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Contributions to Observations of Near-Earth Objects by a Wide-Field CMOS Camera Tomo-e Gozen

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A number of near-earth objects (NEOs) have been detected in ground-based survey observations [1, 2]. In order to detect NEOs efficiently, quick survey with a wide-field camera is preferred. The Tomo-e Gozen project aims to develop a wide-field camera equipped with 84 CMOS sensors newly-developed by Canon (hereafter, referred as to the Tomo-e Gozen camera), which will be mounted on the 105-cm Kiso Schmidt telescope in Kiso Observatory, the University of Tokyo. The Tomo-e Gozen camera is composed of four mosaic cameras, each of which has 21 CMOS sensors. The field-of-view of the Tomo-e Gozen camera is, in total, as large as 20 square-degree. Each CMOS sensor has 2160×1200 pixels with a pixel scale of about 1 arcsecond. Thanks to the CMOS sensors, images are continuously obtained at 2 Hz and the overhead time due to readout is almost negligible. This enables us to cover a region of about 10,000 square-degree in two hours with a limiting magnitude of about 19 mag. at the V-band. The Tomo-e Gozen camera will be a powerful tool to discover new NEOs.

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To evaluate the performance of the CMOS sensor, a prototype of the Tomo-e Gozen camera (hereafter, referred as to the Tomo-e PM) was developed. The Tomo-e PM, equipped with 8 CMOS sensors, is able to record a sky of about 2 square-degree at up to 2 Hz [3]. The limiting magnitude of the Tmo-e PM was the same as that of the Tomo-e Gozen camera. The commissioning of the Tomo-e PM was carried out in November, 2015. The limiting magnitude in 0.5 s integration was about 18 mag. in the V-band. A number of moving objects including meteors, artificial satellites, and debris were detected. The Tomo-e PM successfully recorded a track of a JAXA's asteroid explorer Hayabusa2 during an Earth flyby. The Tomo-e PM demonstrated that the Tomo-e Gozen camera will have advantage in observing fast moving objects as well as quick survey.

Data obtained with the Tomo-e Gozen camera are immediately analyzed within the observatory. Photometric results, movies of transient events, meteor trails, and stacked deep images will be distributed. Development of one of the four mosaic cameras will be completed in late 2017. The commissioning of the Tomo-e Gozen camera with the 84 CMOS sensors is scheduled in late 2018.

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