

Future Collaborations of the First Japanese Formation Flight Mission Using Polar-Orbiting Compact/Micro Satellites with EISCAT_3D and ALIS_4D Based on In-Situ and Remote-Sensing Observations for the Space-Earth Coupling Mechanisms

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We present the overview of a future formation flight mission by Japan for the integrated in-situ/remote-sensing observations to study the physical processes and mechanisms of the auroral acceleration structure as well as magnetosphere-ionosphere-thermosphere coupling, an important element in the space-Earth connections. The formation flight for in-situ observation consists 2-4 compact/micro satellites in a polar orbit at altitudes of about 300-4000 km, and the ground segments include both optics and radar system. Among those, EISCAT_3D and ALIS_4D(Auroral Large-scale Imaging System) constitute essential elements. . We tentatively call the formation flight mission FF-MIT (Formation Flight exploration for Magnetosphere-Ionosphere-Thermosphere coupling mechanisms). The detailed mission targets and the state-of-the-art methodology will be given in this presentation. The key issues of this FF-MIT could be listed as follows: (a) Transports and conversions of plasma and electromagnetic energies across the space-Earth boundaries, (b) Planetary/space plasma accelerations and mass escape via the wave-particle interactions, and (c) Response of the neutral atmosphere to space plasma activities via the plasma-neutral interactions.

In addition to this FF-MIT space exploration using the formation flight technique, it is also essential to coordinate and perform simultaneous observations with progressing ground-based observational facilities/equipment like EISCAT_3D, ALIS_4D, and the other high-speed optical imagers using EMCCD in order to obtain the physical parameters especially in the wider dimensions/areas of the upper atmosphere. The specialized science center would be required for effectively coordinating these integrated observations in space and on the ground and significantly organizing and expanding the data analyses/modeling/simulation activities, which are very similar to the situation of the successfully on-going Arase project owing to our vast efforts.

Within 1 year, we plan to start pre-project (Phase A study) of the FF-MIT mission starting toward the realization of the fascinating demonstrative research based on this cutting-edge space exploration mission and the powerful ground-based sites in mid 2020s.