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All-sky observations by Suzaku wide-band all-sky monitor

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Abstract. All-sky observation in wide energy band is important to study bright gamma-ray sources as well as other transient phenomena such as Gamma-ray Bursts (GRBs). Suzaku Wide-band All-sky Monitor (WAM) enables such all-sky observations up to soft gamma-ray band thanks to its wide energy coverage from 50 keV to 5000 keV with very large effective area of 400 cm^2 even at 1 MeV. During seven year operations, the WAM has successfully detected more than 1000 GRBs, soft gamma repeaters (SGRs) and solar flares. In addition, long term variability of Crab nebula can be monitored with earth occultation technique. WAM also could provide good information of geomagnetically-trapped charged particles with daily monitoring data.

Key words. X-rays: bursts

1. Introduction

There are many non-thermal energetic phenomena in hard X-ray to soft gamma-ray band such as Gamma-ray Bursts (GRBs), soft gamma repeaters (SGRs) and solar flares. Suzaku, Japanese 5th X-ray observatory, has a capability of all-sky observation in such energy band. The hard X-ray detector (HXD) (Takahashi et al. 2007) onboard Suzaku is surrounded by very large 20 $Bi_4Ge_3O_{12}$ (BGO) crystals to serve main detectors as an active shield. In addition, its large geometrical and effective area (400 cm^2 even at 1 MeV) and wide field-of-view ($\sim 2\,\pi$ str) enable to observe

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all-sky covering very wide energy band (50 − 5000 keV) with high photon statistics (Wide-band All-sky Monitor: WAM). The WAM has the largest effective area among other all-sky instruments above 300 keV (Yamaoka et al. 2009). During seven year operations, the WAM has successfully detected more than 1000 GRBs and many SGRs and solar flares. The WAM data is publicly available as well as other Suzaku data. The detector response files for the data that we have issued GCN circular are also putting on the web site.

2. Highlights of seven-years observation by Suzaku-WAM

The WAM data is very useful to investigate the emission mechanism of the transient phenomena and bright gamma-ray sources by making use of its unique characteristics of very large effective area up to soft gamma-ray energy band. As for the GRBs, Krimm et al. (2009) has investigated spectral parameter distribution of GRBs by combination of Swift/BAT data to realize wider energy coverage and found that similar spectral parameter distribution as was reported previous BATSE experiment but the peak energy ($E_{\rm peak}$) distribution shows larger winds at both high and low energy band due to large effective area compared with BATSE. Correlation between total energy and $E_{\rm peak}$ are also examined in this paper and found that short GRBs do not satisfy the same correlation as long GRBs, suggesting different origin between short and long duration GRBs. Such $E_{\rm peak}$ and radiated energy correlation was also studied for time-resolved spectra with WAM high statistics data (Ohno et al. 2009). This study has revealed that time-resolved spectra also follow similar correlation with time-averaged spectrum, but detail property is different between pulse rising and decay phase. Other time-resolved spectral analysis has been done by Tashiro et al. (2011) and found that spectral variation in the decay phase of the bursts can be explained by either cooling of black body radiation or synchrotron emission. These time-resolved analyses give information or constrain on the emission region and emission mechanism of GRBs.

More than 260 bursts from AXP 1E1547.0-5408 have been observed on January 2009. The WAM successfully detected the emission up to MeV energy band from one of those bursts. This result could give a constraint on the emission region of SGRs. As for the solar flare, the WAM detected hard X-rays from some solar-microflares. Joint analysis with RHESSI shows that same spectral component is extended up to hard X-ray band. (Ishikawa et al. 2012). The WAM continues to monitor Crab nebula for more than six years by earth occultation technique and confirmed the trend of the flux decay in hard X-ray band (300−800 keV) around 2008 to 2010. Similar trend has also reported by the Fermi/GBM (Colleen et al. 2011). The WAM always monitor the particle background both from the space and the earth. The six-years data of the WAM indicates that trapped particles around southern Africa might extent than that of estimated by standard particle models. Such study could be also useful for such particle background model.

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