

論文 / 著書情報
Article / Book Information

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著者(和文)	薄井 竜一
Author(English)	Ryuichi Usui
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論文要旨

THESIS SUMMARY

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学生氏名 : Student's Name	薄井 竜一		指導教員 (主) : Academic Advisor(main)	河合 誠之
			指導教員 (副) : Academic Advisor(sub)	陣内 修

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

We present the systematic search of short X-ray transients for the 1327-day data obtained with MAXI (Monitor of All-sky X-ray Image). Short X-ray transients have been detected by past X-ray/gamma-ray satellites in large-sky surveys, and their temporal, spectral and spatial characteristics have been studied. They include Gamma-Ray Bursts (GRBs), X-ray bursts from neutron-star binaries, X-ray flares of active stars and X-ray short activities of blazars. In addition shock breakouts of supernovae and tidal disruption events at the center of a nearby galaxy have been also reported recently. Discovery of new class of transients should also benefit astrophysics. To perform the search we used the data obtained by the Gas Slit Camera (GSC) of MAXI, an X-ray detector that monitors almost the whole sky with the arc-like field of view every 92-min orbital period of the International space station. While the search of transients using the GSC data has been already performed in the past, its method required detailed modeling of the instrument and the background, and the propagation of errors and the evaluation of significance were not trivial. In addition, the used data covered only the first 15-month of operation. Thus, we newly develop a simple and versatile analysis program, and conducted the search for short X-ray transients from the MAXI-GSC data obtained since October 2009 until May 2013.

The search consists of two main processes; global search and localization. First we prepare a dataset which excludes data from the galactic plane and the vicinity of 30 bright X-ray sources in order to prevent false detections. Next, as the global search, we extracted candidate transient events which have significant excess X-ray counts over the background assuming the Poisson statistics. Third, the localization process determines the accurate position, X-ray flux and refined detection significance of these candidates. The significance is evaluated by the probability for the observed excess assuming the null hypothesis that it is consistent with the background, which is sampled in the regions surrounding the candidate in the time-vs-detector coordinate plane. Since these excesses include false detections originating from X-rays of solar flares and increasing of background, we carefully removed them and finally obtained 146 short X-ray transient with sufficiently high significance.

First we performed cross matching of the detected short X-ray transients with the reported GRBs and some optical/X-ray/gamma-ray source catalogs. This study resulted in associations with 11 prompt emissions of GRBs, one GRB's afterglow, several X-ray bursts from neutron-star X-ray binaries, and flares of active stars. On the other hand, we cannot find significant associations with active galactic nuclei partly because the localization error is not so small considering the source density on the sky.

In addition we studied spectral characteristics and investigate positional and spatial distributions of the detected short X-ray transients. Their hardness ratio of 8-20 keV to 2-8 keV energy bands is larger on average than those of stellar flares, and comparable to those of X-ray bursts and prompt emission of GRBs. The dipole and quadruple moment of the transients imply their positional distribution is isotropic, which is consistent with the expectation of the previous studies. However, V/V_{\max} test reveals that the spatial distribution is not consistent with a uniform distribution in space. This distribution indicates the detected transients include too many faint events near thresholds. In addition, the log N-log S plot shows excess of the faint transients, and is also inconsistent with the uniform spatial distribution. The excess of short X-ray transients at large distance implies a distribution astrophysically implausible.

To investigate possible origins of such false detections, we examined their correlations with the detected time, detector coordinate and detected position on earth. However, we found no significant dependence on them, meaning that solar flares or variation of charged particles at high latitudes and around the South Atlantic anomaly is not responsible for the false detections. The variations of anti-coincident signal count are confirmed not to significantly affect the false detections except for one case. We found, however, one anomaly. One of the GSC (camera 7) had significantly larger number of detections than another (Camera 1) while these two cameras share the same field of view. This indicates that one of the origins of false detections is intrinsic to the camera, probably noise in the detector or readout electronics.

備考 : 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).