Ground-based observations of sodium in Mercury's exosphere

S. Kameda (1), M. Kagitani (2), J. Ono (3), H. Nozawa (4), I. Yoshikawa (1), and S. Okano (2)

(1) The University of Tokyo, (2) Tohoku University, (3) Gakushuin University, (4) Rikkyo University

Many spectroscopic observations have been performed since the first detection of sodium in Mercury's exosphere. The suggested release mechanisms of sodium atoms 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. 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.

Mercury has a very eccentric orbit, with a perihelion at 0.31 AU and an aphelion at 0.47 AU. Two-dimensional images of Mercury's sodium exosphere have been accumulated, which showed enhancements at high latitudes. North-South enhancements and asymmetries in column abundance were observed only when Sun-Mercury distance was more than 0.33 AU. We carried out the observations of sodium in Mercury's exosphere with Fabry-Perot interferometer at Haleakala High Altitude Observatory in Hawaii in March, 2005. We found enhancements near the subsolar point when the Sun-Mercury distance was 0.31 AU.

We carried out four-hour continuous daytime observations at Okayama Astrophysical Observatory (OAO) in December, 2005. Mercury was tracked for two hours a day at a maximum in past observations. Though seeing was anticipated to be bad , the averaged seeing size was 2 arcsec. This value is small enough for an observation of Mercury. The observed change of sodium density is less than seven percents. In this presentation, we report the results in detail.