Development of X-ray CCDs for the NeXT satellite

Daisuke Matsuura[a], Hideki Ozawa[a], Noriaki Tawa[a], Kenji Mukai[a], Tomofumi Miyauchi[a], Naohisa Anabuki[a], Emi Miyata[a], Hiroshi Tsunemi[a], Shinichiro Takagi[b], Tatsura Inui[b], Hironori Matsumoto[b], Takeshi Tsuru[b], Yukiko Kamata[c], Satoshi Miyazaki[d], Kazuhisa Miyaguchi[e]

[a] *Department of Earth and Space Science, Graduate School of Science, Osaka University, 1-1 Machikaneyama, Toyonaka, Osaka 560-0043, Japan*

[b] *Department of Physics, Graduate School of Science, Kyoto University, Kitashirakawa-Oiwakecho, Sakyo-ku, Kyoto, 606-8502, Japan*

[c] *National Astronomical Observatory, Osawa, Mitaka-shi, Tokyo, 181-8588, Japan*

[d] *Subaru Telescope, National Astronomical Observatory of Japan, 650 North A'ohoku Place, Hilo, HI96720, USA*

[e] *Solid State Division, Hamamatsu Photonics K.K. 1126-1 Ichino, Hamamatsu 435-8558 Japan*

The focal plane detectors of the multilayer supermirror(HXT) are planned to be employed the Wide-band X-ray Imager (WXI) consisting of X-ray CCDs (SXI : Soft X-ray Imager) and CdTe pixelized detector (HXI : Hard X-ray Imager). HXT has a large band effective area in 0.5–80keV. The detector is required of spectroscopic capability in those band. SXI has requirements, one is the high quantum efficiency from 0.1keV to 20keV, the other is to make hard X-ray penetrated the CCDs wafer. In order to fulfill these, We are developing the Back supportless CCDs(BS-CCDs) and N-type CCDs. BS-CCDs are taken the back package and field-free region. N-type CCDs is made of high resistivity N-type silicon, which make the thickness fo the depletion layer. For this CCDs,the QE is improved both in X-ray band and optical band.

We started to develop model of the BS-CCDs as "CCD-NeXT1", whose image area is 24 $\times$ 24 mm and format is 2048 $\times$ 2048 (12 micron) pixels, and N-type CCDs, which are planned thickness of depletion layer to be about 300 micron. The estimated performance of them was obtained used by drive system at Osaka Univertsity. For the first model of "CCD-NeXT1", readout noise was given 11 electrons (r.m.s) and spectral resolution : the full-width at harf-maximun (FWHM) was given 156 eV at 5.9keV (Mn Kα). They are sufficient results at the present time. Next step is to make imaging area large up to 42 $\times$ 42 mm. For N-type CCDs, readout noise and FWHM were given 15 electrons and 255 eV at 5.9keV (Mn Kα). FWHM is lower than BS-CCDs's because of the noise of charge transfer. As previously noted, N-type CCDs shoud has thick depletion layer (about 300 micron) , which is able to measure from countrate of ^{241}Am. the value is under examination. Additionally, charge transfer efficiency (CTE) of N-type CCDs is almost improved at present, about 0.9999995. The development is proceeding smooth.