Development of a high energy particle spectrometer for a future Jupiter mission

Jun Yamasaki[1]; Satoshi Kasahara[2]; Takeshi Takashima[3]; Yoshifumi Saito[4]
[1] Dept.Earth & Planet. Sci,Univ.Tokyo; [2] ISAS/JAXA; [3] ISAS, JAXA; [4] ISAS

Jupiter has strong magnetic field (10 times larger than that of the Earth at the surfaces) and its magnetosphere is the biggest accelerator in our Solar System. Existence of the four largest moons (Io, Europa, Ganymede, and Callisto) adds uniqueness to this magnetosphere. In particular, Ganymede is the only moon in the Solar System which is known so far to have its own magnetosphere (about the same size as Mercury's). Typical morphologies of the Jovian magnetosphere have been clarified by flybys of Pioneer 10 and 11, Voyager 1 and 2, and Ulysses, as well as in-orbit measurements by Galileo. However, details of plasma dynamics, such as mass and energy transport, remain unsolved.

JUpiter ICy moons Explorer (JUICE) is planned to be launched by ESA in 2022, arriving at Jupiter in 2030 to characterize the Jovian system among the four largest satellites with an emphasis on Ganymede, Europa, and Callisto. Acceleration, transport, and loss of charged particles in the Jovian magnetosphere are also important scientific targets of JUICE. Aiming at an investigation of the energetic particle dynamics in the Jovian magnetosphere and its interactions with the moons, we have been developing a high energy particle spectrometer (10s of keV to a few MeV). Specifically, in order to reduce the mass, we combined electron detectors and ion detectors in a single sensor head.

Ion mass and energy are determined by a combination of Time-of-Flight (TOF) unit and Solid-State-Detector (SSD), which provide velocity and energy of incoming ions, respectively. Ions such as H, He, O, S and other heavy ions up to a few MeV are measured. On the other hand, the energy of electrons up to 1 MeV is detected by multi-stacked SSDs. We will present the design and performance of the TOF unit obtained through numerical simulations.