

**PDC2013  
Flagstaff, AZ, USA**

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**THE ASTROMETRY ALGORITHM USED AT THE KLET OBSERVATORY**

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**Keywords:** *NEO; astrometry; follow-up; software*

**ABSTRACT**

From mankind perspective the Near-Earth Objects (NEOs) belong to the most important small bodies in the solar system, having the capability of close approaches to the Earth and even the possibility to collide with the Earth. Their discovery and observation is therefore of high interest to the mankind. Since every observation incorporates an error, it is impossible to calculate reliable orbit of an object from single nights observation.

Especially for observatories focused on NEOs research, flexibility in observing plan is crucial. Smaller NEOs are often discovered when passing close to the Earth and failure in promptly obtaining enough data to determine their orbit results in inevitable loss of the asteroid. Therefore newly discovered NEO should be observed and its astrometric positions sent to the Minor Planet Center (MPC) as soon as feasible. With the additional data available, the accuracy of the asteroid's orbit increases and there is more time available to obtain further observations before the asteroid would become lost due to its deviation from its predicted position.

Every observatory produces their unique data processing structure over the time with gained experience. This work focuses on astrometry as its done on Klet Observatory. Klet Observatory has been carrying out astrometric measurements

since 1969 and developed handful of useful strategies since, allowing for astrometric positions to be sent within few minutes of images acquisition. Klet Observatory team consists of just four workers, but handles the largest telescope in Europe used exclusively for NEOs follow-up observations. The KLENOT project contributed over 13 000 astrometric positions to MPC between 2002 and 2008. By sharing our methodology we hope to bolster confidence of smaller observatories to participate in the worthwhile endeavour of NEOs research.

The Klet Observatory uses two reflectors, 1.06-m KLENOT telescope and 0.57-m telescope, both equipped with CCDs. Our *Ephem* tool lists the observable objects of desired category and brightness in right ascension order. Observational priority is given to NEOCPs (NEO Confirmation Page of MPC), V.I.s (Virtual Impactors), radar targets and NEOs with high orbit uncertainty. A set of the target objects images is taken and its up to observer, supplemented with our custom tools, to identify the object. Our *Astrometry* tool is used to reduce the image to objects and utilizing USNO B1.0 catalog the identification of stars is carried out using similarity of triangles. Plate parameters are computed, stars positional errors are determined and standart 80-character output is produced for the targeted object. The new data is automatically added to our databases. Our *Residua* tool is ran and the observed positions of the object are compared with ephemerides computed using local orbital elements database which is updated daily with new MPC data. The observer can therefore verify the correctness of objects identification and possibly drop the lines with higher error before sending the observations to MPC. The whole process from taking the image set to sending the objects observations takes up to several minutes.

The core of our *Astrometry* tool was written in 1993 and enhanced over the years, although the underlying principle stays the same. The tool is already ready for the new MPC format and Klet Observatory team is currently reviewing the program to take advantage of todays more powerful computing power.