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Asteroid and comet hazard: Identification problem of observed space objects with the parental bodies

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Abstract

This article focuses on the genetic identification of observed small cosmic bodies with alleged parental bodies; namely, comets, asteroids and meteoroid swarms. There is a problem of the upper D-value limit as a measure of proximity between the orbits of the bodies in the five-dimensional phase space (Southworth and Hawkins, 1963). In the study of genetic relationships of the comet and meteor complexes, the D value is usually taken as equal to 0.2 for all meteor showers. However, the upper D limit should be investigated for each meteoroid complex. For example, such investigation was performed for the Taurid meteor complex (Porubčan et al., 2006). In this paper, the upper D-criterion limit value was investigated for the Perseid meteor shower. The 1862 III Swift–Tuttle comet is its parental comet. © 2014 COSPAR. Published by Elsevier Ltd. All rights reserved.

Keywords: Asteroid and comet hazard; Meteoroids; Meteoroid streams; Small bodies of the Solar system; The orbits evolution

1. Introduction

The Earth, like other planets and their satellites, experiences collisions with cosmic bodies. There are no fewer than 130 craters, with diameters of up to 250 km and different ages on the Earth's surface. The famous Meteor Crater in the USA has a diameter of 1200 m and a depth of 175 m. The crater was formed when the iron asteroid fell about 50,000 years ago. The size of this iron asteroid was equal to 60 m.

The standpoint finds more confirmation that the sudden dinosaur extinction was explained by the Earth's collision with a huge asteroid. A crater with a diameter up to 180 km, and age of about 65 million years was found near the Yucatan Peninsula in Mexico. The content of the iridium is hundreds times greater than the concentration in other layers found in the geological layers. It is known

that the iridium is contained in large amounts in meteorites. Another global cosmic catastrophe may have occurred about 10,000 years ago and was the cause of widespread fauna extinction. These global cosmic catastrophes have become important factors in the life development on the Earth.

Under the influence of many cosmogenic factors the evolution of orbits of small bodies of the Solar system leads to the formation of meteoroid complexes (Sokolova et al., 2013). A set of criteria is used to find the genetic relationships. The comparison of theoretical and observational data will make it possible to determine the limiting values of D-criteria for each meteor stream and to use them successfully for genetic identification of the small bodies for solving various astronomical problems.

2. The use of the D-criterion method for the analysis of observational data of Tunguska event

More than 100 years passed after the mysterious explosion of an unknown body in the area of the

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