

Report of the GP-Spin student workshop

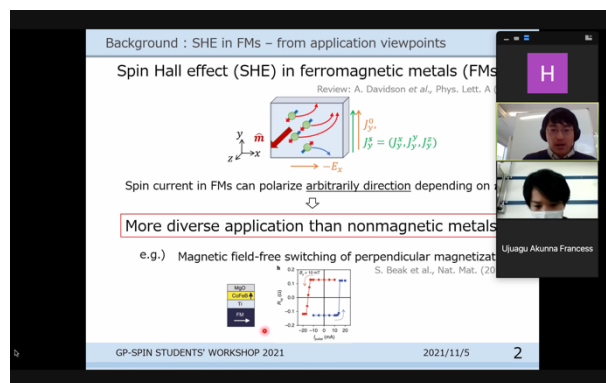
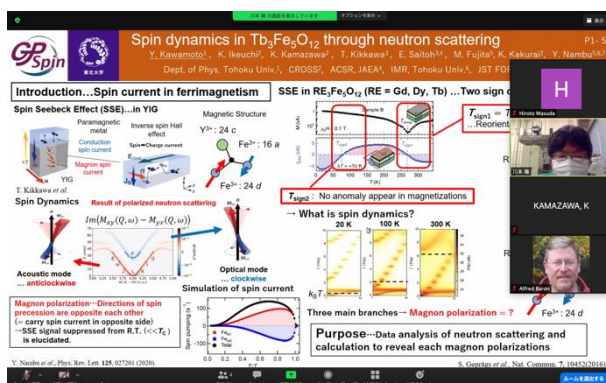
“Spintronics with quantum beams”

Hiroto Masuda (November 5th (2021), online)

1. Concept

Studies in the research field of spintronics have mainly focused on the macroscopic facets of magnetic and electrical transport physics phenomena. The microscopic picture is, however, indispensable to precisely understand the mechanism of physics. The quantum beams are then paid attention even in the spintronics field, which enables the microscopic investigation. This student seminar aims to appeal the importance of the quantum beams for the spintronics and to provide a good opportunity to broaden students' horizons by discussing with overseas and Japanese researchers.

2. Poster session



In the poster session, presenters (mainly students) explained their studies. Contents of talks include not only experimental investigations using electrical and/or quantum beam methods but also theoretical calculations. Presenters discussed the detailed physics with overseas and Japanese researchers.

3. Oral session

Five professors gave their presentations.

(1) **“A New Magnetic Intermediate State, “B-Phase”, in MnSi Probed by Small-Angle Neutron Scattering and Muon Spin Rotation”** by Professor Kazuki Ohishi
 Prof. K. Ohishi talked about his group's recent observation of “B phase” in MnSi, which had been hidden phase until recent times. He used the neutron and muon scattering experiments and showed evidence that B phase has the skyrmion lattice and conical magnetic structure.

(2) “Polarized Neutron Scattering -Powder Diffraction-” by Professor Kazuhisa Kakurai

Prof. K. Kakurai reviewed the basics of polarization-dependent neutron magnetic scattering and polarized neutron powder diffraction experiments.

(3) “Old materials revisited for spintronics” by Professor Michiyasu Mori

Prof. M. Mori showed the effectiveness of the rare-earth garnets for the spintronic devices, which had been widely studied in a few decades ago. He explained the large spin-orbit coupling in rare-earth elements leads to the phonon Hall effect by comparing theory with quantum beam experiments.

(4) “Mesoscale Atomic Dynamics of Liquids: Unique Properties, Steps Forward, Back, and Forward Again” by Professor Alfred Q. R. Baron

Prof. A. Baron showed how the atomic dynamics in liquids changes when the wavelength is varied from long to short.

(5) “Atomistic spin dynamics for studying magnons” by Professor Joseph Barker

Prof. J. Barker explained the computational method of atomic spin dynamics. He showed that his group’s method contributed to the recent observation of magnon polarization by quantum beam measurements.

4. Summary

We successfully finished the student seminar “Spintronics with quantum beams” without any troubles. Students enthusiastically asked questions to speakers and discussed the contents profoundly. On a personal note, I was impressed by the compatibility between quantum beam scattering experiments and theoretical approaches. Also, I realized the usefulness of quantum beam scattering to investigate novel phase in materials, which may lead to the observation of novel physics phenomena applicable to the spintronics devices. I am pleased to participate in this student workshop.