CCD ASTROMETRY OF NEAR–EARTH ASTEROIDS

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Automated observations of near–Earth asteroids have been underway at the USNO Flagstaff Station since February 1994. Observations are made with an 8-inch transit telescope utilizing a CRAF/Cassini 1024×1024 CCD. The scale of 1.2 arcsec/pixel provides a field 20.5 arcmin on a side. Pointing and imaging are done automatically using nightly schedules of transit times and declinations of the asteroids to be observed. Observations are made in scan mode, allowing an integration time of 80 seconds at the celestial equator and a limiting magnitude of about 17.5. Flats, collimation and scale frames, and photometric standard fields can all be included in the nightly schedules. The telescope operates unattended during the night, but is monitored remotely by observers at another USNO telescope.

The 40–50 asteroids to be observed each night are selected from a list of hundreds of candidates proposed by collaborators at USNO, Edward Bowell of Lowell Observatory, and Donald Yeomans at the Jet Propulsion Lab. The USNO candidates comprise objects of special historical or dynamical interest. Those proposed by Yeomans are generally future targets for spacecraft encounters. By far the largest number of candidates is provided by Bowell and includes Earth–crossing asteroids, planet–crossers, objects on the MPC critical list, and other asteroids whose orbits need improvement.

Asteroid coordinates are computed using a transformation derived by a least-squares fit of pixel coordinates of field stars to an astrographic projection of their catalog positions. The accuracy of the resulting coordinates is thus highly dependent on the quality of the catalog employed. At present the Guide Star Catalog is used, yielding a typical accuracy of ±0.3 arcsec. Magnitudes are estimated by linear least-squares fit of the star images' intensities to their catalog magnitudes. Using the GSC magnitudes leads to an uncertainty of ±0.5 magnitudes. Accuracies should improve significantly with the use of the Hipparcos catalog, and the number of observations will increase due to planned hardware and software improvements.