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Structure and dynamics of the lunar exosphere

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The Moon has no global intrinsic magnetic field and only has a very thin atmosphere called surface-bounded exosphere. Some ground-based measurements have revealed the structure of the lunar exosphere since the discovery. The alkali components such as Na or K have especially been observed to understand the generation process and the transport mechanisms. The ground-based measurements and laboratory experiments have proposed that the alkali exospheric components are produced by ion-induced desorption (sputtering), photon-stimulated desorption, meteorite-induced vaporization and/or thermal desorption from the surface. One of the loss processes of the exospheric particles is photoionization and ion-pickup process. The ionized exospheric particles are transported by the surrounding electric field. By using the SELENE(KAGUYA) ion measurement data, we have studied the lunar exosphere as well as interactions between the solar wind and the planetary surface. MAP-PACE IMA has detected low-energy ions at 100-km altitude. The MAP-PACE measurements have elucidated that the ions originate from the lunar surface and exosphere and that the ions are at least composed of He+, C+, O+, Na+, K+ and Ar+. The measurements of ions from the Moon enable us to continuously monitor the lunar exosphere. The 1.5-year observation of SELENE(KAGUYA) shows that the ions from the Moon have been detected both when the Moon is exposed to the solar wind and when it is in the Earth's lobe region. The observation suggests that the solar wind is not the dominant source mechanism for the lunar exospheres. Moreover, the MAP-PACE observation shows the dependence on the solar zenith angle and the dawn-dusk asymmetry of the lunar exosphere. We report the features of the lunar exospheres obtained by the SELENE(KAGUYA) observation and discuss the source mechanism of the lunar exospheres.

Keywords: Moon, exosphere, mass analysis