Utilization of two types of Ground-based Hyperspectral Telescope to Support SELENE Science Research

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Two types of hyperspectral telescope had been developed. This presentation introduces their results supporting for SELENE LISM operation and discuss the future application supporting LISM science. One telescope is Advanced Lunar Imaging Spectrometer (ALIS) and another is Tunable Liquid-crystal Telescope (TLT). They apply different dispersive elements. ALIS uses PGP (Prism-Grating-Prism) devices covering 380 - 1700 nm. It is a Cassegrain telescope equipped with two spectrometers; Visible (VIS) one and Near Infrared (NIR) one. Each spectrometer is composed of an imaging sensor and a PGP unit. The spectrometers capture ”1-line spatial information” x ”wavelength information” image at one shot. Line images are assembled by scanning an image on a slit of the spectrometer using a rotating mirror. TLT is a multi-band telescope using a tunable liquid-crystal filter covering 650 - 1100 nm. It is a refracting telescope equipped with a cooling CCD camera and a tunable liquid-crystal filter covering 650 - 1100 nm. Each telescope has its own merits and demerits. The merits of ALIS are (1) simultaneity of acquisitions of hundreds of bands at each sampling point and (2) perfect spatial coincidence among the bands. The demerits of ALIS are (1) difficulty in flat field correction because mainly of wavelength-shift called smile effect, (2) difficulty in photometric measurement of stars caused by scanning system, and (3) perfect tracking requirement for correct geometry of objects. The merits of TLT are (1) simultaneity of acquisitions of all pixels on each mono-band image and (2) facility in flat field correction. The demerits of TLT are (1) sub-pixel discordance in reconstruction of spectrum for one specific point and (2) difficulty in temperature control for the stability of the liquid crystal. Making the most of their advantages, ground-based observations of the moon were carried out. ALIS succeeded in detecting the shift of the wavelength of Fe 2+ absorption band at around 1000 nm in lunar mare region and TLT succeeded in gaining a lunar absolute radiance and reflectance.