

## Field-aligned and transverse plasma accelerations and spatial distributions observed by Reimei and FAST in the auroral regions

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It is prevalingly known that the magnetic reconnection and shock mechanisms in the collisionless plasma systems are powerful and universal particle accelerators, both of which can be directly observed in and near the terrestrial and planetary magnetospheres in our solar system. Recently, the plasma wave-particle interaction mechanisms particularly in the radiation belts are also arousing our interests from the viewpoint of the high-energy electron accelerations. While these are very important as fundamental plasma acceleration mechanisms in the magnetospheric plasma system, the terrestrial and planetary ionospheric plasma could be energized in the space-Earth/planet coupling regions represented by the polar auroral regions through the different or somewhat similar types of the plasma acceleration mechanisms, namely the field-aligned electric field accelerations and the transverse ion accelerations due to the wave-particle interaction processes. These mechanisms are considered to drive the terrestrial and planetary atmospheric plasma outflows, which have to be more intensively investigated in coming decades because not only the planets in our solar system but the exoplanets should be comprehensively and integratedly understood from the viewpoint of the universal space-planet coupling system.

In particular, the continuous energy and mass transports in these near-Earth space are mostly controlled by the electromagnetic field effects on the ionized atmospheric particles and the space plasmas. While state-of-the-art measurements in these important regions for understanding the space-Earth(planet) couplings have not been achieved yet, the previous space missions, represented by DE-1/2, Viking, Freja, Akebono, POLAR, FAST, CLUSTER-II, and Reimei, have been providing us with considerable elemental knowledge. Particularly, the acceleration and transport processes regarding the electrons and ions could be surveyed in more systematic and carefully based on the database of these satellite missions. We, therefore, have been analyzing the observational results made mainly by Reimei and FAST because these data are open, accessible, and easily investigated with some updated tools. The high-time resolution data obtained by these two satellites are available for studying the spatial distributions or time variations of the space plasmas by field-aligned electric fields and the wave-particle interaction processes although there are not made any simultaneous observations by Reimei and FAST.

In this presentation, we discuss the similarities and differences seen in the Reimei and FAST observations by focusing on the dynamics of the electrons and ions at the altitudes ranging from 400-4000 km in the midnight polar regions.