外国人客員所員を経験して

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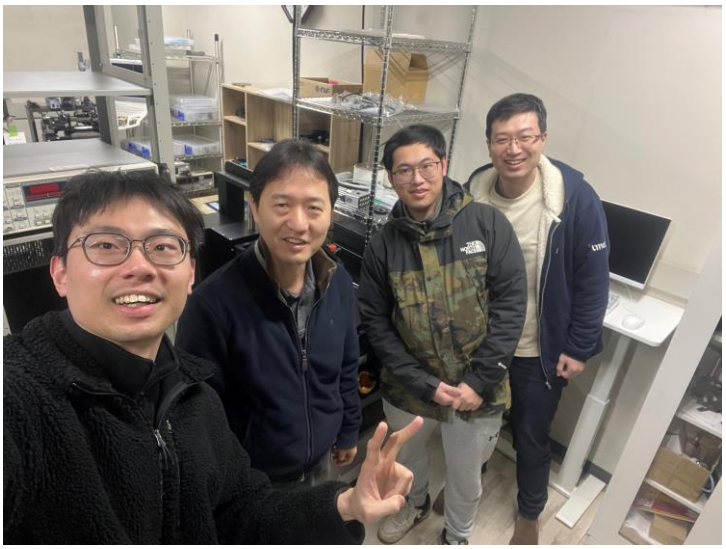
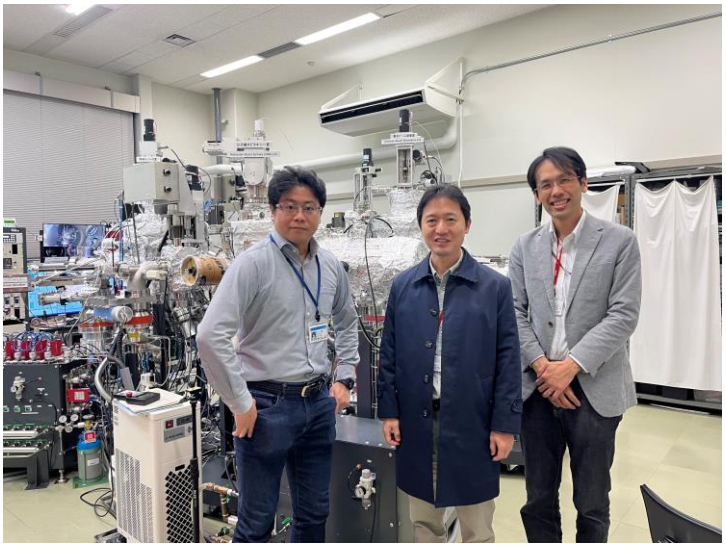
I had the great pleasure of visiting the group of Professor Shinji Miwa at the Institute for Solid State Physics (ISSP), the University of Tokyo, for four months. Prior to joining KAIST, I worked at the Hitachi Cambridge Laboratory in the UK and had the opportunity to visit Tokyo on a yearly basis. However, this was my first extended stay in Japan. During this period, I was able to gain a deeper understanding of both Japanese daily life and research culture, which made this visit particularly meaningful.

During my four-month stay, I participated in two research projects in the Miwa group. The first project, carried out in collaboration with Jieyi Chen, focused on the orbital torque generated in single-crystalline Ti and its crystallographic orientation dependence. This work took advantage of the Miwa lab's advanced molecular beam epitaxy (MBE) capabilities, which enabled us to grow high-quality single-crystalline Ti (110) thin films on MgO substrates. We quantified the orbital torques generated in Ti and exerted on adjacent ferromagnetic layers (Ni and NiFe) using harmonic Hall measurements. These experiments were conducted in collaboration with my KAIST group member. The preliminary results revealed that the torque arising from the orbital current exhibits a clear dependence on the crystallographic direction. Furthermore, we observed a non-negligible torque component along the x-direction at certain crystal orientations, which has not been previously reported and suggests the presence of additional mechanisms requiring further investigation. This research has continued even after my return to Korea. The second project, conducted in collaboration with Xiaoyu Piao, aimed to quantify spin currents generated in antiferromagnetic NiO using spin diode effects. This study was carried out using the well-established ST-FMR measurement technique developed in the Miwa group. The experimental measurements have been completed, and the data are currently under analysis.
Following this visit, I would like to continue collaborative research on both topics with the Professor Miwa lab. Furthermore, I hope this visit will serve as a starting point for establishing a Korea–Japan collaborative platform in spintronics to promote sustained research collaboration and academic exchange.

In addition to my research, I actively engaged in academic exchanges during my stay. First I delivered a keynote talk at '*International Symposium on Spintronics with Antiferromagents and Altermagnets'*, and I co-organized the ISSP workshop 'Spintronics Future Prospects' with Prof. Miwa, where we invited outstanding researchers from Japan, Korea, and China to discuss future directions in spintronic research. Furthermore, I gave six invited seminars at major universities and research institutes, including AIST, Tohoku University, NIMS, Osaka University, the University of Tokyo, and Kyoto University. These presentations that focused on spin–orbit torque physics and their potential applications provided valuable opportunities for scientific discussion and collaboration.
Last, but not least, I would like to sincerely thank Ms. Yuko Ishiguchi of the International Liaison Office at ISSP for making my visit as smooth as possible. I am deeply grateful for her time and effort she devoted to helping me enjoy a comfortable and pleasant stay in Japan. I also sincerely appreciate the support and hospitality of Professor Shinji Miwa's group members, including Ms. Yukiko Kato and the students, whose collaboration and discussions were invaluable throughout my stay. I look forward to continuing our collaboration and visiting ISSP again in the near future.





