

Dust Particle Release from the Lunar Surface: Influence of Adhesion and Meteoroid Impacts

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It is shown that for consideration of dust particle release from the lunar surface one has to take into account (among other effects) both adhesion and meteoroid impacts. The effect of surface roughness on the adhesion intensity on the Moon is discussed. The rate of meteoroid impacts with the lunar surface per unit area is determined. The strength of the regolith due to the adhesion effect is estimated. The processes occurring when a high-speed meteoroid impacts with the lunar surface are described. In particular, the characteristic parameters of zones of evaporation of the substance, its melting, destruction of particles constituting lunar regolith, their irreversible deformations, and elastic deformation of the regolith substance are found. A possibility of the rise of micrometer-sized dust particles above the lunar surface is shown. It is demonstrated that most of the particles rising over lunar surface due to the meteoroid impact originates from the elastic deformation zone. The number of dust particles raised over the lunar surface as result of a meteoroid impact is estimated. The size-distribution function of particles released from the lunar surface due to meteoroid impacts is determined. It is noted that micrometeoroid impacts can result in rise of dust particles of the size of a few μm up to an altitude of about 30 cm that explains the effect of "horizon glow" observed by Surveyor lunar lander. This work was carried out as part of the Russian Academy of Sciences Presidium program no. 7 and was supported by the Russian Foundation for Basic Research (projects nos. 15-02-05627, 15-32-21159) and the Russian Federation Presidential Program for State Support of Young Scientists (project no. MK-6935.2015.2), as well as NCN grant Rezonans 2012/07/B/ST9/04414.