

Lunar electromagnetic response to be observed by Lunar ElectroMagnetic Sounder (LEMS) in the SELENE-2 mission

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The present status of lunar interior structure is a consequence of the thermal history of the Moon. Therefore information on its internal structure is a key issue to understand the lunar origin and evolution. The electrical conductivity structure, which is independent of the seismic velocity structure, is important to estimate the thermal structure in the lunar interior, since the electrical conductivity of silicates has a strong temperature dependence. Hence, we propose a lunar electromagnetic sounder (LEMS) to estimate the electrical conductivity structure of the Moon.

Temporal variations in the magnetic field of lunar external origin induce eddy currents in the lunar interior, which in turn generates the magnetic field of lunar internal origin. In the SELENE-2 mission, the inducing magnetic field is to be measured by two triaxial fluxgate magnetometers onboard a lunar orbiter, and the induced field as well as the inducing field is to be measured by two triaxial fluxgate magnetometers onboard a lunar lander. We plan to use dual magnetometer technique as mentioned above to avoid strict electromagnetic compatibility requirements like those for the Kaguya spacecraft.

Here we present a current status of the LEMS mission. We also show electromagnetic response of the Moon by assuming electrical conductivity structures of the lunar interior. It turns out that the magnetic field data as obtained in the Apollo mission are insufficient to estimate the electrical conductivity structure for the outermost few hundred kilometers of the Moon because of the low sampling frequency. Estimation of lunar electromagnetic response was attempted by using the magnetic field data obtained by the lunar magnetometer (LMAG) onboard the Kaguya spacecraft. Although the magnetic field data at higher frequencies are available, it is difficult to estimate electromagnetic response only by the lunar orbiter. Thus it is very significant to measure the magnetic field by both a lunar lander and a lunar orbiter in the SELENE-2 mission.

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