**IDENTIFICATION OF METEORITE-PRODUCING EVENTS IN MARTIAN AND TERRESTRIAL ATMOSPHERE.** D. Kuznetsova¹ and M. Gritsevich¹,², ¹Institute of Mechanics and Faculty of Mechanics and Mathematics of the Lomonosov Moscow State University, Michurinsky pr., 1, 119192, Moscow, Russia, morven9@yandex.ru, ²Finnish Geodetic Institute, P.O.Box 15, FI-02431 Masala, Finland, maria.gritsevich@fgi.fi.

**Introduction:** Meteorite production on Mars is a new and dynamically developing subject of scientific investigation e.g. [1,2]. In this study, we develop the theory describing a meteoroid entry into an atmosphere of a planet and apply our results to the atmosphere of Mars. Based on physical parametrisation, we introduce two key dimensionless parameters, which allow to construct the criterion for the meteorite fall identification in a simple analytical form. The described approach is very convenient for analysis and classification of the possible impact consequences.

**Problem formulation and main results:** We consider a meteoroid with the pre-entry mass $M_e$, pre-entry velocity $V_e$, bulk density $\rho_3$, and the local angle between the trajectory and the horizon $\gamma$, which is supposed to be constant. For describing the motion we use the classical equations of the model of meteor body deceleration [3,4]. The analytical dimensionless solution for the mass-velocity dependence and the height-velocity dependence can be expressed using two main parameters [5-7]: the ballistic coefficient $\alpha=c_e\rho_3 h_0 S_3/(2M_e \sin \gamma)$ and the mass loss parameter $\beta=(1-\mu)c_e V_e^2/(c_d h^2)$, where $c_e$ is drag coefficient, $h_0$ - height of the homogeneous atmosphere, $c_d$ - coefficient of heat exchange, $S_3$ - initial area of middle section of the body, $\rho_3$ - atmospheric density near the planetary surface, $H^2$ - effective enthalpy of destruction, $\mu$ - constant parameter relating the middle section $s$ and the mass $m$ of the body in dimensionless units as $s=\mu m$ [8]. The ballistic coefficient $\alpha$ characterizes the aerobraking efficiency as it is proportional to the ratio of the mass of the atmospheric column along the trajectory having cross section $S_3$ to the meteoroid initial mass. The mass loss parameter $\beta$ is proportional to the ratio of the fraction of the kinetic energy of the unit body's mass arriving at the body in the form of heat to the effective destruction enthalpy. These parameters uniquely characterize an atmospheric trajectory of a given meteoroid.

The values of these parameters can be used to determine the impact consequences. The meteorite fall condition can be set as $M_e \geq M_{\text{min}}$: the terminal mass of the meteoroid should exceed or be equal to a certain chosen value $M_{\text{min}}$. This condition can be written using $\alpha$ and $\beta$, while the equality sign represents boundary curve in $(\alpha, \beta)$ space, so the impact consequences are described by the position of the case-under-investigation point relatively to the boundary curve.

We consider two types of meteoroids: chondrite, with the density $\rho_0=3.5$ g/cm$^3$ and entry velocity $V_e=10$ km/s, and the iron meteoroid, with $\rho_0=8$ g/cm$^3$ and $V_e=15$ km/s (the values of the velocity considered here are close to the mean atmospheric entry velocity [9,10]). For the Martian atmosphere the following parameter values are used: $h_0=11$ km and $\rho_0=0.0154 \times 10^{-3}$ g/cm$^3$. The obtained results are compared with the similar meteoroid entry into the atmosphere of Earth ($h_0=7.16$ km and $\rho_0=1.29 \times 10^{-3}$ g/cm$^3$). We show that for the certain $M_e$ range a meteoroid entering the terrestrial atmosphere would be fully ablated, while a fraction of the body reaches the planetary surface if a meteoroid with similar properties would be entering the Martian atmosphere. In Fig. 1 the example is shown. A full line represents the boundary curve for Mars, and a dotted line - for Earth. One can see that the point corresponding to the meteoroid entering the Martian atmosphere lies to the left of the boundary curve, which means meteorite fall, and point corresponding to the meteoroid entering the terrestrial atmosphere lies to the right of the boundary curve, which means its full ablation.

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