Spectroscopic observation of Lunar sodium and potassium atmosphere

Shingo Umekawa[1]; Masato Kagitani[2]; Hidetaka Ueto[3]; Shoichi Okano[4]; Takeshi Sakanoi[5]

[1] Planet. Plasma Atmos. Res. Cent., Tohoku Univ; [2] PPARC, Tohoku Univ; [3] Planet. Plasma and Atmos. Res. Cent., Tohoku Univ.; [4] PPARC, Tohoku Univ.; [5] PPARC, Grad. School of Sci., Tohoku Univ.

Small bodies in the solar system, such as Moon and Mercury, are known to have surface bound exosphere (SBE), which is collision-free tenuous atmosphere. It is important to investigate its production mechanism that will be useful for understanding of the space weathering process in the solar system. Among others, the Moon is the most pertinent target for studying SBE because we can observe distribution of the atmosphere relatively easily from the ground. The lunar atmosphere is divided into hot component and cold component in terms of the temperature. The former originates from non-thermal processes such as photo-stimulated desorption due to solar radiation and the latter is produced by thermal desorption with surface temperature.

Ground based spectral observation of lunar atmosphere was carried out at Iitate Observatory using a combination of a 60 cm telescope and a spectrograph, and resonantly scattered D lines of sodium and potassium were obtained. Our observation is characterized by a wide field of view along slit length (400arcsec), which covers altitude of 800km from the lunar surface at a time. Altitude profiles of Na and K emission were obtained by subtracting solar continuum from the raw spectra. A function consists of two exponential functions was fitted to altitude distribution of each emission to obtain the two scale heights which reflect the two temperature components. As a result, temperatures of 3790K and 490K were obtained as hot and clod components, respectively, for sodium, while those of 2280K and 470K were obtained as hot and cold components, respectively, for potassium. These values are consistent with theoretically expected values. Also, the number density ratios of hot component to cold component are different between sodium and potassium, suggesting that there should be difference in production mechanism for elements with different mass.