

## A Future Formation Flight Mission of Compact Satellites and Mission-Oriented Developments of Plasma/Neutral Particle Analyzers for Elucidating Space-Terrestrial Coupling Mechanisms

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In 21st century, we led the Reimei mission realizing the fine-scale auroral emission and particle observations by the high-time/spatial resolutions and also initiated the ERG mission based on the trinity research system consisting of in-situ observation using spacecraft, ground-based network observation, and data analysis/modeling approach. The main scientific targets of these missions are the space plasma dynamics occurring universally in the regional and energy couplings in the terrestrial ionosphere and magnetosphere. Through these space exploration missions, we have actually noticed and been proposing the importance of coherent cooperation in the different methodologies (in-situ/ground-based observations, data analyses, modeling/simulation) as well as the significance of appropriate international collaborations, especially in the instrumental developments. It should also be noted that some novel ideas and the cutting-edge technologies matching them have been stimulating new exploration missions. For example, the high-resolving simultaneous measurements of auroral emissions and particles were carried out in the Reimei mission by using both our original auroral camera and plasma instrument. Recently, we are also developing so-called software-type wave-particle interaction analyzer (S-WPIA) in ERG in order to elucidate the energy transport between the plasma waves and particles in the collisionless plasma regime. These research experiences and expertise in our community are now leading new research activities to propose a new exploration mission using polar formation-flight configuration of compact satellites for the space-terrestrial coupling mechanisms. In this future mission, we will directly investigate the interactions and couplings in the plasma and neutral particles and the electromagnetic fields and waves in addition to the plasma wave-particle interaction analyses for the ionospheric transverse ion acceleration (TIA) and the simultaneous auroral emission-particle observations for the magnetosphere-ionosphere coupling processes like Alfvénic electron acceleration and their related auroras, and the field-aligned current distribution and variation. In this presentation, We introduce the formation-flight exploration mission using compact satellites and also discuss the instrumental development plans for their realization.

Keywords: space plasma, atmospheric neutral particle, space electromagnetic fields and wave, integrated observation, compact satellite, formation flight