[EE] Evening Poster | P (Space and Planetary Sciences) | P-CG Complex & General

[P-CG21]Future missions and instrumentation for space and planetary science

convener:Shingo Kameda(School of Science, Rikkyo University), Satoshi Kasahara(The university of Tokyo), Mitsunori Ozaki(金沢大学理工研究域電子情報学系, 共同), Kazuo Yoshioka(Graduate School of frontier Science, The University of Tokyo)

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Not only national space agencies but some universities and even companies in the world are now leading a number of space science and exploration missions and also energetically initiating new research activities for satellite and rocket developments and international collaborations in these days because the Earth observations from the space and the space explorations could be achieved much easier than a few decades ago. The deployment to the space, which itself is not purely a scientific purpose but one of methods for better sciences, is vigorously motivating the technical innovation and the educational development. For successful space missions, it is also crucial to research and develop aim-oriented on-board instruments, and the fundamental research and development of observational instrumentation with future perspectives could totally lead space missions in some case. Detailed investigation and evaluation on various on-board instruments are needed during their proposals, selections, and fabrications in order to promote the missions, and inevitably we have to make multi-sided arrangements and evolution at every process and aspect of any type of space missions, independently of their mission sizes. In this session, we focus on these comprehensive research activities in the space missions, including the mission integrations and the individual instrumental developments, and we also call many presentations showing the uniqueness and renovation regarding the mission strategy and methodology, and the status and latest results in the related state-of-the-art researches and developments, which would provide all of researchers and developers with invaluable opportunities for active discussion, information sharing, and collaboration toward the realization of more missions for more fruitful space sciences and explorations in nearer future.

[PCG21-P05]Evaluation of Direction Finding Methods based on Spectral Matrix

*Mamoru Ota[1], Yoshiya Kasahara[1], Shoya Matsuda[2], Ayako Matsuoka[3], Mitsuru Hikishima[3], Yasumasa Kasaba[4], Mitsunori Ozaki[1], Satoshi Yagitani[1], Fuminori Tsuchiya[4], Atsushi Kumamoto[4] (1.Kanazawa University, 2.Nagoya University, 3.ISAS/JAXA, 4.Tohoku University)

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The ERG (Arase) satellite was launched on 20 December 2016 to study acceleration and loss mechanisms of relativistic electrons in the Earth's magnetosphere. The Plasma Wave Experiment (PWE), which is one of the science instruments on board the ERG satellite, measures electric field and magnetic field. The PWE consists of three sub-systems; EFD (Electric Field Detector), OFA/WFC (Onboard Frequency Analyzer and Waveform Capture), and HFA (High Frequency Analyzer). The OFA/WFC measures electromagnetic field spectra and raw waveforms in the frequency range from few Hz to 20 kHz. The OFA produces three kind of data; OFA-SPEC (power spectrum), OFA-MATRIX (spectral matrix), and OFA-COMPLEX (complex spectrum). The OFA-MATRIX measures ensemble averaged complex cross-spectra of two electric field components, and of three magnetic field components. The OFA-COMPLEX measures instantaneous complex spectra of electric and magnetic fields. These data are produced every 8 seconds in the nominal mode, and it can be used for polarization analysis and wave propagation direction finding.

In general, spectral matrix composed by cross-spectra of observed signals is used for direction finding, and many algorithms have been proposed. For example, Means method and SVD method can be applied on the assumption that the spectral matrix is consists of a single plane wave,while wave distribution function (WDF) method is applicable even to the data in which multiple numbers of plane waves are simultaneously included. The estimation accuracy of these direction finding methods is fundamentally dominated by the average duration and the sample size of the cross-spectra. The dominant parameters therefore should be determined adequately for the reliable estimation. In order to understand the influence due to the parameters on the direction finding, we evaluated the accuracy of the estimation results of some methods with various parameters by using the PWE/WFC data. In this presentation, we introduce these results.