Report on Visit to Nagoya University (ISEE) on SVS Program 2026

Name: Ryoma Matsuura

Affiliation: University of California at Los Angeles (UCLA), Los Angeles, USA

Date: 9/24/2026 – 10/23/2026



I have completed my month-long visit to ISEE as a visiting student advised by Professor Yoshizumi Miyoshi and supported by the SCOSTEP Visiting Scholar (SVS) Program. The research goal during the visit was to build a neural network model of the Earth's dynamic magnetic field using a physics-informed loss function that includes a divergence penalty. Another goal outside of research was to experience the life at a university in Japan to have a good picture of what a potential career in Japan could look like, and to build a relationship with students and researchers in Nagoya that will hopefully continue beyond the program.

As a preparation for the research at Nagoya, I came in already having some basic Python program for the neural network which I developed at UCLA. I had done some basic tests using synthetic magnetic field data from T96 model sampled anywhere within the domain, and my first step at Nagoya was to wrap up this synthetic data phase by constraining the data sampling along realistic spacecraft trajectories and to test the effect of sampling prior to using real spacecraft data. In the first half of my visit, I conducted this test, particularly focusing on the performance improvements by adding latitude coverage beyond missions with approximately equatorial orbits. I compiled a ~30 min presentation of this work, as well as a brief overview on my other work at UCLA and presented at the weekly Miyoshi-group meeting.

In the second half of my visit, I trained an initial model on real spacecraft data, and spent the rest of the program optimizing the feature set, spacecraft set, boundary conditions, etc. The final version of the model I had at the end of the program used local-time-resolved ring current indices, auroral indices, solar wind parameters, and dipole tilt as well as exponentially weighted averages of the time histories of some of these parameters as the model input, with no boundary condition, trained on data from number of missions with various orbital geometries (apogee, inclination, etc.). The model outperforms some of the older Tsyganenko models by a large margin and is comparable or better than a few of the newer models in many aspects, which I consider a success given such a short visit.

Outside of research, I attended weekly seminars and group meetings and learned about the other projects the students and researchers are working on at Nagoya. Many of the projects were highly relevant to what I have seen my group members at UCLA do, and I felt that there would be a lot that both groups can learn from each other if there were to be more collaborations. On the social side, I often joined the faculties/researchers or got together with some of the students for lunch, and joined some of the researchers for dinner on Fridays, from which I could learn about their lives in Nagoya beyond their research activities. It was also valuable that I was able

to have a one-on-one meeting with Dr. Hiroshi Hasegawa who was visiting to give a talk from JAXA since I was able to learn about life as a scientist at JAXA.

On the weekends, I visited various places in Nagoya, including Atsuta-Jingu, Osu-shopping Street, Tokugawa Art Museum, Arimatsu Shibori Museum, Toyota Commemorative Museum of Industry and Technology, and Nagoya Castle, as well as a few places slightly farther out including Inuyama Castle (plus its castle town) and Meiji-Mura on daytrips. I also enjoyed trying Nagoya-meshi, including miso-katsu, kishimen, tebasaki, hitsumabushi, and ogura-butter toasts.

The opportunity I had to connect with the people at Nagoya University was extremely valuable, and I look forward to future opportunities to reconnect and stay in touch. The research experience at a Japanese-university setting was also valuable, and I'm planning on continuing on the project back at UCLA hopefully for a further model improvement and eventual publication. I'd like to thank Dr. Miyoshi and his group members for the support I received throughout this amazing opportunity. I'd also like to thank the department and dorm staff for setting up my visit and providing a comfortable space to make the most out of my time. Lastly, I'd like to thank Dr. Kazuo Shiokawa, ISEE, and SCOSTEP for the approving my visit and for financial support that made this possible.







