**OPTICAL AND LOW FREQUENCY RADIO OBSERVATORY ON THE MOON.** H. Noda[1] , H. Hanada[1] , T. Iwata[2] , N. Kawano[1] , S. Sasaki[1] , H. Araki[1], and T. Imamura[2], [1] National Astronomical Observatory of Japan (2-12 Hoshigaoka, Mizusawa, Oshu, Iwate 023-0861, Japan, noda@miz.nao.ac.jp), [2] Institute of Space and Astronautical Science, Japan Aerospace ExplorationAgency (3-1-1 Yoshinodai,Sagamihara, Kanagawa 229-8510, Japan)

**Introduction:** One of the targets of the lunar exploration is to realize astronomical observatories on the Moon, because the Moon offers less-noisy environment for astronomical observation with high accuracy. We propose two experiments on the Moon to the Japanese post-SELENE landing mission. One is the ILOM (In-situ Lunar Orientation Measurement), which measures the rotation of the Moon to elucidate the inner structure of the Moon, and another is a low frequency radio antenna for the observation in the frequency range of 20-25 MHz.

**Optical measurement:** The ILOM is a selenodetic experiment to study lunar rotational dynamics by direct observations of the lunar physical and free librations from the lunar surface with an accuracy of 1 millisecond of arc in the post-SELENE mission [1]. An optical telescope is put on the lunar polar region so that it can track spiral trajectories of stars located near the lunar celestical pole. Year-long data will provide information on various components of the physical librations, and possibly those on the lunar free librations in order to investigate the lunar mantle and the liquid core. A photographic zenith tube (PZT) telescope, which is similar to ones used for the international latitude observations of the Earth, is applied. The ILOM optical telescope is small in size (20 cm diameter ) so that it is also positioned as a precursor for the future larger telescopes.

If small dust particles levitate above the surface due to the electromagnetic forces or artifitial disturbances in landing, it is expected that these particle scatter the solar light and that the sky above the instrument becomes brighter [2]. This phenomenon, if it is detected, could affect the optical observation. However, it also provides us of the information of the lunar dust behavior.

**Low frequency radio telescope:** Astronomical radio observation in the low frequency, long wavelength region has been argued for more than two decades (e.g. [3]), but it has never been realized until now. In the next generation of the lunar exploration, many lunar landers are expected to land on the lunar surface, so that we can study the possibility of the low frequency radio antenna on the Moon. We propose a strategy as well as instrumentation for the future large astronomical facility on the Moon. As the first stage, a dipole antenna will be put on the lander, which will be an element of a very long baseline interferometer (VLBI) with Earth's ground antennas in 20-25 MHz. This array will be dedicated to study the source region of Jovian decameter emission. In the following stages, arrays of low frequency radio antennas in less than 10 MHz range will be put on the Moon for the astronomical study.

Attention should be paid to the result by the former mission that the lunar ionosphere is considered to exist ([4]). The existence of the lunar ionosphere could constrain the lowest frequency limit for the astronomical study. The radio science experiment on SELENE will provide us of the electron density profile of the lunar tenuous atomosphere ([5]). Also, it is noteworthy that the use of radio waves for communication purpose in the vicinity of the Moon should be appropreately regulated in terms of the frequency protection for the astronomical study.

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