Geophysical Research Abstracts
Vol. 18, EGU2016-3954-1, 2016
EGU General Assembly 2016

Influence of solar wind ions on photoemission charging of dust

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The lunar surface covered by a layer of dust grains is exposed to solar wind particles and photons coming from the Sun on the sunlit side. Solar wind ions cause sputtering of dust grains or can be implanted into grains. We suppose that as a consequence of ion implantation, an additional energy is transferred to grains, more valence band electrons are excited, and the photoelectron yield is increased. An increase of the photoelectron current causes the enhanced density of electrons that form a sheet above the illuminated lunar surface. Thus, an influence of solar wind ions on the Debye length and photoelectron sheet formation is expected.

We present laboratory estimations of work functions and photoelectron yields of a single micron-sized silica grain before and after ion implantation. The silica grain used as a lunar simulant is caught in the electrodynamic trap. Grain's specific charge is evaluated by an analysis of the grain motion within the trap, while its work function is determined from observations of a time evolution of the charge-to-mass ratio when the grain is irradiated by photons of different emission lines. By comparison of the photoelectron current (from grain) with photon flux (from UV source), we establish the photoelectron yield of the trapped object. The influence of ion implantation is thoroughly analyzed and discussed.