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X-ray performance evaluation and structural analysis of the wide-field X-ray monitor with Lobster Eye Optics

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HiZ-GUNDAM is a future satellite mission for gamma-ray burst observations, designed to detect X-ray transients with the wide-field X-ray monitor, and to perform automatic follow-up observations with the near-infrared telescope. The wide-field X-ray monitor consists of an X-ray optical system, Lobster Eye Optics (LEO) and pnCCD imaging sensor to monitor a wide field of view (FoV) of ˜0.5 steradian at 0.4-4.0 keV.
LEO is soft X-ray focusing mirror, which is an innovative X-ray optical system that provides both a wide field of view and high sensitivity. It has a spherically curved SiO2 plate with millions of micropores, and inside of pores are coated with heavy metals. It reflects and focus soft X-rays and making the cross image on focal plane. Compared to the current mainstream coded mask method used in astronomical satellites, mirror optics like LEO can efficiently focus and reduce the effect of cosmic X-ray background. That makes possible to achieve an improvement in sensitivity of more than one order of magnitude. The LEO segments can be expanded its FoV by arraying and aligning multiple LEO segments on a spherical shell.
We developed an optical frame as a breadboard model (BBM) to set 9 LEO segments manufactured by Photonis Co. Ltd. on the spherical shell. Each segment measures 4 cm × 4 cm, and the cross image size at the focal plane is 2 cm × 2 cm, with a distance of 30 cm from LEO. The detector system combining the optical frame with a CMOS image sensor was constructed, and its X-ray performance has been tested. The tests focused on key parameters such as angular resolution, effective area, and angular response of the LEOs. In addition, vibration tests simulating launch of locket were conducted on the BBM frame with LEO to assess the structural characteristics of the system. We investigated the characteristic frequencies of the BBM frame and the response for random vibration. In addition, we performed further vibration tests for the BBM housing combined with the BBM frame, and investigated the structural properties of the entire detector system of the wide-field X-ray monitor.
We will report detailed X-ray performance and structural properties of the wide-field X-ray monitor with Lobster Eye Optics.

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