LIGHT FLASHES, DUST CLOUDS, AND ELECTRIC DISCHARGES CAUSED BY METEOROID IMPACTS ONTO MARS. I. B. Kosarev, I. V. Nemtchinov, V. A. Rybakov, and V. V. Shuvalov, Institute for Dynamics of Geospheres, Russian Academy of Sciences, 38 Leninsky Prosp., Building 6, Moscow 117979, Russia (kosarev@idg1.chph.ras.ru).

A meteoroid impacting into the rarefied martian atmosphere penetrates much deeper than into the more dense Earth's atmosphere. The meteoroids with the size above 1 m as a rule hit the martian surface [1], while for the Earth they usually "explode" in the air at altitude of about 25–30 km or so [2]. Meteoroids with the size of about 0.1–1 m typically "explode" above the martian surface, but these explosions create intense blast waves and light flashes with luminous efficiency higher than at the Earth [3]. Combined effects of light impulse, shock waves and cratering cause mobilization of dust [4]. The impulsive formation of dust clouds may even trigger the local martian storms [4] in addition to the dust devils [5]. These processes were studied by numerical simulations using 3D SOVA Code [6] and laboratory experiments.

Experiments using impulsive laser model events with various altitudes of energy release above the ground. They demonstrated a complicated pattern of shock waves interaction and development of turbulence. The amount of raised dust does not substantially decrease until the altitude is less than the characteristic size of the blast wave, that is about 1 km for a 10 t meteoroid, the amount of mass being is about 1 kt. Result of numerical simulations agree with these observational data.

For the case of the direct meteoroid impact onto the surface cratering process and presence of a rarefied channel in the atmosphere formed by the meteoroid during its flight also inject a large the amount of dust. For a 5-m in radius stony meteoroid in 300 s after the impact the mass of the dust equalls 60 M_0, where M_0 is the mass of the impactor. Thus the mass of the dust is about 100 kt. The altitude of the dust cloud at this moment is about 10 km.

Motion of the martian dust [7,8] may lead to its charging and electrification of dust clouds, similarly to that in the volcanic eruptions and dust storms in deserts, and may cause electric discharges [9]. In the case of meteoroid impacts additional factors intensify electrification processes: photoemission and thermoemission and sublimation of alkali atoms from the dust grains caused by light flash and direct contact with the hot gas.

Specific processes in the electrified dust clouds, i.e. corona discharges and dynamic formation of ionic channels free of dust [10], increase the electric field strength at the end of these channels and facilitate electric breakdowns. Electrical processes may substantially influence the motion of the dust cloud initiated by meteoroid disruption in the atmosphere or(and) by impact on the surface similarly to the electric activity caused by the wind driven dust motion [11]. Light flashes, dust clouds, and electric discharges may serve for remote detection of meteoroid impacts onto Mars and determination of impact frequencies and even meteoroid characteristics.

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