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SELENE (Kaguya) achievements and perspectives

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Abstract

The SELenological and ENgineering Explorer (SELENE, nicknamed Kaguya) collected much data during its about one and a half year mission period. Many new findings for the Moon have been published based on the SELENE data. The SELENE data and products have high potential to promote research of lunar sciences and future lunar exploration. Various SELENE products derived from the data have been released to the public via the SELENE data archive site. The SELENE data and products are expected to be more used by science communities all over the world.

1. Introduction

The SELenological and ENgineering Explorer (SELENE), a Japanese lunar orbiter nicknamed Kaguya, was launched on 14 September 2007 and ended its mission by controlled impact onto the Moon on 10 June 2009. Mission instruments installed on the explorer successfully collected various valuable data for understanding the origin and evolution of the Moon and to study how to use the Moon. Five years have passed since SELENE's launch, and three years since the cessation of its mission. During these years, the data have been calibrated and validated and many products from the data have been released via the SELENE data archive system [http://l2db.selene.darts.isas.jaxa.jp]. In this presentation, we summarize the scientific achievements from SELENE data and products, and discuss perspectives of future researches based on the achievements.

2. High Potential SELENE data and products

SELENE data products have high potential for promoting research in lunar sciences and future exploration.

SELENE data include totally new kinds: ion data acquired by Plasma energy Angle and Composition Experiment (PACE) [1,2], continuous reflectance spectra in the visible and near-infrared ranges of the lunar surface acquired by the Spectral Profiler (SP) [e.g. 3,4], subsurface structure acquired by the Lunar Radar Sounder (LRS) [5], etc. These data are revealing new aspects of the Moon.

The SELENE data are higher in quality than that previously attained. For example, lunar surface stereo-pair images from Terrain Camera and elevation data based on the image data have 10 m/pixel spatial resolution [3]. Such high-resolution data had been limited to the eastern side of the equatorial region of the Moon. The Multiband Imager (MI) could achieve one-order higher spatial resolution multi-band data than could Clementine UV-VIS [3,6,7].

The global, homogeneous, high-quality coverage achieved by SELENE polar orbit observations is an example of the high potential of the SELENE data. The data of the lunar farside and polar regions that had been conspicuously lacking are revising our knowledge of the Moon. The lunar farside gravitational field provided new information of the initial lunar crust [8,9]. New models of lunar evolution are being developed based on new findings of the global distribution of key minerals and elements derived from SELENE data [e.g. 4, 10-14].

SELENE instruments could observe the same locations multiple times during the SELENE mission that was extended to one and a half years. Data acquired at different times are very significant for calibration and validation, leading to improved reliability of the data. Data obtained under different solar photometric conditions could be used to derive the lunar surface photometric functions [15].

Various SELENE data of terrain structures, minerals, elements, gravitational field, plasma, and electromagnetic fields could be made more significant by synthetic analysis. The subsurface structures detected by LRS could be confirmed by TC and MI as layer structures exposed on the inner walls of craters [16]. The synthetic analyses of ions and electrons with magnetic fields could provide more reliable information of the plasma behavior around the wake of the Moon. Much more synthetic analyses are expected to be achieved now that fundamental calibration and validation for products is being completed.

3. Conclusion

In the last decade, many lunar explorers visited the Moon, opening a new era of lunar science and exploration. In the next decade, more lunar explorers will arrive at and land on the Moon, and furthermore return with samples from the Moon. Pre-studies to resend humans to the Moon are also starting. Numerous new missions to the Moon are being considered in many countries. We hope the SELENE data and high-potential products will be used by lunar and planetary science communities all over the world to study lunar sciences and future lunar exploration.

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