Local ballistic method for solving the inverse problem of fireball physics: their precision and reliability.

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A new method is proposed for calculating velocities and other physical parameters of fireballs. It is based on the correlation between fireball velocity and the density of the Earth's atmosphere. The physical parameters of firebal body can be calculated by the linear regression method for a sliding segment of variable length on fireball path. The method allows to place the fireball velocity values with best precision. The other physical parameters of fireball and their body can be estimated very reliably. In particular, the values of the ablation coefficient (mass-loss coefficient) can be obtained with confidence no less than by the integral method of Pecina and Ceplecha with solving for gross-fragmentation points. The other advantages of this method are the possibilities for joint use of the data of all images of the same fireballs. In this case only the observational data of fireballs are most useful and the data of results are of most homogenous precision for all sample of fireballs.

Trajectories of hyperbolic meteors

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The analysis of orbital elements for more than 700 hyperbolic meteors has shown, that number of meteors with $Ex > 5$ km/s (Ex – is an excess of heliocentric velocity above the parabolic limiting velocity at $r = 1$ a.u.) varies from 18 to 38% for various observations. Meteor particles producing these meteors, penetrate to Solar system on the obviously hyperbolic orbits from interstellar medium. Instead of usual heliocentric orbital elements, for these meteors the following parameters are used: V – the infinite velocity, d – distance of the asymptote from a beginning of readout, i – inclination of the hyperbolic orbit, $\lambda(r)$ and $\beta(r)$ – spherical co-ordinates of the interstellar antiradiant with define the particle movement at the limiting distance ($r \rightarrow \infty$) from the Sun. For these parameters the following statistical dependencies are obtained:

1. A distribution of the number of hyperbolic meteors on the interstellar velocity magnitude V is strongly limited at $V = 20$ km/s. It is connected with an elimination from the sample of meteors those having $Ex < 5$ km/s. In average, the velocity of interstellar meteor particles insignificantly differs from that of the nearest bright stars.

2. The probability of collision between meteor particles and planets highly depends upon the inclination of their orbits to ecliptical plane. Such a probability is minimal when $i \approx 90°$, that explains the clear minimum in the distribution of hyperbolic orbits at the corresponding inclination. Most important is a symmetrical character of the distribution. This is the main distinction from distribution feature of the short-periodical meteor orbits. This fact confirms an interstellar origin of the hyperbolic meteors.

3. The probability of collision of the meteor particles with Earth strongly increases at the periheliocentric distance $q \approx 1$. It is explained by the orbits' closeling and enlargement of an area of their touch. Therefore, the maximum of observed distribution of the number of meteor particles falls on q value approximately equal 1 a.u.

Polarimetry of asteroid 2100 Ra-Shalom. Comparison of polarization phase dependences of C and S asteroids and comets

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The results of polarimetric observations of C-type asteroid 2100 Ra-Shalom made at the 2-m telescope of Pik Terskol Observatory equipped with the two-channel CCD-polarimeter are presented. Polarization degree for phase angle 59.7° was 11.1±0.4 % and 10.7±0.2 % for blue (431/95 nm) and red (680/111 nm) filters correspondingly. These data extended the synthetic phase dependence of C-type asteroid polarization significantly and showed that the polarization phase dependences of C asteroids and comets perceptibly differ starting from phase angle $\alpha \geq 45°$. Comparison of average phase and wavelength dependences of C and S types asteroids and dust comets group was carried out. The similarity and diversity of polarization phase dependences for asteroids and comets are discussed within existing mechanisms of light scattering.

Analysis of photometric observations of mutual occultations and the system of Jupiter's satellites in 1991

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Some problems of processing photometric observations of mutual events in the system of Galilean satellites are studied. A method to derive moments of contacts of the events from analysis of the lightcurves are worked out. Results of processing 19 light curves are given for observations of 1991. The results are given in the form of normal places which have accuracy of a few milliarcseconds.

Investigation of fine structure in meteor showers and associations

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Meteor showers and associations, that were collected during long-term observations at Problem Scientific Research Laboratory of Radioengineering in Kharkov State Technical University of Radioelectronics, are investigated. In the databank there are more than 260 thousand of individual meteor orbits, from which 5160 meteor showers and associations were selected. Original technique for investigations of fine structure of showers is created. Two-dimensional function is formed in a crossection of a shower by a plane that is perpendicular to the mean shower orbit. The function is investigated by means of computer tomography technique. General idea of this method consists in constructing of a set of one-dimentional functions and then restorating of two dimentional function from the set of one dimentional ones. This method provides high efficiency of restoration even for a weak showers and small associations. Obtained results are discussed.