VLBI Observation of Okina and Ouna in Kaguya (SELENE), for better Estimation of the Orbit and the Lunar Gravity Field

Hideo Hanada[1]; Takahiro Iwata[2]; Nobuyuki Kawano[1]; Noriyuki Namiki[3]; Fuyuhiko Kikuchi[4]; qinghui Liu[5]; Koji Matsumoto[1]; Yoshiaki Ishihara[1]; KAZUYOSHI ASARI[6]; Toshiaki Ishikawa[1]; Hirotomo Noda[1]; Seiitsu Tsuruta[7]; Sander Goossens[1]; Natalia Petrova[1]; Sho Sasaki[1]; Hanada Hideo VRAD Team[8]; Kobayashi Hideyuki VERA Group[8]

[1] RISE, NAOJ; [2] ISAS/JAXA; [3] Earth and Planetary Sciences, Kyushu Univ.; [4] none; [5] NAOJ; [6] National Astronomical Observatory,Mizusawa; [7] RISE,NAOJ; [8] -

http://risewww.mtk.nao.ac.jp/index.html

KAGUYA consists of the main orbiter, and two small free-flying sub-satellites, called Rstar (OKINA) and Vstar (OUNA). We are observing OKINA and OUNA using differential VLBI observations with the aim of improving the lunar gravity field model. Our observations will particularly improve the accuracy to which the low degree gravitational harmonics and the gravity field near the limb can be measured, and when combined with Doppler measurements will enable three-dimensional information to be extracted. Differential VLBI will be used to accurately measure the trajectories of the satellites, both with the Japanese VERA (VLBI Exploration of Radio Astrometry) telescopes and an array including the international VLBI stations, Shanghai, Urumqi (China), Hobart (Australia), and Wettzell (Germany).

We are using multi-frequency VLBI to determine the angular distance between OKINA and OUNA using three frequencies in S-band, (2212, 2218 and 2287 MHz), and one in X-band, (8456MHz). Two periods of international observations, each of one month in duration, with the participation of VERA and the international stations, (in addition to the normal observations by VERA only) are planned for the one year mission period.

VLBI observation was started on Nov.5, 2007 and the first international VLBI observation was performed in Jan, 2008. We have succeeded in obtaining phase delay with an accuracy of several pico-seconds in S-band.