LONG-FOCUS CCD ASTROMETRY OF PLANETARY SATELLITES

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Twenty-five years ago, the driving motivation for satellite astrometry was the need to improve the obsolete satellite theories by the almanac-producing countries. Photographic tangent plane observations were more than adequate for that task.

With the advent of spacecraft reconnaissance of the major planets and their satellites, there was a need for more accurate ephemerides. In addition, many new satellites discovered in these encounters were impossible to detect from the ground. These new challenges were met with the application of new techniques, instruments and detectors.

The principal advance in astrometric observation in the past 15 years was the introduction of CCD detectors. The quantum efficiency and linear response of the CCD detector have been largely responsible for its success for both tangent plane astrometry and for the observation of the mutual phenomena of the bright moons of Jupiter and Saturn. However, caution should be used when applying CCDs to large scale systems because the small size and complexity of the CCD chip make it difficult to calibrate. This caveat not withstanding, it is now possible to obtain relative positions of the satellites with a precision of 5-20 milliarcsec.

Of the 25 newly discovered satellites which cannot be observed from the ground, at least 15 of them can be observed with the Hubble Space Telescope (HST). Images of the eight brightest of the inner satellites of Uranus have already been detected and measured on recent WFPC2 frames. The astrometric precision of these observations is also expected to be in the 5-20 milliarcsecond range.