

Recent status of SELENE-2/VLBI instrument

Fuyuhiko Kikuchi¹, Koji Matsumoto^{1*}

¹RISE Project, National Astronomical Observatory of Japan

We proposed a VLBI (very long baseline interferometry) radio source mission for the Moon lander SELENE-2. The purpose of our mission is to improve the lunar gravity field and to estimate the lunar interior structure. Differential VLBI observations between an orbiter and a lander are carried out to determine the position of the orbiter and the lander in addition to the conventional 2-way Doppler observation (Fig.1). VLBI measures a difference in an arrival time of a signal transmitted from a radio source to two ground stations. This measurement gives plane-of-sky position information of the radio source in contrast to 2-way Doppler measurement that gives line-of-sight position information. The combination of VLBI with Doppler is effective for precise position determination of the spacecraft.

This presentation shows the recent status of the VLBI radio source mission of SELENE-2.

1. A simulation study of the lunar gravity field estimation is carried out. The result shows that a potential Love number k_2 accuracy better than 1 % can be achieved by 3 months of the VLBI mission duration provided that arc length is 14 days and that historical tracking data including SELENE are combined with.

2. The sensitivity of the geophysical parameters, in particular that of k_2 , the moment inertia of the Moon, and the seismic travel time, for the lunar deep interior structure is evaluated. A preliminary result shows that a density and a radius of the lunar core can be estimated within the error of 10 %.

3. We have conceptual design for an antenna that will be used on the lunar surface. A simulation evaluates the electric characters of the antenna, which are the gain, the beam pattern, and its temperature characteristics.

4. In order to decrease the power consumption of the VLBI radio source, the observation method and the manner of the operation are reconsidered.

Keywords: selene-2, vlbi, moon, internal structure