

Visit to the University of New Hampshire

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Thanks to the PBASE program, I visited University of New Hampshire in Durham, USA, from July 10th to July 25th, 2024, to collaborate in person with Professor Lynn Kistler. The aim of the project is to understand ion injections to the plasma sheet boundary layer (PSBL) from the Earth's magnetotail during geomagnetic storms and their impact on the plasma sheet ion composition. Especially injections of O⁺ ions are predominantly only seen during storm times, and the Arase satellite is in the prime position to identify these features in the PSBL due to its off-equatorial orbit.

The PSBL shows two O⁺ populations on the nightside, low-energy (< ~1 keV) ionospheric outflow and high-energy (> ~5 keV) injections that show dispersed features in energy and pitch angle. The energy dispersion occurs because the higher energy ions are faster and reach the satellite location first. The dispersion can be used to determine the distance traveled by the ions and, thus, the origin of the injection. Additionally, the dispersion in pitch angle shows that the injected ions are first observed to move Earthward, and then change to the opposite direction likely due to mirroring.

During my visit I created a procedure to identify the energy and pitch angle dispersions from Arase measurements from the LEP-i and MEP-i ion particle instruments, and to estimate the distance to the injection location and the timing of the injection. The preliminary results are consistent with the expected origin of injections in the near-Earth neutral line. This procedure will be used to determine the characteristics of ion injections during storms, and I will also study the correspondence of O⁺ and H⁺ injections, concurrent plasma waves, and the impact of injections on the plasma sheet.

I collaborated with Prof. Kistler and other researchers at the University of New Hampshire on this project as they have expertise on the PSBL ion dynamics, which has allowed me to deepen my understanding on the topic. I presented my work in a group meeting and heard about the current magnetospheric ion



One of the many university buildings in Durham.

research conducted at the university. I also promoted the usage of the Japanese Arase data.

Since my visit took place in July, the university town of Durham was relatively quiet as most students had left for the summer holidays. Nevertheless, the town has several restaurants and a supermarket within walking distance from the university buildings. There is the livelier town of Portsmouth just a 15-minute car ride away, and one can also take a train from Durham to Boston (1.5 hours), which offers many options for sightseeing such as American historical sites and a variety of museums.



The Museum of Fine Arts in Boston.