KAGUYA に搭載された粒子計測器による月周辺環境観測

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Science targets of Charged Particle Spectrometer (CPS) onboard the SELENE (KAGUYA) spacecraft

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The CPS consists of two sub-components, one is the Particle Spectroscopy (PS) and the other is Alpha Ray Detector (ARD). The PS sensors, that will be onboard the SELENE spacecraft for the first Japanese lunar mission to be launched in 2007, will measure the high energy cosmic ray particles to measure a radiation environment around the moon for human activities in the future and to study their acceleration and propagation in the solar system. The PS sensor consists of 4 detectors: High energy Isotope Detector (HID), Low energy Particle Detector for Heavy ions (LPD-HE), Low energy Particle Detector for proton (LPD-p) and Low energy Particle Detector for electron (LPD-e). These are Si stuck detectors using the dE by E method that are cover the energy range from 100keV to 60MeV for proton, from 30keV to a few MeV for electron and from 3MeV/n to 400MeV/n for heavy ions, respectively. We use a new type B+ doped Si(Li) detector of which thickness is from 1 to 6mm with high energy resolution for each sensor. We can identify the isotopes for heavy ions from He to Xe by the PS sensor. The objectives of the PS subsystem can be divided into two categories. The first category is the measurement of radiation effect around the moon by charged particles that were accelerated in the geomagnetosphere, the interplanetary in the solar system and in shock regions in outer our solar system; we will know how will those particles impact on a radiation environment around the moon and will apply our observation results to a radiation forecast in the moon. The second category is the investigation of the structure and properties of the interplanetary medium. The interplanetary space is filled with magnetic field and there are planets with a large magnetosphere. Interplanetary shock waves frequently formed accelerate electrons and ions to MeV/n or more in Interplanetary Magnetic Field (IMF). The PS sensor will make a comprehensive measurement of energetic particle events from interplanetary or planetary origin. Energetic particle observation moreover can be used to study the propagation of ions from the point where particles were accelerated to the earth.

Primary target of the ARD is the alpha particles emitted by 222Rn and 210Po. It is trapped by the lunar gravity and decays with the half-life of 3.8 days emitting 5.490 MeV alpha particles. In the decay sequence of 222Rn, 210Po emits alpha particle with the energy of 5.305 MeV. Time scale of the activity is dominated by the 21-year half-life of 210Pb. Results from Apollo 15, 16, and recent Lunar Prospector mission indicate that the average amount of radon on the lunar surface is much smaller than expected, and the radon-alpha distribution suggests that radon comes out through gas emanation from fissures of the lunar surface. We developed a large-area detector of 326 cm2 for the ARD, which is 15-20 times larger than the detectors of Apollo and Lunar Prospector. Reduction of the background was achieved with the anticoincidence by rejecting cosmic-ray tracks. It will enable (1) precise global mapping of the radioactive material on the lunar surface, (2) identification of gas emanation, (3) study of the radon gas emanation mechanism on the lunar surface and the origin of the lunar atmosphere, and (4) obtaining information on the crusted movement during the last - 50 years.

We will present the initial results of the CPS and observation plans by SELENE.