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In-flight caribration of XRS onbord MUSES-C

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The X-ray fluorescence Spectrometer (XRS) has five CCD chips for the MUSES-C mission. The CCDs have high-energy resolution of 160eV full width half maximum (FWHM) at 5.9keV, when its temperature is under -30 degrees Celsius. The XRS will be used to detect fluorescence X-ray illumination from the asteroid surface and to analyze the major elemental composition such as Mg, Al and Si.

Since a CCD has a complex gate structure, the response function for low-energy range is complex. So we have been made a model formula for the response function by the numerical simulation. In addition, charge traps due to the radiation damage will cause the characteristic changes with the CCD.

During the transfer and return phase, the MUSES-C spacecraft will turn off the ion propulsion thruster and point its high-gain antenna to the earth station for high-rate communication linkage three or four hours every week. Then the XRS will observe X-ray sources such as supernova remnants (SNR) or cosmic X-ray backgrounds (CXB). These have been investigated in detail by observations of many astronomical satellites and will be utilized for the in-flight calibration of the detector. We report the in-flight calibration method and its numerical simulation. All the simulations were based on the best-fit models to the ASCA SIS spectra.

1. X-ray continuum emissions created by synchrotron radiation are coming from the Crab Nebula like SNR. The response spectra, which are expressed as a simple photon power-low, will be used to evaluate the detection efficiency and to measure depth of the depletion layer. 2. X-ray line emissions created by highly ionized atoms are coming from Young SNR like the Kepler. The response spectra will be used to evaluate the response function and to calibrate with the gain and charge transfer inefficiency (CTI). 3. Many of CXBs are considered to be coming from black holes. The soft X-rays became clear with the quasi-stellar object (QSO), which have been investigated in detail by the ASCA and Chandra satellite. The hard X-rays have been regarded as the origin in the active galactic nuclei (AGN). These hard and soft X-ray spectra will be used to evaluate the detection efficiency and response function like the Crab Nebula.