Poster

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Title: Performance Study of Si-CdTe Semiconductor Compton Telescopes with Monte Carlo Simulation

Abstract:
A Compton telescope with high angular resolution and high energy resolution is a promising detector for the next generation mission to observe hard X-rays and gamma-rays. We have been working with a semiconductor Compton camera based on Si and CdTe (Si-CdTe Compton telescope). The Si-CdTe Compton telescope consists of a several 10 layers of high-resolution double-sided silicon strip detectors (DSSD) and cadmium telluride (CdTe) pixel detectors. Their high energy resolution of a few keV (FWHM) allows us to realize an accurate reconstruction of the Compton scattering in the telescope. We have demonstrated that the angular resolution of 3.9 degree at 511 keV, which is close to the theoretical limit due to Doppler broadening effect. In this talk, we will present results of Monte Carlo simulation to study optimum configuration of the Si-CdTe detector. Since precise simulation of the detector accounting proper background environment in an orbit is required to study its performance, we utilize the recent measurement obtained with the Hard X-ray Detector on board the Suzaku satellite. The emphasis will be placed on the sensitivity in the energy region from 60 keV to 300 keV. The configuration of the detector is to stack 24 layers of DSSD with a thickness of 0.5 mm and 4 layers of CdTe pixel detectors with a thickness of 0.5 mm. About ten percent of efficiency, in which incident gamma-ray photons are scattered in the DSSD part and absorbed in the CdTe part, are expected with this configuration after Compton reconstruction. The effects of a well-type BGO active shield is also presented with the expected performance of the polarization measurement.