Low-energy ion and electron spectrometers for the sounding rocket of SS520-3

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In-situ low-energy charged particle measurement in terrestrial or planetary plasma environment has been done with a variety of analyzers onboard spacecraft. Detailed studies of plasma characteristics demand measurement of a three-dimensional distribution function with adequate energy and angular resolution, a wide energy range, full coverage of space, and a high sampling rate. For three-dimensional energy analysis of low-energy charged particles, the top-hat electrostatic method using spherical deflectors or toroidal deflectors has usually been applied because of its large geometric factor and uniform angular response while requiring relatively few resources.
Since the in-situ plasma measurements have advanced and matured, today multi-spacecraft observation is indispensable to resolve not only the small-scale but also large-scale structures in the plasma environment. In addition, to achieve high-time resolution, one spacecraft is equipped with a dozen of identical electron and ion spectrometers, such as the MMS mission. Therefore, the reduction in size and weight is more and more important for following plasma observation missions. On the other hand, in the case of deep space exploration, since a variety of science instruments are mounted on the spacecraft for the comprehensive planetary science, there is left a small space for the charged particle instruments.
We have designed and fabricated a low-energy charged particle spectrometer, which is capable of measuring ions and electrons alternately by switching the polarity of high-voltage power supplies. For the sounding rocket of SS520-3 which will launch in the end of this year, we are preparing low-energy ion and electron spectrometers. The two analyzers consist of two identical sensors/optics and two sorts of high-voltage power supplies for ion and electron measurements. We present the design and characteristics of the analyzers.

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