Numerical simulation of Mercury's sodium tail

Aya Sonobe[1]; Hiroaki Misawa[1]; Akira Morioka[2]; Shoichi Okano[1]

[1] PPARC, Tohoku Univ.; [2] Planet. Plasma and Atmos. Res. Cent.,Tohoku Univ.

A decade after the Mariner 10 flybys to Mercury, the sodium exosphere was discovered by the ground-based observation[Potter and Morgan,1985]. Distribution of the sodium atoms is expected to form the shape elongated toward the antisolar direction, like a comet, due to the solar radiation pressure. It called sodium tail and Potter et al.(2002) identified it for the first time.

In this study, we calculated distribution of the sodium tail, especially cross-sectional profile of the tail, by a numerical simulation with the Monte Carlo method. The result of the simulation is, then, compared with that of the observation by Potter et al.(2002) in order to investigate origin of the sodium exosphere. For this simulation, we considered the following three source processes; i.e., photon-stimulated desorption, meteoroid vaporization and solar wind sputtering. Consequently, it is suggested that 1) most of sodium atoms at the tail are released from the surface of Mercury by solar wind sputtering, however, 2) the columnar content of sodium atoms at the tail cannot be reproduced by the production rate expected by Killen et al.(2004) due to too small production rate by solar wind sputtering to explain the cross-sectional profile. We have considered reconcilable production processes which can explain observed shape and amount of the sodium distribution simultaneously based on the numerical simulation.