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Development of Electric Field and Plasma Wave Investigations for Future Space Weather Missions: ERG, SCOPE, and beyond

Y. Kasaba (1), A. Kumamoto (1), T. Ono (1), H. Misawa (1), H. Kojima (2), S. Yagitani (3), Y. Kasahara (3), and K. Ishisaka (4)

(1) Tohoku University, Geophysics, Sendai, Japan (kasaba@pat.geophys.tohoku.ac.jp, 022 795 5775), (2) RISH, Kyoto University, (3) Kanazawa University, (4) Toyama Prefectural University

The electric field and plasma wave investigation is important for the clarification of global plasma dynamics and energetic processes in the planetary Magnetospheric studies.
We have several missions which will contribute those objectives.
the small-sized radiation belt mission, ERG (Energization and Radiation in Geospace),
the cross-scale formation flight mission, SCOPE,
the BepiColombo mission to Mercury, and the small-sized and full-scale Jovian mission in future.
Those will prevail the universal plasma mechanism and processes in the space laboratory.

The main purposes of electric field and plasma wave observation for those missions are: (1) Examination of the theories of high-energy particle acceleration by plasma waves, (2) identification of the origin of electric fields in the magnetosphere associated with cross-scale coupling processes, (3) diagnosis of plasma density, temperature and composition, and (4) investigation of wave-particle interaction and mode conversion processes.
Simultaneous observation of plasma waves and energetic particles with high resolution will enable us to investigate the wave-particle interaction based on quasi-linear theory and non-linear models.

In this paper, we will summarize the current plan and efforts for those future activities.
In order to achieve those objectives, the instrument including sensitive sensors (the long wire / stem antennae, the search-coil / loop antennae) and integrated receiver systems are now in development, including the direct identification of nonlinear wave-particle interactions associated will be tried by Wave-particle Correlator.

And, as applications of those development, we will mention to the space interferometer and the radar sounder technologies.