

月のアルカリ外気圏の構造と変動 Variation of the ionized lunar sodium and potassium exosphere

横田 勝一郎^{1*}; 斎藤 義文¹; 浅村 和史¹; Nishino Masaki²; 綱川 秀夫³
YOKOTA, Shoichiro^{1*}; SAITO, Yoshifumi¹; ASAMURA, Kazushi¹; NISHINO, Masaki²; TSUNAKAWA, Hideo³

¹宇宙研, ²名大太陽地球環境研究所, ³東工大
¹ISAS/JAXA, ²STE Lab., ³Tokyo Institute of Tech.

Lunar exosphere has been observed and studied on many occasions by ground-based telescopes since the discovery of surface-bounded alkali exosphere. The observed exospheric components were alkali atoms such as Na and K because the emission lines are much brighter than for other conceivable components. The structure, source, and the transport mechanisms of the lunar exosphere have been discussed based on these ground-based observations of the alkali atoms. As for the source mechanism of the thin lunar alkali exosphere, five processes were proposed as follows: thermal desorption, electron-stimulated desorption (ESD), photon-stimulated desorption (PSD), ion-induced desorption (sputtering), and vaporization by micrometeoroid impacts. Structure of the lunar exosphere gives us the key parameters to investigate the source mechanism. The observed Na exosphere distribution suggested that PSD and/or sputtering do not simply release the exospheric particles. Since PSD is capable of releasing alkali atoms only out of very shallow region in the lunar soils, PSD has relatively limited store of the exospheric particles in the lunar surface. If there was no replenishing process, PSD would deplete surface alkalis. We present latitude and longitude distributions of Na⁺ and K⁺ fluxes from the Moon derived from the Kaguya low-energy ion data. Although the latitude distribution agrees with the previous ground-based telescope observations, dawn-dusk asymmetry has been found in the longitude distribution. Our model of the lunar surface abundance and yield of Na and K demonstrates that the abundance decreases to around 50%, at dusk compared to that at dawn due to the emission of the exospheric particles. It is also implicated that the surface abundance of Na and K need to be supplied during the night in order to explain the observed lunar exosphere with the dawn-dusk asymmetry.

キーワード: 月, 外気圏, アルカリ大気, 質量分析
Keywords: Moon, Exosphere, Alkali atmosphere, Mass analyses