THE SIMULATION OF METEOROID CONTENT IN THE CIRCUMLUNAR SPACE FOR ANALYZING THE PARAMETERS OF POSSIBLE LUNAR IMPACTORS

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Introduction: Asteroids crossing the orbit of the Moon are also near-Earth asteroids. At the same time, such objects can also be circumsolar objects [1]. In the latter case, they can reach equilibrium temperatures sufficient to change the surface due to thermal breaks, drying, and decomposition of hydrated silicates. When an asteroid moves near the Sun, it is subjected to very strong tidal and thermal effects, and also interacts with the solar atmosphere at relatively small heliocentric distances [2]. Therefore, when modeling the meteoroid content of the circumlunar space, it is necessary to take into account all these features of small celestial bodies (SCBs).

Methods: An interpolation regression method has been developed for determining the dynamic parameters of circumlunar asteroids and finding their genetic relationships with meteor showers. The method is based on modern observations of meteor showers and the use of the physical theory of meteoroids [3].

Results: Models of meteoroid abundance in the circumlunar space based both on ground-based measurements and observational data from space missions are built using interpolation regression methods. To solve this problem, the density of sporadic meteoroids was converted from the coordinate system of spacecraft to the terrestrial one [4]. Metrics of elements of meteoroid orbits were used to study the genetic relationships between meteor showers and their parent bodies [5]. As a result, the genetic relationships of circumlunar asteroids of the Apollo group with meteor showers were determined using the author's multifactorial method. In this method, to find genetic links, we use: Drummond's D-criterion [6], Kholshevnikov metrics [7], the Tisserand's parameter [8], quasi-stationary parameters of the restricted three-body problem, and analysis of orbital perihelion longitudes [9]. A method has been developed for modeling the probability of a meteor particle hitting a certain area with a mass exceeding a given value and for determining the density of a meteor shower from radio observations [10]. The "tomography" method has been developed for calculating the distribution of the density of sporadic meteors on the celestial sphere using radar observations of meteors together with goniometric measurements [11].

Conclusions: As a result, asteroids with small perihelion distances, which can be classified as circumsolar asteroids, were studied, and chemical characteristics of these celestial objects were obtained based on an analysis of the genetic relationships of asteroids crossing the Earth's orbit [12–15]. An analysis was made of possible changes in the structure of small objects under the action of thermal gradients during the formation of meteor showers from them.

All the obtained parameters of SCBs can be further used to analyze the structure of the Moon [16], its dynamic characteristics [17], physical and chemical properties of the Moon's surface [18], and its morphological features [19].

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