The influence of high energy photoelectrons on the structure of photoelectric sheath and dynamics of dust grains

Hiroki Senshu[1], Hiroshi Kimura[2], and Koji Wada[1]

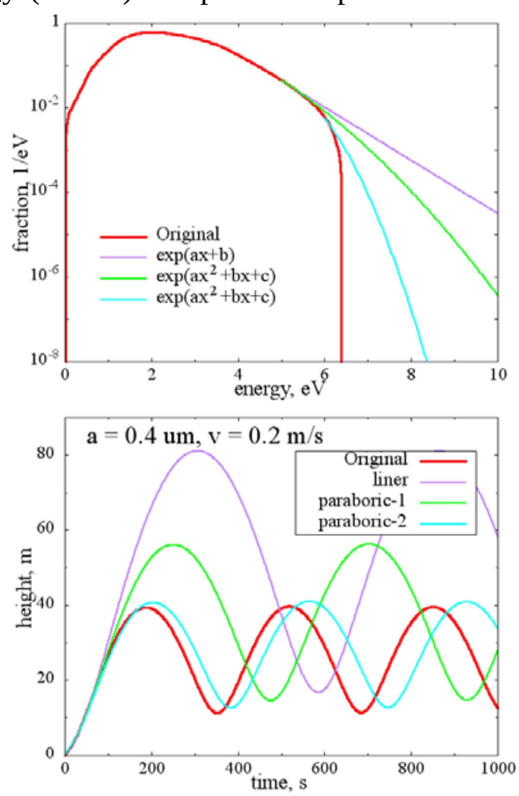
[1]*PERC/ ChiTech, Japan,* and [2]*Kobe University, Japan*

When an air-less body is irradiated from solar UV, photoelectrons are emitted from the surface making a photoelectric sheath above the surface of the body. If a dust grain is lofted from the surface, its charge will be changed not only by photoelectron emission but also impingement of sheath electrons and solar wind electrons. Thus the dynamics of a dust grain in the photoelectric sheath is affected by the structure of photoelectric sheath and is not straightforward.

We have shown that the previous studies used an energy distribution function of photoelectrons obtained from laboratory experiments inadequately [1]. Although the energy distribution function was experimentally measured for integrated value only in the emission angle from the normal to the surface to about $\pi/4$ [2], some of previous studies used the energy distribution function as a vertical component and others assumed Maxwellian distribution function for photoelectric energy using the mean energy obtained by the experimental study. Thus we developed a new analytical method to calculate an angle-resolved velocity distribution function of photoelectrons from the experimentally obtained data and studied the difference in the dynamic motion of a dust grain in the photoelectric sheath depending on the adopted energy distribution function of photoelectrons [1].

In the last meeting, however, we omit the high energy (> 6eV) component of photoelectrons because the fraction of high energy component is too low to be evaluated from the original figure. But, it is clear that irradiation of high-energy photons to lunar surface fines emit photoelectrons beyond 6 eV from the lunar surface. Indeed, the Apollo 14 charged-particle lunar environment experiment (CPLEE) on the moon revealed the presence of high-energy photoelectrons between 40 and 200 eV emitted from the lunar surface [3].

Because the extent of an electric sheath depends on high energy component of photoelectrons, a proper consideration of high energy component can be crucial to a correct understanding of the structure of photoelectric sheath and the dynamics of dust grains within the sheath. Therefore, we study the influence of high energy component of photoelectrons on the structure of photoelectric sheath and the dynamics of dust grains within the sheath by extrapolating the energy distribution function of photoelectrons in some manners.



Figures: Examples of extrapolated energy distribution function of photoelectrons (top) and the resunting dynamics of a dust grain launched with 0.2m/s from the surface of Eros (bottom).

References: [1] Senshu et al. (2015) *PSS*, in press. [2] Feuerbacher et al. (1972) *GCA* 3, 2655. [3] Reasoner and Burke (1972) *JGR* 78, 5844.