Validation of lunar absolute radiance measured with a telescopic imaging spectrometer

Kimiko Saito[1]; Kazuto Saiki[2]; Ryosuke Nakamura[3]

[1] Phy.,Sci.,Osaka Univ.; [2] Earth and Space Sci., Osaka Univ.; [3] JAXA

The method of presuming absolute radiance of the moon with a ground-based observation is presented and the accuracy of our estimated value of the lunar radiance is discussed.

The project named Project ALIS is in progress. The purpose of the project is to establish the photometoric model of the moon as a spectral radiance standard of space-borne imaging instruments by observation of the moon from the International Space Station with ALIS(Advanced Lunar Imaging Spectrometer) (Refer to Saiki's presentation on this session for the outline of the project). For the establishment of the photometric model of the moon, lunar absolute radiance which is gained outside the earth atmosphere is indispensable. Though we had developed ALIS assuming use in space, we started the study of removal of the effect of atmosphere in order to proceed lunar science by the ground-based observation. In preparation for the observation with ALIS at the peak of Mt. Haleakala (Hawaii, USA) in this year, we observed the atmosphere in Osaka with a cooling CCD camera and examine the method of atmospheric correction.

In order to convert the observation after dark and flat correction into the lunar absolute radiance, the calibration of radiance and the atmospheric correction is indispensable. In the atmospheric correction the optical thickness of the atmosphere is one of the most important optical parameters. Various elements of the earth atmosphere such as aerosol, nitrogen, oxygen and atmospheric water vapor, scatter and absorb the light from the moon. Because the temporal and spatial variation of aerosol and water vapor is large, it is very important to gain a sufficient amount of atmospheric data with high accuracy the same time as the observation of the moon.

In this study we observed the atmosphere in Osaka through the bandpass filter of 650nm central wavelength with a CCD camera (MUTOH CV-04) mounted on a telescope. The number of pixels of the camera is 768(H) x 512(V) and the dimension of the pixel is 9 x 9 micro meter. Cooling system is double-peltier system. It can cool down 40 maximum lower than ambient temperature. Dynamic range of the output image has 16 bits depth. The telescope is a refracting-type telescope (GP-ED102S ,Vixen) and its aperture size is 80mm and its focal length is 720mm. Tracking with an motor-drive equatorial mounting, we observed some fixed stars (Alnath, Sirius, etc.) and the moon. After dark and flat correction, the integrated relative radiances were plotted against air-mass. Based on the results, the stability of the air and the atmospheric correction coefficient were estimated. The CCD camera was indirectly calibrated by observing a portable integrating sphere which had been calibrated by ALIS. ALIS had been calibrated with an integrating sphere in JAXA (Japan Aerospace Exploration Agency). In this presentation, we present our estimated value of the lunar absolute radiance using accumulated data by that time and discuss the evaluation of error.