

かぐや搭載月レーダサウンダーによる初期観測結果

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Initial results from the Lunar Radar Sounder on-board the Kaguya spacecraft

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The Lunar Radar Sounder (LRS) on-board the KAGUYA (Selene) lunar orbiter is currently being equipped to provide the data of subsurface stratification and tectonic features in the shallow part (several km deep) of the lunar crust, by using an FM/CW radar technique in HF (~5MHz) frequency range (Ono and Oya, 2000; Ono et al. 2007). Knowledge of the subsurface structure is crucial to better understanding, not only of the geologic history of the moon, but also of the regional and global thermal history of the moon and of the origin of the Earth-Moon system (Yamaji et al., 1998). In addition to the subsurface radar experiment, LRS will provide the spectrum of plasma waves and solar and planetary radio waves in a wide frequency range from 10 Hz to 30 MHz (Kumamoto et al., 2007; Kasahara et al., 2007).

The technique of the instrumentation of LRS is based on the plasma waves and sounder experiments which have been established through the observations of the magnetosphere, plasmasphere and ionosphere on-board Jikiken, Ohzora and Akebono satellites, and extended to observations of the Martian ionosphere as well as surface land shape on-board the Nozomi spacecraft. By using digital signal processing techniques for the RF waveform generation and on-board data analyses, it becomes possible to improve the S/N ratio and resolution, as well as capability of data handling for the subsurface sounding of the Moon (Ono and Oya, 2000; Ono et al. 2007). The instrumental and theoretical studies showed that the observations on-board the SELENE spacecraft will provide detailed information about the subsurface structures within a depth of 5 km from the lunar surface, with a range resolution of 180 m for a region with a horizontal scale of several tens of km (Kobayashi et al., 2002, 2006).

The Kaguya spacecraft was successfully launched on September 14, 2007, and the antenna system was deployed on October 29 on Moon's orbit starting the passive mode observations. The passive mode observation provides us spectra of solar and planetary radio waves and plasma waves surrounding the moon's body along the Kaguya's orbit. On November 20, and 21, 2007, Sounder mode operation provided the first light data. LRS experiment on-board Kaguya performs well as it was planned. The existence of subsurface echo was first verified in the maria regions. The SAR image and strata identification have been successfully carried out at the northeastern part of the Mare Imbrium near the Kirch crater retrieved from the LRS sounder mode observation data on November 21, 2007, from 22:13 to 22:15 (JST). We found significant difference of subsurface boundary in the Mare Serenitatis in comparison with the ALSE results. We will investigate the detail of subsurface geological feature by using the huge database of the LRS experiment.

The present state of the LRS experiment is under the continuous observation for achieving global survey of the moon on-board the KAGUYA (Selene) spacecraft. This paper provides initial results from the LRS observation on-board the spacecraft in the lunar orbit.