

China NEO Survey Telescope and its preliminary achievement

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Abstract. In recent years, there has been an increasing appreciation for the hazards posed by Near Earth Objects (NEOs), those asteroids and periodic comets whose motions can bring them into the Earth's neighborhood. An NEO Survey Telescope (NEOST) was built in China to be taken part in the international NEO joint survey. This telescope is a 1.0/1.2m Schmidt telescope, equipped with a 4K by 4K CCD detector with a drift-scanning function. After adjusting the telescope and test observations, in December 2006 the NEOST began its NEO survey program. We have found 188 new asteroids including an NEO – 2007 JW2 and one periodic comet – P/2007 S1 (Zhao).

Keywords. telescopes, asteroids, surveys, astrometry

1. Introduction

The rate of asteroid discoveries shows an exponential growth. After astronomer Guiseppe Piazzi of Palermo, Sicily, discovered the first asteroid on January 1, 1801, the number of new finds per year increased to five by 1865, 15 per year by 1895, 25 by 1910 and up to about 40 by 1930. By the end of September of 2007, the number of numbered asteroids was more than 160,000 including about 800 Potential Hazardous Asteroids (PHA). (see <http://neo.jpl.nasa.gov/stats/>)

According to NASA's report (NASA 2007), the further objectives of NEO Survey Program are to detect, track, catalogue, and characterize the physical characteristics of NEO equal to or larger than 140 meters in diameter with a perihelion distance of less than 1.3 AU from the Sun, achieving 90% completion of the survey within 15 years after enactment of the NASA Authorization Act of 2005.

Chinese scientists have contributed substantially to the field of asteroid survey and related aspects. In the early 1960s, Purple Mountain Observatory began observations of asteroids and found over 130 new numbered asteroids during the following decades. The Schmidt CCD Asteroid Program (SCAP) of Beijing Astronomical Observatory started in 1995 and found 575 asteroids in several years (Ma, Zhao & Yao 2007).

2. NEOST and observation

In October 2006, the 1.0/1.2 m NEOST equipped with a 4096×4096 SI CCD detector was installed and began the test observations. Due to the small focal ratio and the high quantum efficiency (QE) of the CCD detector, the observational system can reach $B=22.5$ with a 40 s exposure, which makes the asteroid survey very efficient. About 22 Gb of raw image data, corresponding to the sky coverage of 2700 deg², are produced each good

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observing night providing on average more than 2000 asteroid positions. To reduce the observational data and to report the asteroid positions to Minor Planet Center (MPC) in a timely fashion is a challenge to us. We have established a set processing software to reduce the data with good precision (Table 1 where D29 is the station code for NEOST).

Table 1. Residuals statistics of asteroid position for top-ten observational program (up to 2007-09-30). (see <http://www.cfa.harvard.edu/iau/special/residuals.txt>)

COD	Tot	< 1''	< 2''	< 3''	< 4''	≥ 4''	R.A.	Decl.
G96	4417	4307	101	7	2	0	-0.01 ± 0.33	-0.09 ± 0.31
D29	57486	52095	4678	624	89	0	-0.04 ± 0.45	-0.08 ± 0.46
644	288266	286027	2127	94	18	0	$+0.02 \pm 0.26$	$+0.11 \pm 0.23$
E12	27058	24408	2524	116	10	0	-0.05 ± 0.42	$+0.24 \pm 0.43$
691	374098	366226	6582	1012	278	0	-0.09 ± 0.28	$+0.07 \pm 0.28$
D35	21884	20233	1586	49	16	0	$+0.09 \pm 0.42$	$+0.26 \pm 0.37$
704	177620	119287	52736	5147	450	0	-0.09 ± 0.61	$+0.45 \pm 0.64$
291	21476	20559	819	83	15	0	-0.13 ± 0.38	$+0.13 \pm 0.30$
699	28249	20993	6616	599	41	0	-0.13 ± 0.57	$+0.44 \pm 0.55$
703	3532	2568	867	93	4	0	-0.23 ± 0.63	$+0.12 \pm 0.63$

3. Preliminary achievement

From December 2006 to September 2007, we carried out the test observations of asteroids and accumulated more than 600 Gb of raw image data with the sky coverage more than 20000 deg² near the opposite position. Our observations ranked among the top-ten observational programs in the world. Until September of 2007, we have found 188 new asteroids including an Apollo-type NEO - 2007 JW2. In the middle of September, a new Jupiter-family comet, P/2007 S1, was found.

We used 25 observations from May 7, 2007 to May 10, 2007 to obtain the 2007 JW2's orbital elements and their uncertainties. Dynamical evolution shows that 2007 JW2 has no chance to impact the Earth within 200 years and its MOID is 0.22 AU. For the periodic comet, it is more fortunate that there are many more observations to determinate the orbit. According to its orbital elements, P/2007 S1 is a typical Jupiter-family comet. The astrometric errors of this comet are much larger than that of an asteroid, resulting in higher orbital element uncertainties.

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References

- Ma, Y., Zhao, H., & Yao, D., 2007, *Proceedings IAU Symposium No. 236*, 381-384.
 NASA, 2007, *Near-Earth Object Survey and Deflection Analysis of Alternatives (Report to Congress)*.