THE COORDINATE RANGING OF THE DELTA CANCRIDS METEOR SHOWER

Y. A. Nefedyev[1], M. V. Sergienko[1], A. O. Andreev[1, 2],
[1]Kazan Federal University, Russia, Kazan, Kremlyovskaya st., 18. E-mail: star1955@mail.ru
[2]Kazan State Power Engineering University, Kazan, Krasnoselskaya str., 51, E-mail: alexey-andreev93@mail.ru

Introduction: The aim of this paper is to refine the radiants distribution of the meteor shower Delta Cancrids (MSDC) branches and their drift motion and to study features of radiants distribution and orbit elements for MSDC using television observations [1]. The MSDC complex is an unconfirmed small MSDC shower with 2 branches [2]. We designated objects genetically related to MSDC as MSDCO. For MSDC there is no parental body found among comets, and its genetic connections with MSDCO are therefore being studied. The observations of MSDC were produced using radar and television methods [3].

Methods: The MSDC orbits of and Southern SB and Northern NB branches of MSDC complex presented in the television catalogues were used. In the catalogue MSDC orbits for NB and SB respectively are presented using the observations taken between 2008 and 2014 [4]. The minimum registered magnitude for the MSDCs was $+3.4^m$, the error of determining geocentric speed was about 1.0 km/s [5]. The coordinates of the radiant and their diurnal variations for each branch were determined using both the individual radiants' coordinates of the registered MSDCs and the coordinates averaged on 1° of the solar longitude. For the study of radiants distribution and orbit elements methods of robust analysis were applied.

Results: The values of geocentric radiants' coordinates at solar longitude of 298° were obtained: for NB right ascension $130.3^0 \pm 3.0^0$ with diurnal variation = $+0.24^0$, declination $19.7^0 \pm 2.7^0$ with diurnal variation = -0.04^0; for SB right ascension = $128.4^0 \pm 6.4^0$ with diurnal variation = $+0.10^0$, declination = $13.5^0 \pm 2.3^0$ with diurnal variation = -0.05^0. For NB and SB radiation areas are $6^0 \times 7^0$ and $3^0 \times 4^0$ respectively. For NB diurnal radiant drift is more reliably determined than for SB due to the presence of a larger statistical base for its orbits. The study of the dependence of major semi-axes and eccentricities on a MSDC's magnitude in the range from -4^m to $+4^m$ has shown that at NB for weaker MSDCs the values of major semi-axes and eccentricities decrease by 0.22 AU and 0.02 respectively. For SB this dependence is poorly expressed.

Discussion: Geocentric velocities of the branches' MSDC almost coincide, branches are observed on the same dates. The MSDCs' radiants of each branch are distributed evenly with no subradiants detected, and the coordinates dependence on MSDCs' magnitude is not revealed either. For NB the orbits of MSDCs are decreased depending on their mass, which might be caused by the non-gravitational effect due to significant age of the shower. The comparison of orbits produced using television and radar methods and given at [6] also confirms the results obtained by us. The MSDC MSDC have orbital period of about 4 years and are exposed to strong gravitational perturbations from Jupiter. For SB in the zone of strong resonances 2:1 and 1:1 MSDC with resonant orbits are not recorded, the NB MSDC are not observed only at 1:1 resonance.

Conclusions: The radiants for the MSDC that are consistent with few data obtained by other authors are produced [7]. The values of diurnal variation for radiants are refined, radiation areas are derived [8]. There is a decrease in major semi-axes for NB in magnitude range between -4^m to $+4^m$ and orbit eccentricities depending on MSDCs' magnitude [9, 10]. As the radiation area for SB is smaller than for NB and the dependence of orbits' size on their mass has not been revealed, one may suggest there are different formation mechanisms for NB and SB branches (e.g. secondary disintegration of a parental body) [11, 12].

Acknowledgements: This work was partially supported by Russian Science Foundation, grants no. 20-12-00105 (according to the grant, the method for data analysis was created) and 21-72-10024 (the numerical calculations were carried out). This work is performed according to the Kazan Federal University Strategic Academic Leadership Program. This work was partially supported by the Russian Foundation for Basic Research grant no. 19-32-90024 and the Foundation for the Advancement of Theoretical Physics and Mathematics "BASIS".

References: [1] Jenniskens P. (2006) Cambridge, UK: Cambridge University Press. 790. [2] Sokolova M., et al. (2016) *Advances in Space Research* 58/4: 541-544. [3] Sokolova M.G., et al. 2013. *Advances in Space Research.* Vol. 52/7: 1217-1220. [4] Sokolova M.G., et al. (2018) *Advances in Space Research* 62/8: 2355-2363. [5] Churkin K.O., et al. (2018) *Astronomy Reports* 62/12: 1041–1048. [6] Sokolova M.G., et al. (2014) *Advances in Space Research.* 54/ 11: 2415-2418. [7] Varaksina N.Y., et al. (2015) *Journal of Physics: Conference Series* 661/1: Article number 012014. [8] Andreev, A. O., (2018) *Meteoritics & Planetary Science* 53/S1: 6157. [9] Nefedyev Y. A. (2018) *Meteoritics & Planetary Science* 53/S1: 6188. [10] Nefedyev Y. A. (2018) *Meteoritics & Planetary Science* 53/S1: 6192. [11] Sergienko M. V. et al. (2018) *Meteoritics & Planetary Science* 53/S1: 6162. [12] Sergienko M. V., et al. (2018) *Meteoritics & Planetary Science* 53/S1: 6165.