

FF-MIT: A Formation Flight Mission by Innovative Compact Satellites Exploring the Magnetosphere-Ionosphere-Thermosphere Couplings

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We are planning to launch the first Japanese formation flight satellite mission for quantitatively investigating the terrestrial magnetosphere-ionosphere-thermosphere coupling mechanisms, namely the MIT system. The recent progress and latest status of this mission, so-called FF-MIT, will be shown in this presentation. FF-MIT would be carried out on the basis of integrated in-situ and remote-sensing observations using 2-4 compact/micro satellites in a polar orbit at altitudes of about 300-4000 km. The most important science target of FF-MIT is the demonstrative and quantitative investigation concerning the physical processes and mechanisms controlling the space-Earth connections, represented by the MIT system. The observational objectives of 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, (c) Response of the neutral atmosphere to space plasma activities via the plasma-neutral interactions. The satellite and instrumental configuration/specification and the cluster launch capability/strategy by an Epsilon rocket of JAXA would be clarified and fixed within a year in the framework of the FF-MIT working group, which will be proposed in this year to ISAS/JAXA. We have already made some of fundamental assessments of the technical feasibilities on the mission scenario and the instrumental specification/development, particularly regarding some crucial technical subjects with engineering groups in JAXA and design/fabrication teams in manufacturers. This paper will be devoted also to address the updated results obtained in these engineering activities, for instance, the possibility of the orbit insertion for the multiple compact satellites by a single Epsilon launch, the formation flight configuration and its control by satellite propulsion system, the attitude control required for the mission objectives. We are also expanding the possibilities of substantial international collaborations, for instance with EISCAT_3D and ALIS_4D. We would like to start the pre-project (phase-A study) of the FF-MIT mission in a year in order to realize the fascinating demonstrative research based on the cutting-edge space measurements and the powerful ground-based observations in mid 2020s.