Current observation of lunar gamma rays by KAGUYA GRS

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Elemental abundance on the surface of solid body such as terrestrial planets, the Moon and asteroids provides important information for elucidating the origin and the evolution of the bodies and also for understanding the origin and the evolution of solar system.

Remote-sensing gamma-ray spectroscopy of the bodies is extremely powerful technique for the surface measurement of the elemental abundance. Gamma-ray spectrometer (GRS), on board KAGUYA (SELENE) spacecraft launched on September 14, 2007, employed a Ge detector which has the highest energy resolution as the main detector [1]. With the GRS observation data, accordingly we are able to measure the abundances of more elements on the Moon surface than the past Apollo missions and Lunar Prospector had done.

In energy spectra from the early observation of KAGUYA GRS as of February 2008, gamma rays from nine elements (K, Th, U, Si, Ti, Al, Fe, Ca, and O) were identified. The GRS is going to accumulate the observation data at least for 10 months of the nominal mission, but the short observation at present, nevertheless, shows the local differences in gamma-ray intensity between the nearside and the farside, for example, of natural radioactivities of 40K, Th and U [2].

After a long-term accumulation of data in the future, KAGUYA GRS will provide global maps of the elements and will give insights into lunar science. The global mapping of various elements by KAGUYA GRS is expected to contribute the progress in the major topics of lunar science:

(1) Fe, Mg: The magnesium number in the lunar surface will be compared to that on the earth and the comparison will show how the moon was formed and was evolved.

(2) Refractory element (Ca, Al, U, Ti): Refractory element abundance can provide useful information of the differentiation and the formation of lunar crust.

(3) Radioactivity (U, Th, K): The radioactive decay of K, U, Th which is energy source of thermal flow in the moon, is closely related with the thermal history of the Moon.

(4) Volatile element (H, C, S) : The existence of water ice has been expected since 1960’s and has been not only a scientific interest in association with the transport to the moon, but also an interest in terms of lunar utilization, which is very necessary for human activity.

[1] N. Hasebe et al. *EPS*, (2008) in press.

[2] Y. Karouji et al. (presentation in this meeting).