RESULTS OF OBSERVATIONS OF SELECTED ASTEROIDS AT THE NEW TELESCOPE MOBITEL OF NAO IN 2011-12

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ABSTRACT. The results of position observations of selected asteroids with the new telescope Mobitel of NAO are presented. The possibility of using them for contemporary problems is discussed.

Key words: astrometry, asteroid, positional observations.

In 2011 regular observations of selected bright asteroids were begun with Mobitel telescope set up in Nikolaev Observatory. The asteroids were chosen from the compiled observational program for Russian-Turkish telescope RTT150 (Shulga et al., 2010; Shulga et al., 2012). The first list consists of the objects for determination masses of some large asteroids, the second one consists of small asteroids, less than tens kilometers for detection of Yarkovsky effect which changes orbits of small bodies due to re-emission by them in the infrared wavelength. The peculiarity of the selected asteroids is their small size which requires high aperture telescopes and makes difficulty for measuring positions with high accuracy. Namely the high accuracy of astrometric measurements, better than 0.1″, is necessary for successful detection of perturbation effects in the motion of smaller asteroids having encounters with bigger ones and thus determination of their masses.

The results of the past observations under these programs with the RTT150 have demonstrated very good results. The mean internal precision of a single position was 0.10" in right ascension and 0.08" in declination in the UCAC2, UCAC3, UCAC4 reference catalogs for objects of 15-19 magnitudes (Ivantsov, 2011). The first observations of near-Earth asteroids at the Mobitel telescope were made in 2010 (Shulga et al., 2011). That results appeared to be promising for improving orbits.

The telescope Mobitel (D=0.5 m, F=3.0m) is equipped with the CCD camera Alta U9000 (3056x3056, 12x12 mkm^2) of Apogee Imaging Systems,which allows to get imaging with 42'x42' field of view and 1.6″/pix of scale. The observations were made in R Johnson-Cousins-Bessel band. That system allows to get number of reference stars enough for reduction in the UCAC catalogs. The peculiarity of the telescope consists in using time delay and integration mode solely for observations. The length of exposure was not greater than 85s there.

Since June 2011 there were measured 705 positions of 26 program asteroids and 82 positions of 6 asteroids appeared to be present in the same images from the observations at the Mobitel telescope. The reduction was made using "Astrometrica" with the UCAC4 reference catalog. For estimating accuracy of the observations, there was made comparison with the ephemerides provided with the online service "HORIZONS" of Jet Propulsion Laboratory, USA (http://ssd.jpl.nasa.gov/?horizons). The comparison of observed (O) and calculated (C) positions is given by distribution of mean values of (O-C) on Fig. 1. Each point represents the mean of the series of measurements of each asteroid per night. So, one can find points there which correspond to the same asteroid, but obtained in different observational periods. The error bars correspond to one-sigma interval. The weighted mean value of (O-C) for two years gives zeros, while there are significant both negative values in right ascension and declination in 2011, and significant both positive values in 2012.

The distribution of internal errors for a single position with respect to magnitudes are presented on Fig. 2, 3. The errors are 0.1″ for the observed asteroids up to 14 magnitude. The weighted standard error of a single position was 0.2″ in each coordinate for asteroids to 16 magnitudes and it was calculated using standard deviations of (O-C) in positions for each series of observations.

The great values of (O-C) and errors can have explanation in insufficient exposure for faint objects, which is limited by time delay and integration mode of observation.

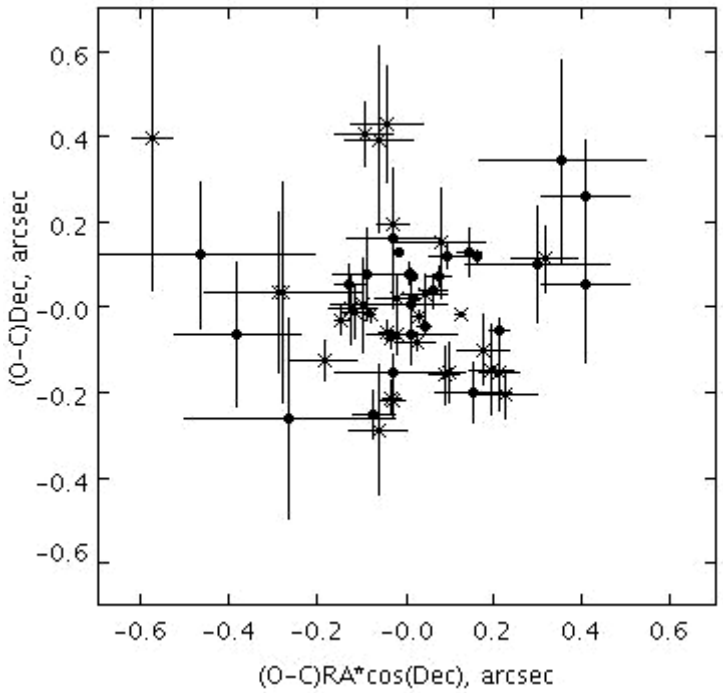

Figure 1: The distribution of (O-C) in positions of asteroids: crosses correspond to the positions observed in 2011, points correspond to the positions of 2012.

