

Development of ground-based lunar spectral imager

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The spectral analysis of mare materials is essential, in order to understand the relationship between the distribution of volcanic emplacements and origins of magma. To obtain spectral data of nearside of the moon, we have developed a ground based Lunar Spectral Imager. It focuses on the absorption band around 950 nm which indicates the contents of mafic minerals. Therefore, the effective wavelength is between 600 and 1600nm.

The ground-based Lunar VIS/Near IR Spectral imager consists of a Newton telescope (F5, focal length of 150 cm, Takahashi MT-300), a spectrometer (Genesis co. grating 200 g/mm), a visible camera (SBIG ST-7E, Si area sensor), a near infrared camera (SU Inc, SU320-1.7RT-D, InGaAs area sensor), and a viewing camera (Genesis co. based on Phillips co. ToUCam-Pro). Lights collected by the telescope focused on a slit mirror. Lights reflected by the mirror, which indicate the lunar surface except the position of spectral analysis, are focused on the viewing camera. Lights passing through the slit are dispersed by the spectrometer, and then split into visible and near infrared by a dichroic mirror. The split lights are focused on the VIS camera and the near-IR camera, respectively. Simultaneously, VIS and NIR data can be obtained on the same condition of the atmospheric absorption and the phase angles of the lunar surface. Spectral and spatial data are recorded in each line and column of area sensors of VIS and IR cameras, respectively.

The reflective mirrors of the telescope are coated by MgF₂ in order to avoid the low reflectivity around the wavelength of 900 nm. The equatorial mounting of the telescope (Takahashi EM500 Tenma PC) is controlled remotely while confirming the observed regions using images of viewing camera. While shifting imaging positions, spectral and 2dimensional spatial images can be obtained. Taking into consideration of the dispersion efficiency, resolutions of wavelength of Visible and NIR cameras are 10 and 20 nm, respectively. Some binning are required to obtain enough Signal to Noise Ratio about 200. The correction of the wavelength is conducted by using emission lines of Ar, Kr, and Hg lamps.

CCD cameras are on the markets and less expensive than the originally developed ones. Moreover, the total weight except the telescope and control PCs is within 4 kg. Thus, our imager is designed for the cases of limited weight and cost.