Light source investigation of the volatile spectral signals observed at the lunar polar regions

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Recently, the water condensation at the lunar polar region has been suggested by remote sensing observation. However, their distribution, amount, and origin are not clear because of the limitation on the available data. To solve these problems, we have been investigating spectral signatures of the water and other volatile components observed at the lunar polar regions by analyzing Spectral Profiler data onboard SELENE (Kaguya) and reported clear evidence of water ice and other volatile components both on the north and south polar regions.

In this study, we investigate the identified spectral signals at the polar region (> ±80˚ in latitude) to estimate origin of the observed volatile components by checking timing, location, and observational geometry of the volatile signals. The results revealed that the identified signals were detected at the sites experiencing the night (i.e., not directly illuminated) and also these sites are not illuminated by the reflected light from surroundings during the observation. And because of the apparent lack of the light source, we further checked possibility of artificial origin for the identified volatile signals such as stray light or noise of the instrument and calibration error. In addition to the artificial origin, possibility of originated from natural light sources other than those coming from the lunar surface, like earthshine and zodiacal light, were checked. But all of these checks resulted in negative. Therefore, we interpret that the identified signals are real, and they are likely originated from the dust and volatile mixture lofted in space and reflecting the solar light. The signals are localized and continues up to several days in maximum and they are much brighter than the previously observed impact flash. And their observed timings did not coincide with major meteoroid streams in most of the cases. These evidences suggest that not all of the volatile signal were the impact events.

Keywords: Moon, polar regions, volatile component

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