Thermal and radiation effects for observation data of X-ray fluorescence spectrometer onboard SELENE

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We are developing an X-ray fluorescence spectrometers (XRS) onboard SELENE spacecraft. The SELENE spacecraft will be launched by H-IIA rocket in 2006, in order to investigate the origin and early evolution of the Moon. The XRS carry out global mapping of lunar surface by X-ray fluorescence spectrometry. The XRS includes high-resolution detectors, X-ray CCDs (MAXI), FWHM 160eV@5.9keV at –30degree Celsius, and large effective area, 100cm2 (CCDx16 chips), Addition, The XRS includes a Solar monitor, CCDx1, and Si-PIN photodiodes x2, FWHM 200eV@all range. The XRS will separate the energy spectrum of major elements, Mg, Al, Si, and Fe.

The SELENE spacecraft will orbit at 100km altitude the lunar pole in two hours. Then, the thermal radiation from lunar surface will cause an observed spectrum thermal noise, and high-energy proton will cause increase of backgrounds.

The CCDs of XRS is equivalent model to that of HAYABUSA spacecraft. The HAYABUSA spacecraft is voyaging to near-earth asteroid Itokawa. The HAYABUSA spacecraft will rendezvous with Itokawa in June 2005, and investigate the origin of solar system. HAYABUSA XRS has been observed cosmic X-ray backgrounds (CXB), supernova remnants (SNR), or active galactic nuclei (AGN) in every week for in-flight calibration. The HAYABUSA calibration data can be utilized for SELENE XRS pre-launch calibration.

In this study, we evaluated characteristic changes of XRS due to thermal radiation from lunar surface that is a simple grid model, and simulated the XRS observed spectrum in lunar polar orbit. Then, increase of noise due to thermal radiation and proton were based on HAYABUSA in-flight calibration data. Addition, we determined suitable parameters of SELENE XRS observation such as an exposure time, an update time of background, and threshold of X-ray event.