

(※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. 2013B0209 実験課題名 Title of experiment Detection of Rashba-type spin splitting using neutron inelastic scattering 実験責任者名 Name of principal investigator Taku J Sato 所属 Affiliation IMRAM, Tohoku University	装置責任者 Name of responsible person Shinichi Itoh 装置名 Name of Instrument/(BL No.) HRC/BL12 実施日 Date of Experiment 2014/03/19-2014/03/25

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.
BiTeI (+5%Mn) Co-aligned single crystals

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.
<p>The four single crystals of BiTeI (+5%Mn) were co-aligned in the Al sample can with the h0l zone in the horizontal plane, and set to the cold head of the standard closed cycle refrigerator. The c* axis of the sample was set parallel to the incident flight path (ki). All the measurements were performed at the room temperature, and to reduce the background we did not set the radiation shield. The incident energy was chosen to be 500 meV, and Iron collimator of 50mm X 50mm was set in the incident beam path. As a divergence collimator, we employed the 1.5 deg collimator; there was no significant change in the measurable Q-range for the 0.3 deg and 1.5 deg collimators, whereas the flux becomes significantly large for the latter one. On the other hand, we had to use A-chopper, which is tighter than the sloppy chopper, since the sloppy one is out of order in this experiment. The chopper was rotated at 600 Hz with the phase of 6428.4 usec. (Unfortunately, this phasing turned out to be wrong later...)</p> <p>In this experiment, we basically did only two runs; one is with the sample, and the other is for the background taken with the empty sample can. Roughly 3 days of beamtime were spent for the sample run, whereas due to the spectrometer trouble (described later), less than 2 days were spent for the background. Shown in the figure 1 are the corresponding sample and background run results.</p>

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

The relative intensities of the two results are not corrected with the total flux, so the comparison can be only made qualitatively. Nonetheless, it is rather clear that $S(Q, hw)$ from the sample run is featureless, and cannot be clearly distinguished from the background results. We, hence, concluded that no significant excitation modes were detected in this experiment.

During the experiment, the vacuum of the scattering chamber was not good enough (roughly 15 Pa). This was initially accepted, however, at the end the experiment was terminated from the safety reason. This is the reason for the shorter background counting duration. In addition, it turned out after the experiment that the chopper was in 180 degrees out of phase mode (due to some technical confusion). This significantly reduced the incident neutron flux. Lastly, the sloppy chopper was not available in this experiment, and alternative selection (A-chopper) provide quite limited flux. In total the absence of the meaningful signal in the sample run may be due to the combination of the above unfortunate events, and hence we are looking forward to measuring this sample again with the best condition of HRC.

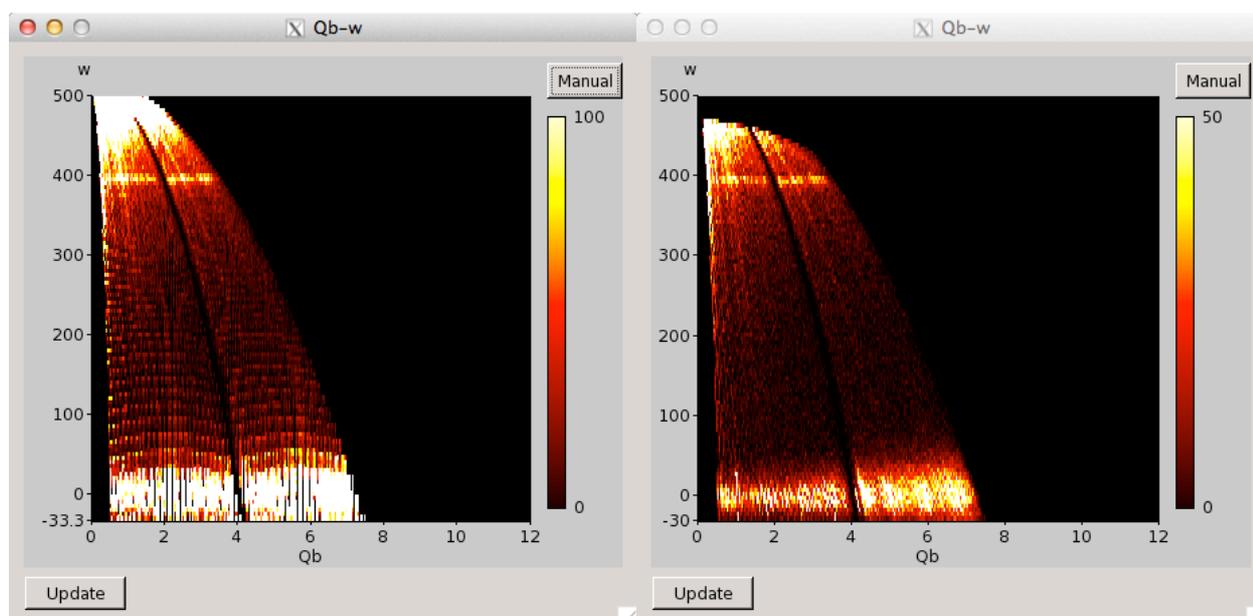


Fig. 1: $S(Q, hw)$ obtained in the BiTeI single crystal sample (left), and corresponding background (right). Higher angle detectors are used to depict the results. Intensity along the c^* -axis is fully integrated, and shown as the function of Q_b ($// h00$). The experiment was performed at room temperature. No incident-flux-correction was made so the comparison of the two figures can be made only qualitatively.