外国人客員所員を経験して

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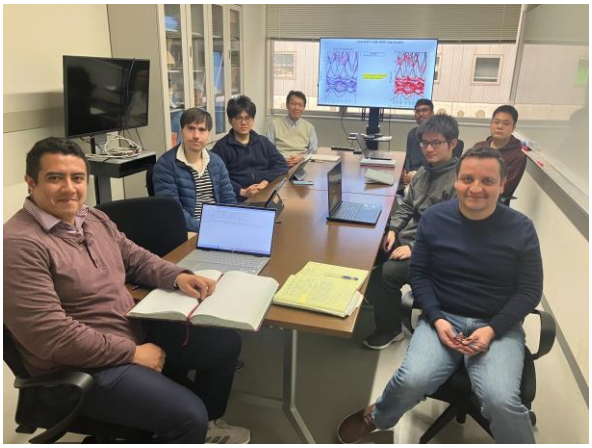
The main outcome from my visit to the ISSP was advancing a computational tool for calculating second-harmonic generation (SHG) in collaboration with Professor Taisuke Ozaki. Said tool expands wave-functions on a basis set of localized atomic orbitals (which are available in OpenMX), and it was developed by Angiolo Huaman and Luis Enrique Rosas at my research group.

The effort was supported from the beginning: Professor Ozaki has developed this functionality on OpenMX and was extremely kind to share unpublished results, which gave us both a benchmark and an expectation of how our results should look like. Angiolo, Luis Enrique and I used most of Fall 2026 improving the methodology (which included basic methodological changes as well as the creation of a single parallel code) and rewriting a manuscript. I parallelized and streamlined our code while at the ISSP, and Luis Enrique successfully cleared bugs in the last parts of it. Details of a proof-of-principle code were published in early 2026 (Huamán *et al.*, *J. Phys.: Condens. Matter* **38**, 045901 (2026)). Other additions are being coded, and we intend to continue this collaboration as I return to America.

During my time at the ISSP, I was also able to further collaborations with experimental groups at Arkansas (arXiv:2602.03996), Wisconsin (arXiv:2510.03220), Germany and China (Chang *et al.*, *Nat. Commun.* **16**, 11063 (2025); Ji *et al.*, *Adv. Funct. Mater.* e24380 (early view, 2026)). Professor Ozaki also supported a visit by experimental collaborator Kai Chang in early November of 2025; the visit was critical to finalize three papers and set directions for further collaboration. Most especially, Professor Ozaki also allowed me to bring PhD student Luis Enrique Rosas to Japan for a three-week stay with the purpose of finalizing significant details of our code (Luis Enrique sits at the lower left in the picture). I will always cherish Professor Ozaki's generosity.



The stay at Tokyo also brought a chance to present my research and to attend some of the multiple colloquia and events; the number of international visitors is a remarkable sign of the Institute's stature and intellectual prowess.

I wish to close this report expressing my gratitude to additional people who helped make this stay memorable: Yuko-san (International Liason Office), Eguchi-san, Dr. Swati Chaudhary, and Dr. Armando Pezo. I also thank Professors Fukuda, Oka, Tsunesugu, and Tiantian Zhang for multiple exchanges during my visit. Last but not least, I shall thank Dr. Babu Prasad at Professor Ozaki's group, whose easy smile and helpfulness were remarkable as well.

There are multiple fond memories from my time at the ISSP, and I look forward to the possibility of coming back.

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外国人客員所員を経験して

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Prior to joining ITP, I worked at the Murakami Lab at Tokyo Institute of Technology, which has since been renamed the Institute of Science Tokyo. However, my previous stay in Japan coincided with the COVID-19 pandemic, which limited opportunities to visit other institutions and research groups. During this recent visit of Professor Oka at ISSP, I gained a deeper understanding of both Japanese daily life and research culture. I was also able to visit several groups in Japan, including the Minamitani Lab and the Niimi Lab at the University of Osaka, Murakami Lab at both the Hongo campus and RIKEN, as well as Hirahara Lab at the Institute of Science Tokyo. These experiences made the visit particularly meaningful.

On the second day after my arrival, thanks to the arrangement by Oshikawa-sensei, I had the valuable opportunity to present my work to Prof. Haldane and receive his feedback. This valuable opportunity marked the beginning of my visit at ISSP. During my six-month stay, I actively engaged with members of the Oka group and greatly benefited from our discussions, including those with Swati, Ziyu, Naoki, Akihiro, Yuki, etc. I am also thankful for the kindness and support extended by members of the Ozaki group and the Kawashima Group, including Babu, Fengfeng, etc. It was precisely this active and stimulating research environment that enabled me to complete a research project in the Oka group. In this work, we proposed an experimental scheme for directly probing the quantum geometric tensor of bosonic collective excitations, and the manuscript is currently under review.

Finally, I would like to express my sincere gratitude to Yuko for her dedicated support in making my visit both smooth and enjoyable. In addition, I would like to extend my best wishes to ISSP and all its members for continued success and prosperity. I hope we can stay in touch and continue our collaboration, and I look forward to meeting again in the future.