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ANALYSIS OF THE GENETIC CONNECTIONS BETWEEN NEAR-EARTH OBJECTS AND DELTA CANCRIDS METEOROIDS

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Introduction

The Delta Cancrids (DCA) relates to unconfirmed small meteor showers, has 2 branches – the Northern (NCC) and the Southern (SCC) Delta Cancrids, and is observed between January, 1 and January, 31. According to IAU, the Northern Delta Cancrids (NCC) is allegedly related to the 1991 AQ? asteroid, while the Southern Delta Cancrids is related to 2001 YB5? (the symbol "?" indicates the status of hypothesis, date of the application is August 18, 2018). The purpose of the paper is to study the activity of the poorly investigated Delta Cancrids and to search for close orbits among NEOs.

Methods

To study the structure of the Delta Cancrids we used the visual observations provided by the International Meteor Organization which has the data on the observations of the Delta Cancrids taken between 1987 and 2006 without separating NCC from SCC. Using the method [1], about 5000 observations of meteors were processed in order to determine the number of meteors and to distribute them for stellar magnitude. We also used meteor orbits of the NCC and SCC branches of the Delta Cancrids presented in television catalogues by Japanese Meteor Network SonatoCo and Croatian Meteor Network CMN, the total number of orbits was 178. The search for a parental body (PB) was performed among 17800 asteroid orbits. The study of the shower's connections with asteroids from the Apollo, Aten, Amor, and Atira groups was conducted using the D-criterion by J.D. Drummond [2] and metrics by K.V. Kholshevnikov [3] as functions of the distance between the orbits as well as Tisserand's parameter and 2 quasi-dynamic parameters of the restricted three-body problem [4]. The upper values of the criteria under which the hypothesis of the orbits' identity was accepted or declined were defined by calculating mean orbits of the shower in each catalogue taking into account variance and catalogue observation errors.

Results

For meteors with the minimum recorded magnitude of $+3^m$ or higher the maximum of activity (8.6±2 meteors an hour) is observed at the ecliptic longitude of the Sun of 298.5°±1.2°. The maximum of activity for smaller meteoroids is recorded 1.4° later. The descending and ascending branches of the activity profile are gently sloping, the shower's width at half of the maximum activity is 5°. The calculations of spatial density for the Delta Cancrids shows that at the shower's maximum activity 1 particle heavier than 1 g is observed at a cube with an edge of 1000 km. When searching for a parental body, the following asteroids from the Apollo group are marked out with the highest probability of more than 0.7: for NCC – 85182 (1991AQ) and 2015PC, for SCC – 2212 Hephaistos (1978SB), 2011SR12, and 2014RS17. For the Delta Cancrids in general the asteroids 2014RS17, 2011SR12, 2003RW11, 2001BO6 from the Apollo group are marked out with the probability higher than 0.6. Almost all the selected asteroids move along asteroid types of orbit (Tisserand's parameter > 3). The modern positions of orbit nodes for the asteroids 2001YB5 and 2010QD2 selected for SCC with the probability of 0.6 coincide with the position of DCA maximum activity within 2°. The search for close orbits in the Aten, Atira, and Amor groups has not given any results. The Delta Cancrids is a poorly studied meteor shower, there are almost no articles concerning the search for a parental body. The asteroid 2001YB5 presented by IAU as a hypothetical parental body for DCA is selected by us with the high probability of 0.7, while for the southern and northern branches – with the probability of 0.6 and 0.5 respectively. Potentially hazardous objects among the selected ones are 2014BX2, 2001YB5, and 2014RS17 with 0.004 AU at the closest approach.

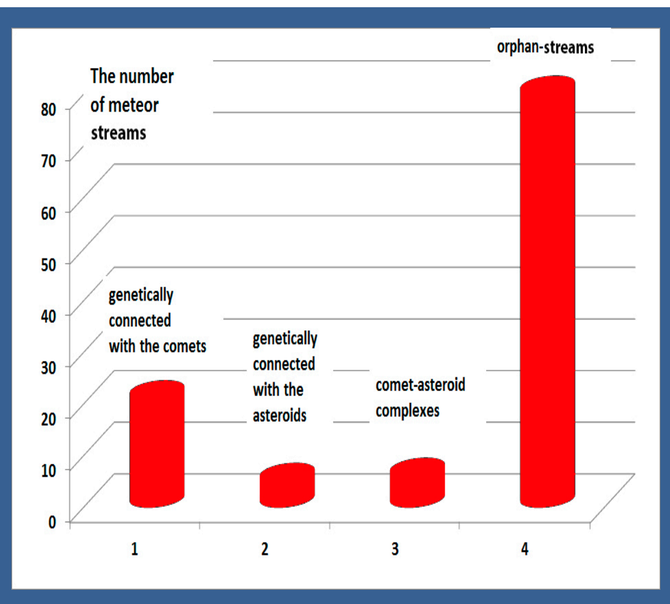

Fig.1 Registry of meteoroid streams

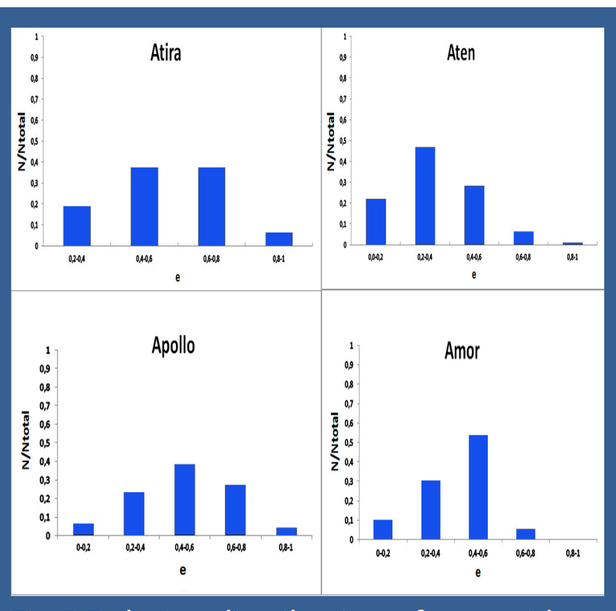

Fig.2 Relative distribution of asteroids for eccentricity in groups.

Conclusion

The observation of the shower's maximum activity at the Sun's longitude of 298,5° suggests that the orbit of a potentially parental body of the Delta Cancrids during the period of the shower's formation had node longitude between 298° and 299°. The involvement of the shower's structure at identifying it with NEOs is important to clarify the shower's origin.

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[[1] Sokolova M., et al. (2016) *Advances in Space Research* 58/4: 541-544. [2] Drummond J. D. (1981) *Icarus* 45: 545-553. [3] Kholshevnikov K.V., et al. (2016) *MNRA* 462/2: 2275–2283. [4] Kramer E. N. and Shestaka I. S. (1987) *Sol. Syst. Res.* 21/1: 75–83.