

Loss of Mercury's Exospheric Sodium

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The lifetime of sodium in Mercury's exosphere can be estimated from the density distribution and velocity of sodium atoms in the tail. We observed the sodium tail on Mercury using the ground-based telescope at the Haleakala Observatory on April 19, 2010. The sodium D2 emission from the tail at the heliocentric distance from Mercury of ~200,000 km was detected and its heliocentric velocity was calculated to be ~30 km/s using the measured Doppler shift. We estimated the lifetime of sodium atoms in the tail as ~3,000 sec, which corresponds to ~19,000 sec at 1 AU because the photoionization is thought to be the dominant loss process and its timescale is inversely proportional to the solar UV flux. Additionally, we estimated the upper limit of the lifetime as ~27,000 sec at 1 AU even if we take into account that the tail in the N-S direction is more than the field of view of our observation. This is 7-10 times shorter than the estimated from the result of ground-based observation of sodium from comets near Earth. We should still discuss the loss process of sodium atom in Mercury's exosphere further. We are planning to observe Mercury after the orbit insertion of MESSENGER.