

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
RESEARCH INSTITUTE “NIKOLAEV ASTRONOMICAL OBSERVATORY”

**METHODS AND INSTRUMENTS
IN ASTRONOMY: FROM GALILEO
TELESCOPES TO SPACE PROJECTS**

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ABSTRACT BOOK

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remained practically away from the given rapid development. Search of moving objects on the image is the case. Actually, much depends on the experience of the observer here, especially in a case of search of star-shaped objects with small proper motion such as asteroids. The situation has begun to change for better only recently, with the advent of the first programs of automatic searching (for example, LINEAR, Spacewatch).

The development of the similar program for telescopes with small apertures in Ukraine is under go at present. In the report the first results of application of the program are presented at processing of observations from various telescopes. Further development of the universal software product allowing to make qualitative detection in different modes of moving objects as in the near-Earth space and far behind the orbit of our planet is planned.

COMPLEX OF ROBOTIC TELESCOPES FOR OBSERVATION OF THE EARTH ARTIFICIAL SATELLITES AND NEAR-EARTH OBJECTS

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Modern tasks for orbit control of the Earth artificial satellites and objects approaching the Earth define high requirements to ground-based telescopes, which have to be equipped with fast objectives, CCD cameras with a chip size not less than two inches. The CCD camera has to work in different modes. The telescopes must be fully robotized, and have a control system with remote operation and alert mode.

In cooperation between RI NAO and NSFCTC, the upgrade of the AZT-8 classical telescope, belonging to NSFCTC, was made. Two telescopes of original design, namely the Fast Robotic Telescope (FRT) and the Mobile Telescope (MobiTel) were made in RI NAO.

The telescopes are equipped with absolute angle encoders, CCD cameras with Kodak KAF-09000 chips, GPS time service, robotic drives and an automatic control system. The telescope features, such as a telescope name, f-number, chip name and operating modes, pixel numbers, field of view, pixel sizes, pixel scale, limiting magnitude, the standard deviation are given in the following list:

- 1) AZT-8 (*NSFCTC*), 0.7/2.8 m, FLI PL09000 stare, 3056×3056 , $45' \times 45'$, $12 \times 12 \mu\text{m}$, $0.9''/\text{pix}$, 20^{m} , $0.05'' \div 0.15''$;
- 2) FRT (*NAO*), 0.3/1.5 m, Alta U9000 stare and drift-scan, 3056×3056 , $1^{\circ}24' \times 1^{\circ}24'$, $12 \times 12 \mu\text{m}$, $1.6''/\text{pix}$, 18^{m} , $0.15'' \div 0.40''$;
- 3) MobiTel-0.5 (*NAO*), 0.5/3.0 m, Alta U9000 stare and drift-scan, 3056×3056 , $42' \times 42'$, $12 \times 12 \mu\text{m}$, $0.8''/\text{pix}$, 19^{m} , $0.05'' \div 0.15''$;
- 4) MobiTel-0.3 (*NAO*), 0.3/0.75 m, Alta U9000 stare and drift-scan, 3056×3056 , $2^{\circ}48' \times 2^{\circ}48'$, $12 \times 12 \mu\text{m}$, $3.2''/\text{pix}$, 18^{m} , $0.20'' \div 0.45''$.

The telescopes are actively used for control of the near-Earth space as well as for the solution of problems connected with the potentially hazardous asteroids and comets approaching the Earth.

Combination of classical and original methods of observations allows us to carry out virtually any observing programme.

Considering objects at geostationary orbits and at highly elliptical orbits, we are able to carry out the following types of observations: massive – survey, boundary – search, high accuracy – single object.

To solve the problems connected with the potentially hazardous asteroids and comets approaching the Earth, we are able to observe faint objects located in the asteroid belt as well as objects approaching the Earth at the distance less than 0.1 a.u. and with elongation angle up to 130° .

FIRST RESULTS OF FUNCTIONING OF THE UKRAINE-CHINA TELESCOPE NETWORK ON SPACE DEBRIS OBSERVATIONS

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Substantial growth of space debris (SD) on the near-Earth orbits is caused by increasing launch number of the Earth artificial satellites