CCD Centroiding Experiment for JASMINE and ILOM

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Abstract
JASMINE and ILOM are space missions which are in progress at the National Astronomical Observatory of Japan. These two projects need a common astrometric technique to obtain precise positions of star images on solid state detectors to accomplish the objectives. We have carried out measurements of centroid of artificial star images on a CCD to investigate the accuracy of the positions of the stars, using an algorithm for estimating them from photon weighted means of the stars. We find that the accuracy of the star positions reaches 1/300 pixels for one measurement. We also measure positions of stars, using an algorithm for correcting the distorted optical image. Finally, we find that the accuracy of the measurement for the positions of the stars from the strongly distorted image is below 1/150 pixels for one measurement.

EXPERIMENTAL EQUIPMENT
The schematic design of the centroiding experiment is shown in Figure 1. Overview of the experimental equipment is also shown in Figure 2.

JASMINE and ILOM
JASMINE is the acronym of the Japan Astrometry Satellite Mission for INfrared (z-band: 0.9 μm) Exploration. JASMINE will measure trigonometric parallaxes, positions and proper motions of stars, with a precision of 10 microarcsec at z = 14mag.

ILOM is the acronym of In-situ Lunar Orientation Measurement. The objective of ILOM is to study lunar rotational dynamics by direct observations of the lunar physical libration and the free librations from the lunar surface in order to investigate the lunar mantle and the liquid core.

Result
The squares show only the separations between photon-weighted means of two stars, that is, no correction is performed. On the other hand, the diamonds are the estimated distances between two stars by using the algorithm. The dispersion of the distance of two stars, the error of the estimation is about 1/150 pixel for one measurement.