Calibration of Spectral Profiler and Examples of the Observed Lunar Surface Spectral Signatures

Yoshiko Ogawa[1]; Tsuneo Matsunaga[1]; Makiko Ohtake[2]; Jun'ichi Haruyama[2]; Yasuhiro Yokota[2]; Tomokatsu Morota[2]; Chikatoshi Honda[3]; Ryosuke Nakamura[4]; Shinsuke Kodama[4]; Tokuhiro Nimura[5]; Haruyama Jun-ichi LISM Working Group[6]

[1] NIES; [2] ISAS/JAXA; [3] ISAS; [4] AIST; [5] Earth and Planetary Sci., Tokyo Univ; [6] -

Spectral Profiler, hereafter we write SP, is a visible and near infrared spectrometer onboard SELENE (KAGUYA), which was launched off to the Moon on 2007/9/14 and starts its nominal mission on 2007/12/21. The operation continues about 1 year in polar orbits.

SP covers 500-2600 nm in wavelength with spectral resolutions of 6-8 nm and high SNRs of ˜2300@810-860 nm, accompanying three detectors (VIS: 513-1010 nm, NIR1: 884-1676 nm and NIR2: 2588-1702 nm). Compared with other spectrometers targeting the Moon in the past, SP is superior in its broader spectral coverage with high spectral resolution and high SN ratios, which could identify the mineralogical compositions of the lunar surface and contributes to the completion of the global map of the mineral distribution.

SP observes lunar surface during all day-time basically, and night-time, too, for calibration (see below). The calibration of SP data is essential for evaluation of the observed spectral signatures and critical for scientific interpretations. Many factors would affect spectral features; observational conditions (phase angles and solar altitude), thermal conditions and surface conditions (including space weathering, compaction, degradation) other than the composition itself, which should be considered carefully.

SP data calibration consists of radiometric and spectral calibration. We apply following sequential process to radiometric calibration: (1) Evaluation and removal of dark signals, (2) Conversion of digital signal (DN value) into radiance, (3) Conversion of radiance into reflectance. As for spectral calibration, we apply evaluation and adjustment of sensitive wavelength of each component in the detectors. We should also take care of their change with time, which may need frequent modification of calibration coefficients. For the above calibrations, we observe the 'standard/ground truth' site (Apollo 16 landing site) for three times and onboard halogen lamps for 4 times a week for in-flight calibration. We also plan the cross calibration with other instruments, especially MI (Multi-band Imager on board the spacecraft).

Here we show examples of SP data after processing and discuss the validity of the calibrations. We first focus on evaluation of the halogen lamp data to see no significant difference between preflight and in-flight data, which guarantees performance of SP. Finishing initial calibrations (1,2), we next get spectral reflectance (3) and show some observed characteristic spectra on the lunar surface locally. We suggest its variation and try to give some scientific interpretations qualitatively. We also try to connect with other geological information, distinguishing representative minerals, if possible.