Time variation in Mercury's exospheric density and its source processes

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Mercury has a thin atmosphere which is often called 'surface-bounded exosphere'. Many spectroscopic observations of Mercury's sodium emission have been conducted since its first detection. The suggested release mechanisms of sodium atoms from the surface are chemical sputtering, thermal desorption, photon-stimulated desorption (PSD), ion sputtering, and micro-meteoroid vaporization. Photon-stimulated desorption should be a dominant release process from the results of laboratory experiments for measuring the release rate from the surface of Mercury. However, solar wind ion sputtering should be dominant for explaining the observed bright emissions at high latitudes. A comprehensive description of the phenomena is still not available, mainly because a ground-based observation of Mercury's sodium is difficult due to its proximity to the Sun and the intensity of surface reflection is much brighter than sodium emission. From the results of recent studies, temporal variability in sodium density for 6 hours is less than 5 % and it is suggested that the dominant source process is PSD. Moreover, the image of sodium distribution extended to several Mercury radii, which is often called sodium tail was observed at the Haleakala Observertory. Since the temperature of extended exosphere is high, ion sputtering and micro-meteoroid vaporization, which release atoms with high velocity, is suggested to be dominant source processes for sodium tail. The Mercury's Sodium Atmosphere Spectral Imager (MSASI) onboard Bepicolombo/MMO can detect the sodium emission from the exosphere on the dayside hemisphere because of its high spectral resolution (˜90,000). In this study, we discuss what is expected from the result of observation by MSASI.