Development of a high-energy electron analyzer onboard CubeSats

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Nowadays, the use of CubeSats for space science researches is no longer unusual in the world. We expect that CubeSats become a more powerful platform for space environment observations, enabling ultra-multi-point 'in-situ' measurements. More chances to install scientific instruments onboard CubeSats are desired to realize future observations and test new technologies in space. Thanks to the JSPS KAKENHI support and the collaboration with Kyushu Institute of Technology, we have an opportunity to install a new high-energy electron analyzer onboard the BIRDS-5 satellite, which is the fifth satellite in Joint Global Multi-Nation Birds Satellite (BIRDS) Program of Kyushu Institute of Technology. BIRDS-5 will be released from the international space station (ISS) in Spring 2022, and its orbit is almost the same as ISS.
Our high-energy electron analyzer for BIRDS-5 is nicknamed "Particle Instrument for NanO-satellite (PINO)." The mission objectives of PINO are followings. 1) To demonstrate a compact high-energy electron detector onboard a CubeSat using the Si/CdTe semiconductor, and 2) To measure the high-energy electron flux precipitating along the geomagnetic fields from the radiation belts. The CdTe semiconductor is commonly used for recent gamma-ray detectors in high-energy astrophysics, but the application of the CdTe semiconductor to the high-energy electron sensor is the first trial. We expect that the CdTe sensor can efficiently measure higher energy electrons because of the higher stopping power of CdTe than that of Si. This characteristic of the CdTe sensor is the advantage of developing a more compact analyzer. We will turn on PINO for continuous 5 minutes in an orbital revolution since electric power resource limits the operation. PINO can observe the precipitating high-energy electron fluxes above 60 degrees of the geomagnetic latitude in the northern hemisphere under this operational condition. With the collaboration between BIRDS-5 and Arase (ERG), we will be able to conduct simultaneous observations of precipitating high-energy electrons from the outer radiation belt at both low and high altitudes.
In this presentation, we will present the outline of science and the PINO development's latest status.

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