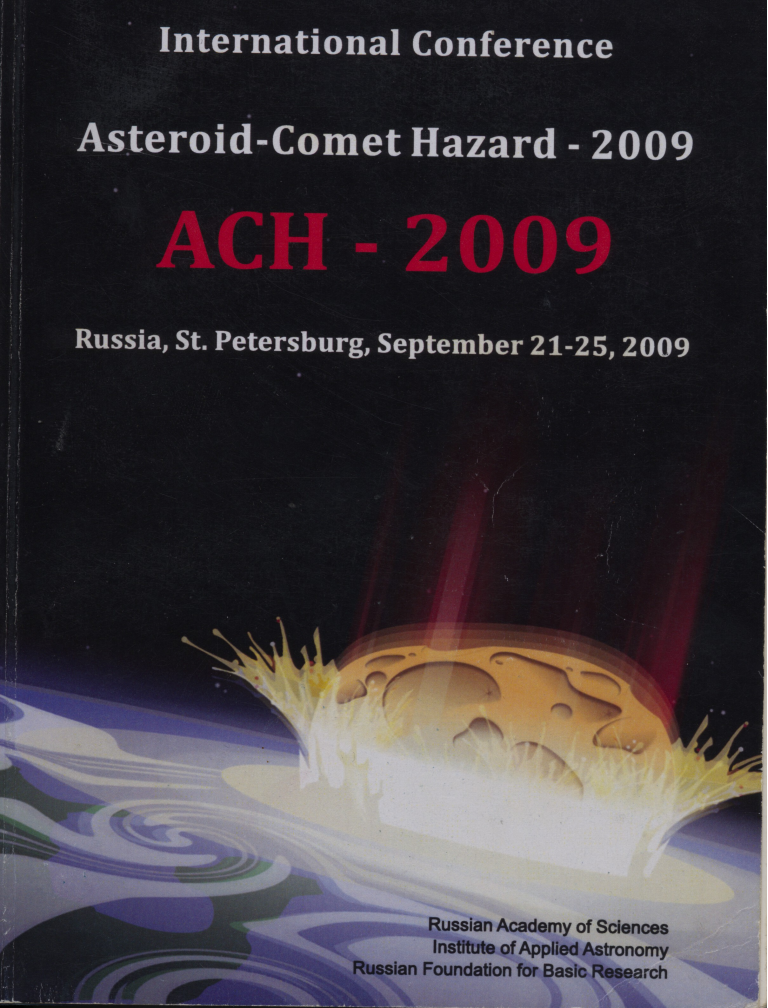
International Conference

Asteroid-Comet Hazard - 2009

ACH - 2009

Russia, St. Petersburg, September 21-25, 2009



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Features of NEO observations during the period of maximal approach to the Earth

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Modern observations of potentially hazard asteroids (PHA) [1] provide detection of objects as small as 10 m and at the distances about two or three diameters of the lunar orbit. Conditions of observations of such PHA are very bad due to the large image smear. Because of this, search and detection of the PHA are usually carried out with fast aperture telescopes (F/D > 2), equipped with supersensitive CCD cameras. In the RI NAO, a so-called combined method (CM) of CCD observations is successfully used for initial orbit determination. This method allows us to observe the PHA having visible motion from 5"/minute to 300"/minute.

In accordance with the data of Near-Earth Objects Dynamic Site (NeoDys) [2] as of middle 2008, 857 numbered and 4651 unnumbered asteroids are classified as asteroids approaching the Earth. During the period from September 2007 to July 2008 at the distances from 0.05 to 0.5 A.U., 429 NEO not fainter than 20^m were detected.

The percent distribution of these 429 NEO at the instant of discovery against distance from the Earth is given in Fig. 1.

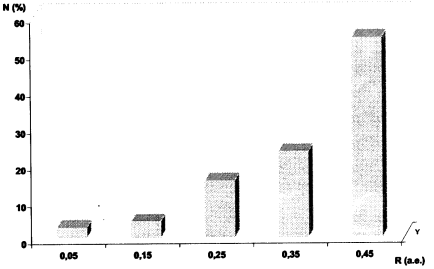

Fig. 1. Distribution of 429 NEO against distance from the Earth.

In accordance with NeoDys data, percent distribution of NEO against the visual velocity in relation to stars is given at Fig. 2. More than 70 % of observations are carried out at the visual velocities less than 10″/minute, i.e. at the distances more than 0.1 A.U. from the Earth.

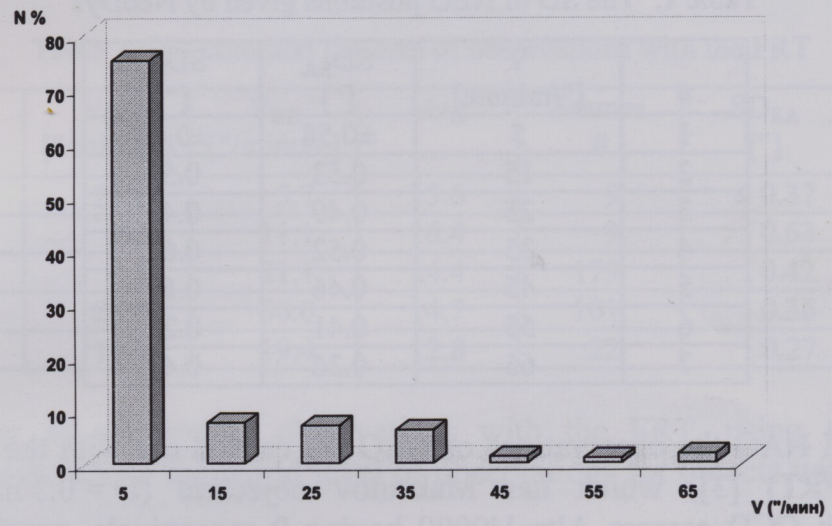

Fig. 2. Distribution of NEO, which approached the Earth up to the distance less than 0.5 A.U., against the visual velocities.

