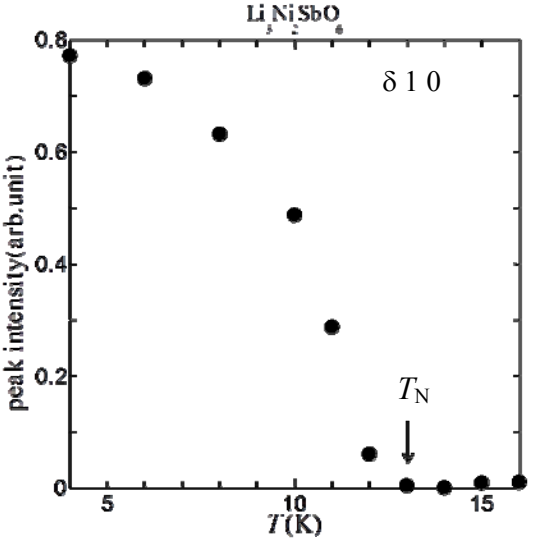

Fig. 2: Temperature dependence of the Bragg peak intensity of $^7Li_3Ni_2SbO_6$ at δ 1 0 magnetic reflection (δ~0.165).