

 MLF Experimental Report	提出日 Date of Report 2011/7/1
課題番号 Project No. 2010B0045 実験課題名 Title of experiment Identifying electromagnons in multiferroic TbMnO ₃ 実験責 任者名 Name of principal investigator Hajime Sagayama 所属 Affiliation Tohoku University	装置責任者 Name of responsible person Ryoichi Kajimoto 装置名 Name of Instrument/(BL No.) 4SEASONS(BL01) 実施日 Date of Experiment 2010/11/16-2010/11/20

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.

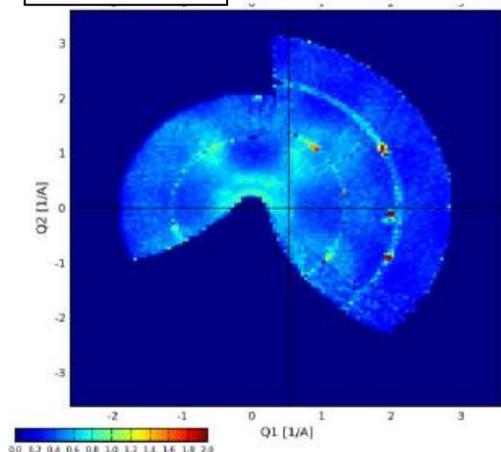
1. 試料 Name of sample(s) and chemical formula, or compositions including physical form. Name of sample : TbMnO ₃ Chemical formula: TbMnO ₃ Compositions including physical form : Six single crystals aligned and fixed in an aluminum cell for neutron scattering experiment.

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. Recent spectroscopic studies for a variety of multiferroics endowed with both ferroelectric and magnetic orders have revealed the possible emergence of a new collective excitation referred to as electromagnon. It is magnetic in origin, but it becomes active in response to the electric field component of light. Especially, spectroscopy of electromagnons in $RMnO_3$ (R denotes rare-earth ions) were energetically investigated. Aim of this study is to obtain whole picture of the electromagnons in representative multiferroic material, TbMnO ₃ . Six single crystals of TbMnO ₃ grown by a floating-zone method were aligned and attached to an aluminum cell which is usually used at JRR-3 for neutron scattering experiment. The c axis was set perpendicular to the horizontal plane and parallel to the sample rotation axis named ϕ . Sample was cooled down to 10K with a closed-cycle He refrigerating machine. Energies of incident neutron beam were tuned into 6, 10, 16, 30, and 76 meV (multi-Ei mode). Energy resolution of each case was 5% of E_i . Generating power was 120kW.

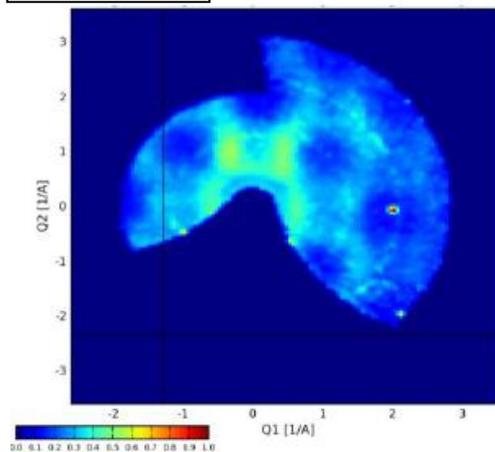
2. 実験方法及び結果(つづき) Experimental method and results (continued)

Inelastic neutron scattering spectra was observed with the time-of-flight technique. Measurement was performed at every 2.5 degree in phi range between - 20 and 120 degree, where phi is angle between the b-axis and incident beam. When the phi is zero, b axis is along the incident beam. Exposure time was 1 hour. Data analysis is going on with UTSUSEMI which is a program for 4-dimentional data analysis developed by Dr. Inamura. Below figures show a part of the analysis. Magnetic excitation can be clearly seen. To investigate a relation between the magnetic excitation and optical absorption, further analysis should be circumstantially performed.

dE 2-4meV



dE 4-6meV



dE 6-8meV

