Search for Hydrogens over the Lunar Polar Surface by Gamma Ray Spectrometer onboard the SELENE Spacecraft

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Gamma Ray Spectrometer (GRS) is to be sent to the Moon onboard the SELENE, a Japanese lunar orbiter scheduled to be launched in 2007, and to perform spectroscopic observation of lunar gamma rays in its circular orbit at the height of about 100 km over the poles for globally mapping of the chemical composition of lunar surface material. Historically, both of neutron detector and gamma ray spectrometer were just launched onboard Lunar Prospector, this neutron detector obtained evidences supporting for existence of hydrogen on the ground at the lunar poles. GRS onboard SELENE consists of a cylindrical germanium detector (66 mm in diameter, 78 mm in length) as a main detector, of which energy resolution and sensitivity are superior to any other gamma-ray detector used ever before. Because of such a higher energy resolution, this GRS is able to identify many more elements with higher precision as compared with any other GRS onboard Apollo and Lunar Prospector. The GRS thus has possibility to directly detect gamma rays emitted by hydrogen on the lunar surface, though these gamma rays consisting of 2.223 MeV seem weaker than or close to the lines from elements Si and Al. Furthermore, some possible interferences from background gamma rays from the spacecraft itself should be taken into account because there exist gamma rays from natural radioactives, nuclei excited by cosmic rays and secondary neutrons from the Moon. Using Geant4 Monte Carlo code, background gamma rays from hydrogens over the lunar surface and the spacecraft have been estimated in order to check the efficiency for identifying hydrogens over the lunar surface.