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Temporal variation of Mercury's sodium density by observed using ground-based telescope at Haleakala observatory

Ayaka Fusegawa[1*], Hayato Dairoku[1], Shingo Kameda[1], Masato Kagitani[2], Shoichi Okano[2]

[1]Rikkyo Univ., [2]Tohoku Univ.

Mercury has a thin atmosphere. In the past, Mercury has been observed by Mariner 10 and MESSENGER, and ground-based observations have also been carried out. H, He, O, Na, Mg, K, and Ca were detected in its atmosphere. Solar-photon-stimulated desorption, sputtering by impacting solar particles, and meteoroid vaporization are considered to be the source processes of Mercury's exosphere. However, the primary process among these three processes is unknown as yet. The resonance scattering constitutes exospheric emission. The NaD emission is well suited for study by ground-based observations because of its high intensity. Past observations have shown that the temporal variation and north-south asymmetry of intensity of sodium emission.

We have observed Mercury's sodium exosphere at the Haleakala Observatory in Hawaii since April 2011. The observations were performed using a 40 cm Schmidt-Cassegrain telescope, a high-dispersion spectrograph, and a CCD camera. We determined the temporal variation of the sodium density using the observational data. It is possible that the temporal variation of the sodium density is caused by variation of solar wind magnetic field if solar wind ion sputtering is the primary source process of Mercury's exosphere. To verify this assumption, we checked the temporal variation of solar wind magnetic field observed by MESSENGER, and then we compared these variations with our observational result.

CMEs toward Mercury probably cause the increase of the sodium density. Potter et al. (1999) suggested that the total amount of sodium on Mercury increased monotonically during several days of observation after CMEs occurred on the same side of the Sun as Mercury. We observed Mercury's sodium exosphere on November 23, 2011 when MESSENGER observed variation of solar wind magnetic field, which indicated CMEs arrived at Mercury. Despite this, our results have not shown large variation of the sodium density like that of Potter et al. (1999). From these results, we discuss the source processes of Mercury's exosphere.

Keywords: Mercury's exosphere, sodium, ground-based observation