R008-06
Zoom meeting D ：11/3 AM2 (10:45-12:30)
11:00-11:15

Full PIC simulations of the surface charging on the nightside of Phobos: The effect of surface-plasma interaction

#Masaki Tanabe[1)], Naoki Terada[2)], Yohei Miyake[3)], Hideyuki Usui[4)]
[1)]Dep. Geophysics,Tohoku Univ.,[2)]Dept. Geophys., Grad. Sch. Sci., Tohoku Univ.,[3)]Kobe Univ.,[4)]System informatics, Kobe Univ

The solar wind interaction with an airless body generates surface charging. On the dayside, the surface potential is determined by current balance between incoming solar wind and plasma emitted from the surface (e.g., photoelectrons, secondary electrons). On the other hand, charging process on the nightside is more complex due to the wake forming effect. This effect is basically explained by ambipolar diffusion. Previous studies calculated the potential on the nightside of Phobos using an analytical model based on a self-similar solution [e.g., Farrell et al., 2018]. These show that the potential reaches about -200 V or more on the nightside. However, the details of electromagnetic field and density distribution around the body have not been clarified. In order to understand the process of surface charging, we have calculated the plasma environment around Phobos by self-consistent 2-D particle-in-cell (PIC) simulations.
Our calculations show that the difference of results between the analytic model and PIC simulation becomes large near the body on the nightside. This discrepancy is thought to be resulted from a surface-plasma interaction effect. To assess this effect, we then calculated plasma environment under some different types of the shape of the body.
In the assumption of an ellipse-shaped body, two types of charge separation are clearly identified, which is not seen for a sphere-shaped body. One is the separation at the wake flank and the other is at the sheath near the surface. It means that ion-rich plasma exists near the surface while the electron density exceeds ion density at the wake flank.
We have identified a number of key factors for better understanding surface charging processes on the nightside of Phobos. We will discuss the importance of Debye screening effects to interpret the obtained numerical results.