

STATE AGENCY ON SCIENCE, INNOVATION
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RESEARCH INSTITUTE “NIKOLAEV ASTRONOMICAL OBSERVATORY”

**ASTRONOMICAL RESEARCH:
FROM NEAR-EARTH SPACE
TO THE GALAXY**

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ABSTRACT BOOK

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Satellite NanoSail-D2 with the sail area of about 10m² has been independently flying since January 2011. This satellite is a prototype of the future mechanisms for the accelerated deorbit the space debris. In the present report, the character of the sail's drag in the Earth upper atmosphere, as well as the properties of its movement about the center of masses are considered. The satellite's dynamics is causing it to orbit the Earth in a flat spin as opposed to a random tumble, or facing into the direction of flight velocity. It is supposed to be the cause of the insufficiently quick braking of the sail. The photometric observations discover different changes of the satellite's brightness, including regular variability. In the latter case, the photometric period is about 5 sec in the end of April with 12 clearly visible variations within period. That confirms the opinion that in the result of interaction with the flux of particles of the upper atmosphere, the sail switched over to the mode of rotation about axis, which does not coincide with the axis of symmetry and, possibly, rapidly precesses in space. The results of modeling of the NanoSail-D2 rotation are presented.

CORRECTION OF DIGITIZED IMAGES OF PLATES USING A RULER WITH CALIBRATED LINES, METHODS AND FIRST RESULTS

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Problems of the processing of scanned images of photographic plates in terms of getting the most accurate astrometric information are described. Method for refinement of coordinate information includes image pre-processing, namely, digital filtering, separation of useful information, identification of image part that contains a ruler with calibrated lines. Next steps are linear approximation of the lines, obtained from image, their identification with the reference measurements obtained with measuring machine Fantasia (GAO RAS, St. Petersburg), and correction of image grid.

Serious attention devoted to the stage of preliminary processing of images is caused by a fairly high level of noises of consumer scanners, which we use to produce images of photographic plates, as well as the heterogeneity of the background caused by optical effects, which essentially is a feature of instrument on which the plate was exposed.

These problems require a solution at this preprocessing stage, since their contribution to the final error is quite high and often difficult identification of ruler lines, as well as images of the observed objects.

At the current stage of work after the correction of plate grid, the image is saved in standard FITS format for calculating the object coordinates by existing programs. In the future, to get more precise coordinates of the objects, we are going to create an interface for transmitting the raw coordinate information of objects into other software developed in NAO.

The first tests of this method and software, produced using the plate with the Pleiades open clusters, showed positive results.

FORMATION OF CATALOGUE OF GEOSYNCHRONOUS OBJECTS IN RI NAO

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The catalogue of the orbital elements of geosynchronous objects was generated from observation results obtained in the period of 2008-2010. Observations were carried out by the combined CCD observation method at Fast Robotic Telescope. The catalogue contains orbital elements of 67 objects. The orbital elements were used to calculate ephemerides on the interval from 2 to 200 days. The comparison of calculated ephemerides with new observation results was made. This made possible to estimate the calculation error of ephemerides and the necessary term of new observation.

The software for generation of geosynchronous objects observation list was developed, which consider the analysis of obtained results. The conception of Internet site for catalogue presentation was developed.

OBSERVATIONS OF NATURAL AND ARTIFICIAL OBJECTS IN NEAR-EARTH SPACE USING THE COMBINED OBSERVATION METHOD

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Near-Earth objects, such as artificial satellites and potentially hazardous objects are difficult for optical astrometry observations. High