Study on the spatial velocity distribution and its variability of Na atoms in Mercury's sodium tail

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We have made spectroscopic observation of the anti-sunward velocity of sodium atoms in the Mercury's sodium tail at Mt.Haleakala in Maui, Hawaii using a high-dispersion echell spectrograph coupled to a 40-cm Schmidt Cassegrain telescope. In 2007, it was confirmed that the sodium tail extends as far as 100 R_M (250,000 km) from Mercury. In addition, it was found that, in the spatial distribution of anti-sunward velocity of sodium atoms in the tail, there exists some non-uniformity in the anti-sunward acceleration in the tail in these data. And it is shown that the non-uniformity in the tail occurs on a time scale of about 20 minutes. As a cause for the non-uniform acceleration, though it is not well understood, we suggest changes of the solar wind ion sputtering.

We tried to interpret these variations using a numerical simulation in which effects of Solar Wind Sputtering (SWS) and Micro-Meteoroid Vaporization (MMV) are included. We found that a tailward velocity produced by SWS is larger than that produced by MMV in the tail region. Then we reproduced the observed non-uniformity by changing the ejection rate of SWS in general. Ejection rates of the condition were MMV = $6.1*10^5$ [atoms/cm^2/s] and SWS = $1.0*10^7$ [atoms/cm^2/s] . However the non-uniformity reproduced by the numerical simulation was not enough.

In this presentation, details of our observation and simulation result will be reported.