Development of Advanced Lunar Imaging Spectrometer (ALIS) for Lunar Polar Exploration Mission (LUPEX)

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We proposed the Advanced Lunar Imaging Spectrometer (ALIS) for the Lunar Polar Exploration Mission (LUPEX), which Japan and India are jointly considering to launch in 2023 or later, and it was selected as a candidate for the rover in April 2020. It was selected as a candidate instrument for the rover in April 2020. ALIS can identify rock-forming minerals in the target area and confirm and quantify the existence of water ice.
ALIS is composed of the following six blocks. ALIS-C (Camera) is the main block, which contains the image sensor, spectroscopic optics, and electrical circuits. ALIS-R (Reflector), a fixed mirror to direct the field of view to the drilled area to observe the excavated soil when the rover drills a hole in the lunar surface; ALIS-L2 (Light2), a second light source to illuminate the excavated soil when observing it; and ALIS-D (Diffuse reflector), a standard diffuse reflector to calibrate the spectral data of ALIS.
There is an absorption band of water ice near 1500 nm, and we aim to use this absorption band to quantitatively detect trace ice of about 0.5 wt%. We will also detect OH groups using the absorption band around 1400-1500nm and identify rock-forming minerals using the absorption band around 1000nm. Even in the permanently shadowed region of the Moon, the surface is likely to have lost ice due to micrometeorite impacts, and ALIS may be able to detect areas where the surface has been stripped by meteorite impacts more recent than about 1 million years, and where subsurface ice, which has not sublimated, is exposed. Also, if water molecules are ejected from the subsurface to the lunar surface for some reason, it may be possible to detect water vapor by using transmitted light from a bright cliff or other background. In addition, it is also possible to identify rock-forming minerals distributed on the surface with the same wavelength range, so that geological surveys can be conducted as well.
In the presentation, we will show the details of the ALIS design and a concrete image of its operation.
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