Analysis of data given at Fig.3 shows that bright NEO were observed at high velocities due to the short period of observations i.e. 5-7 days and large image smear leading to short exposures.

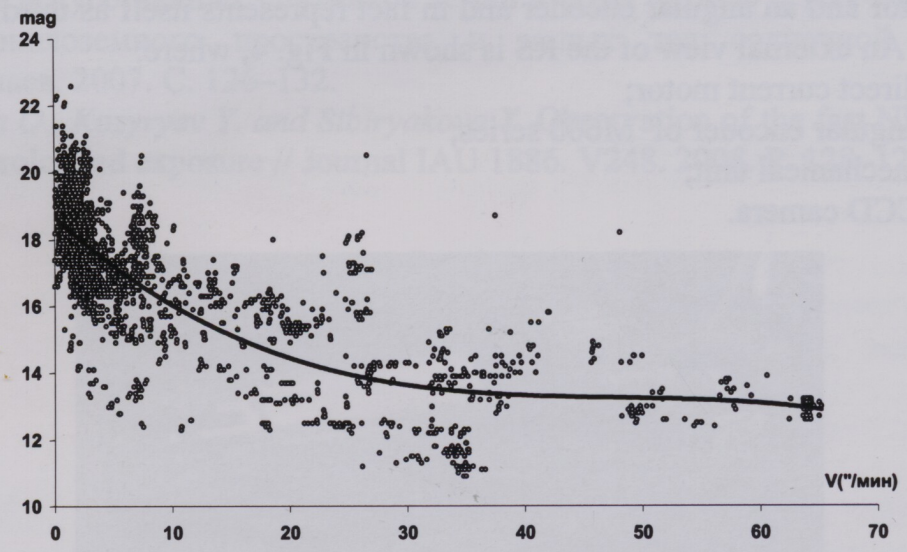

Fig. 3. Dependence of NEO magnitudes at the distances of < 0.5 A.U. against visual velocities.

In accordance with the NeoDys data, the standard deviation (SD) of positions is given in Tabl. 1. The SD lies between values ± 0."27 and ± 0."62 that gives the mean value of ± 0."48.

Table 1. The SD of NEO positions given by NeoDys

#	V ["/minute]	SD_{RA} ["]	SD_{DE} ["]
1	5	±0.58	±0.48
2	15	0.53	0.52
3	25	0.49	0.43
4	35	0.52	0.62
5	45	0.46	0.57
6	55	0.41	0.27
7	65	0.36	0.47

In the RI NAO the observations of NEO are carried out with the Fast Robotic Telescope (FRT) [3], which has Maksutov objective (D = 0.3 m, F = 1.5 m) equipped with CCD camera Alta U9000 having 9 megapixels, automatic driving units for the telescope positioning and enclosure opening, a system for remote control via a local area network.

To carry out observations by the combined method, the FRT has to be equipped with a motorized rotation stage (RS) [4]. Using the RS, columns of the CCD camera are positioned in parallel with motion of observed object. The RS is a mechanical device, which rotates the CCD camera around telescope axis. The RS is equipped with a motor and an angular encoder and in fact represents itself as third axis of the telescope. An external view of the RS is shown in Fig. 4, where:

1. direct current motor;
2. angular encoder of M600 series;
3. mechanical unit;
4. CCD camera.

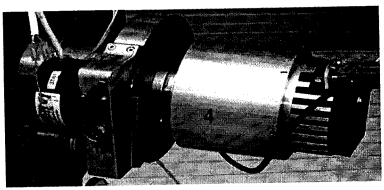

Fig. 4. The motorized rotation stage of the FRT.

In 2008, 320 positions of five NEO, which moved with visual velocities from 5"/minute to 36"/minute in relation to stars, were obtained with the FRT. Common features of observations are given in Tabl. 2. The SD lies between values of ± 0."15 and ± 0."63 that gives the mean value of ± 0."33.

Table 2. The common features of observations with the FRT

Name	V_{RA} ["/minute]	V_{DE} ["/minute]	Mag	Frames #	SD_{RA} ["]	SD_{DE} ["]
2002TD66	21.2	5.7	15.6	9	± 0.37	± 0.24
2008CR116	9.2	11.1	16.4	9	0.63	0.25
2005RC34	6.2	21.1	14.4	179	0.42	0.32
2008TT26	28.8	36.0	14.7	101	0.36	0.24
2008SV11	15.0	19.4	12.8	22	0.27	0.15

Accuracy of astrometric observations with the FRT, using the combined method, corresponds to the world level of observations for objects with similar visual velocities.

List of references

1. http://neo.jpl.nasa.gov/ca/
2. http://newton.dm.unipi.it/neodys/index.php?pc=1.0
3. *Базей А. А., Ковальчук А. Н., Козырев Е. С., Лаврухина Р. В., Сибирякова Е. С., Шульга А. В.* Использование телескопа ШАК-300 для ведения каталога искусственных спутников земли в НИИ «НАО» // Изучение объектов околоземного пространства и малых тел солнечной системы. Николаев. 2007. С. 126–132.
4. *Shulga O., Kozyryev Y. and Sibiryakova Y.* Observation of the fast NEO objects with prolonged exposure // Journal IAU 1886. V248. 2008. P. 128–129.