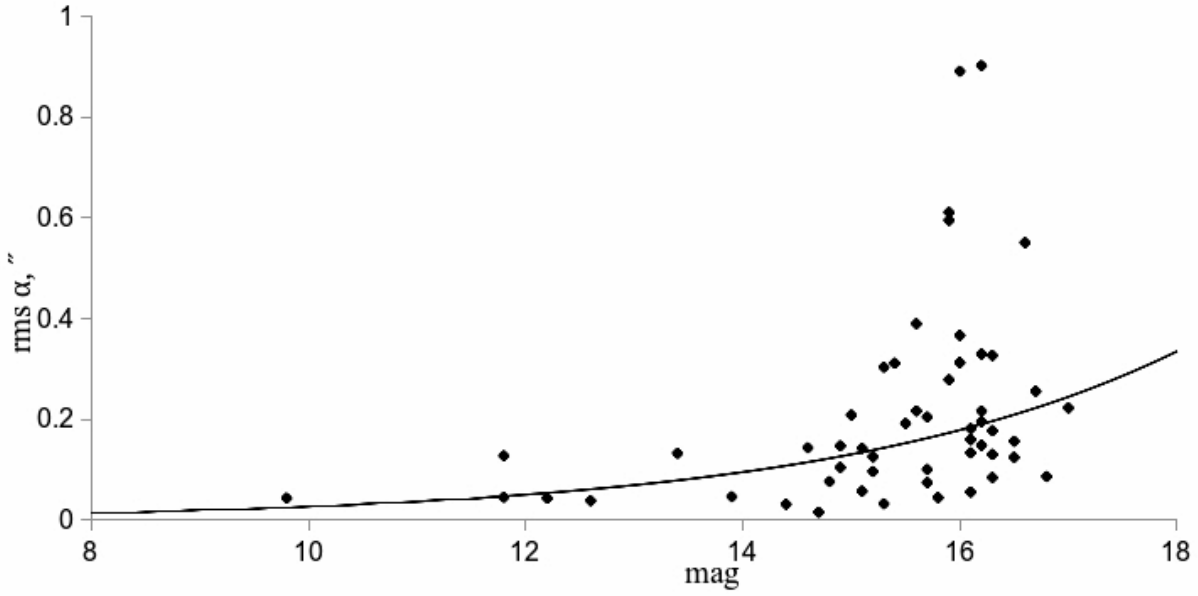

Figure 2: The standard error of position of asteroid in right ascension with respect to magnitude

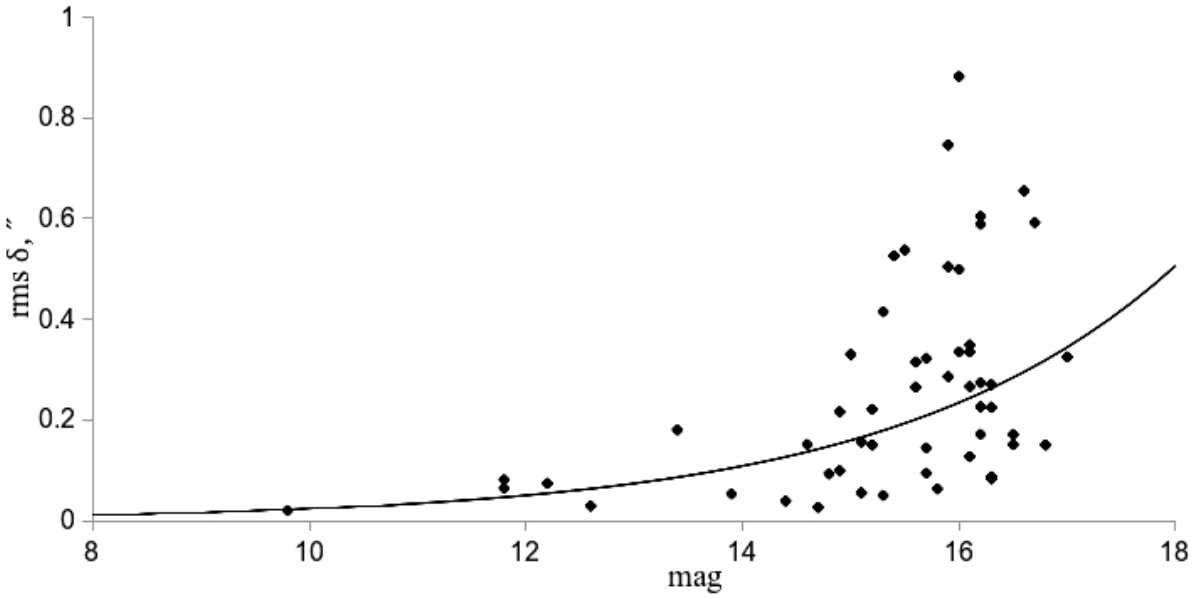

Figure 3: The standard error of position of asteroid in declination with respect to magnitude

Conclusions

At present astrometric observations of selected asteroids at the Mobitel telescope have accidental error of 0.1" in each coordinate for asteroids brighter 14 magnitude and weighted 0.2" for objects up to 16 magnitudes.

For improving systematic and accidental errors of astrometric observations of asteroids, it is necessary to study the field corrections and improve techniques of observations, which will allow to use this telescope for research small effects in the motion of small bodies of the Solar system.

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