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Low Energy Charged Particle Measurement by Japanese Lunar Orbiter Selene

YOSHIFUMI SAITO[1], SHOICHIRO YOKOTA[1], KAZUSHI ASAMURA[1], TAKAAKI TANAKA[1], TOSHIFUMI MUKAI[1]

[1] *ISAS/JAXA*

SELENE (SELenological and Engineering satellite) is a Japanese lunar orbiter that will be launched in 2007. The main purpose of this satellite is to study the origin and evolution of the moon by means of global mapping of element abundances, mineralogical composition, and surface geographical mapping from 100km altitude. PACE (Plasma energy Angle and Composition Experiment) is one of the scientific instruments onboard the SELENE satellite. PACE consists of 4 sensors: ESA (Electron Spectrum Analyzer)-S1, ESA-S2, IMA (Ion Mass Analyzer), and IEA (Ion Energy Analyzer). ESA-S1 and S2 measure three-dimensional distribution function of low energy electrons below 17keV. ESA basically employs a method of a top hat electrostatic analyzer with angular scanning deflectors at the entrance and toroidal electrodes inside. IMA and IEA measure the three-dimensional distribution function of low energy ions below 28keV/q. IMA has an ability to discriminate the ion mass with high mass resolution. IMA consists of an energy analyzer that is basically the same as ESA and an LEF (Linear Electric Field) TOF (Time Of Flight) ion mass analyzer. IEA consists of only an energy analyzer that is the same as the energy analyzer of IMA. Each sensor has hemi-spherical field of view (FOV). With two pairs of sensors ESA-S1 & IMA, and ESA-S2 & IEA, which are installed on the opposite side of the spacecraft, three-dimensional distribution function of low energy electrons and ions are observed. The scientific objectives of PACE are 1) to measure the ions sputtered from the lunar surface and the lunar atmosphere, 2) to measure the magnetic anomaly on the lunar surface using two ESAs and a magnetometer onboard SELENE simultaneously as an electron reflectometer, 3) to resolve the moon - solar wind interaction, 4) to resolve the moon - Earth's magnetosphere interaction, and 5) to observe the Earth's magnetotail. Sputtered ions from the lunar surface will be measured for the first time. Ground-based observations have revealed the existence of tenuous alkali-atmosphere around the moon. The rarefied atmosphere is thought to be produced mainly by solar photons and the solar wind. Sputtering by the solar wind that is one of the source mechanisms of the tenuous atmosphere presumably produces the secondary ions reflecting the composition of the lunar surface. In-situ measurements of low energy ions around the moon will provide us with fruitful information on the lunar surface and atmosphere.