POSSIBLE PHOTOELECTRIC DUST LEVITATION AROUND ASTEROIDS. H. Senshu[1], M. Kobayashi[1], K. Wada[1], N. Namiki[1], H. Kimura[2], T. Yamamoto[2,3], N. Hirata[4], H. Miyamoto[4], and T. Matsui[1]. [1]Planetary Exploration Research Center, Chiba Institute of Technology (senshu@perc.it-chiba.ac.jp), [2]Center for Planetary Science, Integrated Research Center of Kobe University, [3]Institute for low temperature science, Hokkaido University ,[4]The University Museum, The University of Tokyo.

Introduction: Dust grains may exist on and around asteroids. Impacts, including micro-impacts, onto the surface of asteroid break up rocks or bedrock into small pieces. Although some of the ejecta might get enough kinetic energy to escape from the gravity to make a source of interplanetary dust, others return back onto the surface.

Hayabusa mission revealed that sub-km-sized S-type asteroid Itokawa is covered with boulders and cobbles [1,2] but finer dust grains [2,3]. However dust grains smaller than 200 μm are found from sample catchers despite Hayabusa failed to fire projectiles for use in sample collection. The mechanism how dust grains had come into dust catchers is not decided yet [3,4].

Small grains at the surface of an asteroid easily levitate due to small gravity. If grains gain enough energy to escape the gravity, the asteroid loses its mass. Otherwise if grains levitate and migrate laterally, the surface landform features of the asteroid change. Addition to that since thermal conductivity of dust grain layer is small, re-distribution of dust grains could affect following thermal evolution.

The possible triggers for dust levitation are: another impact, tidal force from sun and/or planets, seismic shaking [5], granular flow [3,5], photoelectric force [6,7], etc. Among them, photoelectric force is one of the most plausible processes to levitate dust grains constantly [4,6,7].

An airless asteroid with resistive surface is charged up by a balance between photoelectric effect due to solar EUV and implantation of solar wind electrons, resulting an upward electric field above the surface. At the same time a dust grain above the surface is also charged up as a result of balance between photoelectric effect, implantation of solar wind electrons, and also implantation of photoelectric electrons from the surface of the asteroid. Thus the motion of a dust grain launched with a velocity is decided by a balance between gravity and electric force [6,7]. Thus, in this study, we simulate vertical motion of dust grains by applying a theoretical model for dust motion on Eros and Moon [6,7], to cases for various size of asteroids.

Numerical Model: In this study, we simulate vertical motion of dust grains launched from an asteroid. Our numerical code is based on a theoretical model, proposed by Colwell et al. [7] for dust motion on Eros and Moon, but we have revised the model to avoid internal contradictions and to refer previous studies properly.

Numerical Results: According to our numerical results, dust grains librate above the surface of Eros as is shown by Colwell et al. [7]. On the other hand, for the case of smaller asteroid such as Itokawa and 1999JU3, dust grains librate under only a narrow parameter range.

We found that there is a threshold size of dust grain: larger-sized grains are only slightly affected by photoelectric force and thus follow a nearly parabolic flight path, while smaller-sized grains escape from the gravity with a help of electric repulsion from the surface or otherwise immediately plunge into the surface depending on the launch velocity. This might be an origin of interplanetary dust.

Thus, this model could be validated if vertical distribution of dust grains is analyzed in the future missions.

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