Reimei-GIMRT Workshop Quantum Beams Study of the Dynamics of Rare Earth Garnets

August 7-8, 2023, IMR, Sendai

Scope

The aim of the workshop was to explore the magnetism, dynamics, and transport properties of Rare-Earth Garnets in both bulk form and in films. The goal is to develop an adequate treatment of the complex magnetic dynamics which considers the non-collinear structures that appear in many of the compounds and their origin in terms of crystal field anisotropies acting on the rare-earth sites. The influence of the rare-earth moments on the chiral properties of the spin waves is of paramount importance in, for example, the spin Seebeck effect. Compensation points are potentially interesting for potential applications in spintronics as the magnetic dynamics are altered and domain wall motion enhanced. As well as bulk samples, it is now possible to study films, whose properties are directly relevant to device applications, and this raises issues about the influence of strain and other details of coupling to the lattice. Several groups internationally are looking at the dynamics by neutron inelastic scattering and, more recently, resonant magnetic X-ray scattering, and we hope to encourage discussion between them as to the interpretation of results that are currently being produced, and the availability of samples for future experiments.

Program-Day 1

The morning session of day 1 started with opening address. The 1st scientific talk was on the synergetic investigation by polarized neutron and X-ray scattering for magnetic dynamics and the application to spin caloritronics by Dr. Mannix. Then Dr. Miyawaki introduced recent research on the X-ray scattering on quantum materials and the development of a soft-X-ray scattering station of NanoTerasu, which was in commissioning. The final talk in the morning was on the non-local magnon transconductance on the rare-earth magnetic garnet film by Dr. Kohno. The three talks highlight the different aspects of research on the system and show the importance of the collaboration among different techniques and views.

The afternoon session started with the talk of Dr. Geprägs on the magnonics, which is one of the

highlights of current spintronics research. The talk was followed by a report on neutron scattering by Dr. Peçanha-Antonio. Dr. Shamoto gave another talk combining neutron scattering under ultrasonic injection. These three talks show the interesting magnon properties of these systems.

The final session of Day 1 had two talks. The first was on magneto-crystalline anisotropy by Dr. Tomasello and the second on neutron scattering on the magnons of the terbium iron garnet, which has recently attracted much attention in magnonics and the cavity physics of magnons.

In the evening, participants had exchange and free discussion time.

Program-Day 2

On day 2 the morning session began with midinfrared spectroscopy on spintronics material by Dr. Puebla and Dr. Chudo gave a report on the Barnet effect and the observation of angular momentum.

Dr. Harii reported on the modification of magnetic properties of rare-earth magnetic garnet by ion beam irradiations. Dr. Nakamura talked about the ultrafast TEM measurement on the acoustically induced magnetic domains on ferromagnetic thin films.

The afternoon session started with the talk on the double umbrella structure by Dr. Thomas-Hunt. Dr. Omori show the combinatorial FMR experiments on magnetic garnet films. Dr. Hisatomi reported the Brillouin scattering experiment on yttrium magnetic garnet. The final talk was given by Dr. Hioki on the coherent dynamics on hybridized magnon-phonon.

Dr. Maekawa made a conclusion about the recent progress on rare-earth magnetic garnet shared in the workshop and future challenges for comprehensive collaboration research.

Summary

The workshop offered an important opportunity for intense exchange among experts from different areas and succeeded in sharing of the current status of research. It is notable that many of the participants joined the X-ray scattering workshop (RIXS and REXS) at the IMR, including a visit to NanoTerasu, and made visits to J-Parc for discussion on future collaborations. It shows the importance and the effectiveness of the GIMRT program to push the international collaborations.

Name of organizers

Ieda Jun'ichi, ASRC, JAEA Mori Michiyasu, ASRC, JAEA Fujita Masaki, IMR, Tohoku University Nojiri Hiroyuki, IMR, Tohoku University Ziman Timothy, ILL, Grenoble Sakai Toru, University of Hyogo









Program

Aug. 7 (Monday)		
10:00		Reception
10:20	K. Takanashi (JAEA)	Opening
10:30	D. Mannix (ESS)	Exploiting Polarised neutron and X-ray synergies to reveal magnetic structure and dynamics in spin caloritronics
11:00	J. Miyawaki (QST)	Quantum material research by resonant inelastic soft X-ray scattering facility at NanoTerasu
11:30	R. Kohno (Tohoku)	Non-local magnon transconductance in extended rare-earth magnetic garnet films
12:00		Lunch
14:00	S. Geprägs (Walther-Meißner-Institut)	Rare-earth iron garnets: A prototype material system for spintronics and magnonics
14:30	V. Peçanha-Antonio (U. Oxford)	Rare earth iron garnets from the neutron scattter viewpoint
15:00	S. Shamoto (CROSS)	Spin-lattice coupling in yttrium iron garnet studied by neutron scattering under ultrasound injection
15:30		Break
16:00	B. Tomasello (U. Kent)	Role of magneto-crystalline anisotropies in complex rare-earth garnets
16:30	Y. Kawamoto (IMR)	Neutron scattering studies for spin dynamics in terbium iron garnet
18:00		Banquet
Aug. 8 (Tuesday)		
9:30	J. Puebla (RIKEN)	Mid-infrared spectroscopy characterization of spintronic structures
10:00	H. Chudo (JAEA)	Observation of the angular momentum compensation by using the Barnett effect
10:30		Break
11:00	K. Harii (QST)	Modification of magnetic properties in garnets caused by swift ion beam irradiation
11:30	A. Nakamura (RIKEN)	Acoustically induced nonlocal magnetic domain dynamics in ferromagnet thin film revealed by ultrafast transmission electron microscopy
12:00		Lunch
14:00	J. Thomas-Hunt (Aarhus)	Renewed investigation of the double umbrella
14:30	Y. Omori (NEC)	Combinatorial experiments of FMR on magnetic garnet films
15:00		Break
15:30	R. Hisatomi (Kyoto)	Vorticity-inversion Brillouin light scattering by magnons in yttrium iron garnet crystal
16:00	T. Hioki (U. Tokyo)	Coherent dynamics of hybridized magnons and phonons
16:30	S. Maekawa (RIKEN)	Closing