Global mapping of the lunar magnetic anomalies by electron reflection method

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Crustal magnetic fields are known to exist on Earth, Mars, and the Moon, and they may also exist on various astronomical bodies in the Solar System. Although the Moon has no global magnetic field, there exist locally magnetized regions called lunar magnetic anomalies. Therefore incident solar wind directly impacts the lunar surface, except for the case where the crustal magnetic field prevents it from penetrating into the lunar magnetic anomalies. Interaction between the lunar magnetic anomalies and plasma particles give important information about the distribution of plasma environment and space weathering. Electron reflection measurement is one of the methods for observing the lunar magnetic anomalies. This measurement makes use of the magnetic mirror effect. By the existence of the lunar magnetic anomalies, if the pitch angle of an incident electron reaches 90 degrees before the electron impacts the lunar surface, it is reflected back to the satellite. The crustal magnetic fields on the lunar surface can be estimated by measuring the cutoff pitch angle of the reflected electrons and the magnetic field around the satellite. This method can infer the lunar surface field strength with sensitivity that is independent of spacecraft altitude.
Apollo revealed hundreds of localized crustal magnetic fields. Lunar Prospector made a global map of the crustal magnetic fields for the first time. Kaguya observed the more detailed global crustal magnetic fields with higher time resolution and higher spatial resolution than the previous observations.
We have analyzed the reflected electron data and magnetic field data around the satellite obtained by low energy charged particle analyzers (MAP-PACE) and magnetometer (MAP-LMAG) on Kaguya. Using the electron reflection method, we will report the global map of the lunar surface magnetic fields with high spatial resolution (~8 km). Some of the observations of the reflected electron distributions showed energy-dependent loss cone by the effects of electrical potential differences between the lunar surface and Kaguya. We corrected the influence of the electrical potential difference on our result. By comparing our result of electron reflection method with the magnetic field measured by the magnetometer, we will discuss the behavior of the electron reflection over the lunar surface.

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