

## Near-Earth Asteroid Survey with Tomo-e Gozen

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Advances in astronomical observation has rapidly increased the number of solar system small bodies. Up to now, more than 930,000 objects have been discovered. Large part of newly discovered objects are near-earth asteroids, whose perihelion distances are less than 1.3 au. About 2,000 near-earth asteroids are newly discovered annually. Only a small fraction of near-earth asteroids smaller than about 140 m have, however, been discovered so far. Surveys of such small near-earth asteroids are important in the contexts of the evolution of solar system small bodies as well as the planetary defense. Small asteroids become sufficiently bright to be detected only when they are in the vicinity of the Earth. The closer asteroids are, the faster their apparent motion become. Such a fast apparent motion causes significant sensitivity loss by trailing in observations with standard observation systems with CCD cameras.

We have developed a wide-field mosaic CMOS camera, Tomo-e Gozen, mounted on the 105-cm Schmidt Telescope in Kiso Observatory, the University of Tokyo. Tomo-e Gozen is equipped with 84 CMOS sensors and monitors the sky of about 20 sq-degrees at 2 Hz. The total amount of the data obtained in a night is as much as 20 TB. An unique feature of Tomo-e Gozen is a continuous, video-like observation. Tomo-e Gozen is designed to detect every transient phenomena with timescale of about 1 second. The specifications of Tomoe Gozen, a high sensitivity, large field-of-view, and high frame rate, are ideal to detect fast moving objects, such as near-earth asteroids close to the Earth.

A wide-field survey with Tomo-e Gozen have started in October, 2019. A number of transient phenomena, near-earth asteroids, and space debris have been detected by dedicated data reduction pipelines. A near-earth asteroid pipeline detects every linear motion in the video data. Objects moving at 1–50"/s are successfully extracted even in crowded fields. In the operation in 2019, 6 near-earth asteroids are newly discovered. All the absolute magnitudes of the detected asteroids are fainter than 25 mag, corresponding to about 40 m in diameter assuming that the geometric albedo is 0.1. The survey with Tomo-e Gozen successfully detected small near-earth asteroids. In this presentation, the specifications of Tomo-e Gozen and the survey design are presented, as well as the algorithm to detect moving object in huge data, as much as 20 TB per day. Then, future prospects of the Tomo-e Gozen survey are discussed

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