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The Extremely High-Energy Plasma/Particle Sensor for Electron of the SPRINT-B/ERG satellite

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The ERG satellite is a science mission of JAXA/ISAS , the purpose of which is to reveal the acceleration mechanism of high energy particles in the radiation belt. The high energy electrons of radiation belts change dramatically during a magnetic storm. After such storms occur, these high energy electrons disappear, only to subsequently proliferate during the recovery phase. There are said to be two hypotheses concerning this process, external supply (adiabatic process) and internal acceleration (non-adiabatic process). The ERG satellite consists of four instrument parts, Plasma/Particle (PPE), geomagnetic field (MGF), Plasma wave (PWE) and electric field (PWE). The PPE sensor consists of five particle sensors and four plasma sensors. Our group is now developing one of the sensors, namely the eXtremely high-Energy Plasma/particle sensor for electron (XEP-e). The XEP-e observes 100keV˜20MeV electrons and has four solid-state silicon detectors (SSDs) and a high-Z scintillator (GSO). It has one way conic sight and an electric part is unified with a part of sensor that is covered with aluminum to protect from contamination. The front part of the SSDs discriminate a radiation enters into the sensor and the back part of the plastic scintillator get the value of its energy. Since this satellite will traverse radiation belts, we have to assume a harsh radiation environment. Our group has an electrostatic accelerator in Tsukuba Space Center, via which we can make a radiation environment in space and proof a sensor. It is a pelletron charging system, which involves the accelerator radiating electrons or protons to a sensor in a vacuum chamber. The energies of the electrons and protons are 0.4 ˜ 2.0MeV and the beam current is 1fA ˜ 10nA (table 4). If the beam current of the electrons is set to 1pA, the flux becomes almost 1∗10ˆ6 counts/ sec/cm2. It also has an electron-gun (5 ˜ 50keV). We are using this system to proof the XEP-e and now we are still developing .

Keywords: XEP, electron, Sprint-B/ERG