

Development of an Ion Energy Mass Spectrometer on board the lunar orbiter SELENE satellite

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The SELENE satellite will be launched in 2005, and will be put into the 100km altitude lunar orbit that covers the whole spherical surface of the Moon. One of the science instruments MAP (Magnetic field And Plasma experiment) consists of LMAG (Lunar MAGnetometer) and PACE (Plasma energy Angle and Composition Experiment). Ion energy Mass Analyzer (IMA) of PACE will measure the 3-D distribution function of the mass-discriminated ions around the Moon. We will report the characteristics of our proto-model IMA on the basis of the result of the calibration experiment.

One of the scientific objectives is to measure the Moon-originating ions sputtered by the solar wind. Because there are various species of heavy ions around the Moon, the measurement of the three dimensional distribution of the moon originated ions with high mass resolution is necessary. Our IMA consists of an Energy Analyzer (EA) and a Mass Analyzer (MA). The IMA-EA has angular scanning deflectors at the entrance, spherical deflectors, and sensitivity control electrodes inside. The IMA-MA employs the Linear Electric Field Time-Of-Flight (LEF TOF) method in order to achieve the considerably high mass resolution. Since this specific electric field (LEF) increases linearly with respect to the distance along the center axis, the equation of motion of charged particles in LEF is an equation of a simple harmonic oscillator. The bounce time of the particles from entering to exiting the LEF region is one half of the oscillation period that is independent of the dispersion of energy and angle caused by the passage of the incident ions through a carbon foil. Therefore, high mass resolution can be expected. We fabricated a proto-model of the IMA and experimentally calibrated its characteristics which are energy resolution, geometric factor, and angular coverage of the IMA-EA and the TOF profiles of the IMA-MA for various ion species.