The MAXI/GSC catalog in the low Galactic-latitude sky

Takafumi Hori,[1] Yoshihiro Ueda,[1] Megumi Shidatsu,[2]
Taiki Kawamuro,[1] Atsushi Tanimoto,[1] Saeko Oda,[1] and the MAXI team

[1] Department of Astronomy, Kyoto University, Oiwake-cho, Sakyo-ku, Kyoto 606-8502, Japan
[2] MAXI team, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan
E-mail(TH): hori@kusastro.kyoto-u.ac.jp

Abstract

Complete X-ray source catalogs in our Galaxy are the basis to study the demography of Galactic X-ray populations. Since MAXI/Gas Slit Camera (GSC) covers the 2–10 keV band with the highest sensitivity as an all-sky mission, its Galactic source catalog will be complementary to those of hard X-ray (>10 keV) missions. Here we present the latest X-ray source catalog of MAXI/GSC in the low Galactic-latitude sky ($|b| < 10°$). We utilize the same image fitting method as that in Hiroi et al. (2013), who constructed the 37-month MAXI/GSC catalog at high Galactic latitudes ($|b| > 10°$). To overcome source confusion in crowded regions, we have accurately calibrated the position-dependent shape of the point spread function of MAXI/ GSC by utilizing the onboard data. We also take into account the Galactic ridge X-ray emission in the background, utilizing the model by Revnivtsev et al. (2006). With a preliminary analysis, we detect 149 sources with significance above 8σ, among which about 71% have counterparts in the Swift/BAT 70-month catalog.

Key words: workshop: surveys — X-rays: catalog

1. Introduction

MAXI/Gas Slit Camera (GSC) has achieved the best sensitivity in the energy band of $2 - 10$ keV among all past or on-going all-sky X-ray missions. All-sky X-ray source catalogs of MAXI/GSC are complementary to other ones covering different energy bands, such as those of *ROSAT* (< 2 keV), *Swift* (> 14 keV), and *INTEGRAL* (> 15 keV). The 37 month MAXI/GSC catalog in the high Galactic-latitude sky ($|b| > 10°$) is published by Hiroi et al. (2013). At low Galactic latitudes, source confusion becomes more significant because the Galactic plane is crowded by bright X-ray sources. Also, we need to take into account the the Galactic ridge X-ray emissions (GRXEs) in modeling the background. In this paper, we report the current results of the MAXI/GSC catalog in the low Galactic-latitude sky.

2. Data Reduction and Analysis

We utilize the first 37-month MAXI/GSC data observed from 2009 September 23 to 2012 October 15. The Galactic center region ($l < 30°$, $330° < l$, and $|b| < 5°$) is excluded, where source confusion is too serious. Data reduction is performed with the same procedures described in Hiroi et al. (2013). We use our latest model of the non X-ray background (NXB) plus the cosmic X-ray background (CXB), which is detailed in Shidatsu et al. (2017, this conference).

In addition to the NXB and CXB, we consider the GRXE, whose surface density rapidly increases toward the Galactic plane ($b = 0$). We model the GRXE profile with the ellipsoid model by Revnivtsev et al. (2006), which consists of the Galactic disk and bulge/bar components.

3. Current Results

To determine the significance and flux of each X-ray source, we perform Poisson maximum-likelihood fit to the observed image with a model consisting of source point spread functions (PSFs) and the background (NXB+CXB+GRXE). We first only consider the sources of the Swift/BAT 70-month catalog by fixing their positions. Then, from the residual image, we search for sources detected only with MAXI/GSC.

As a result, we detect 149 sources with significance above 8 σ at $|b| < 10°$, among which 107 (71%) are in the Swift/BAT 70-month catalog. The number of sources in each category is summarized in Table 1. Figure 1 shows the locations of the detected sources in Galactic coordinates, including the high Galactic-latitude sources in Hiroi et al. (2013). Figure 2 shows the log N-log

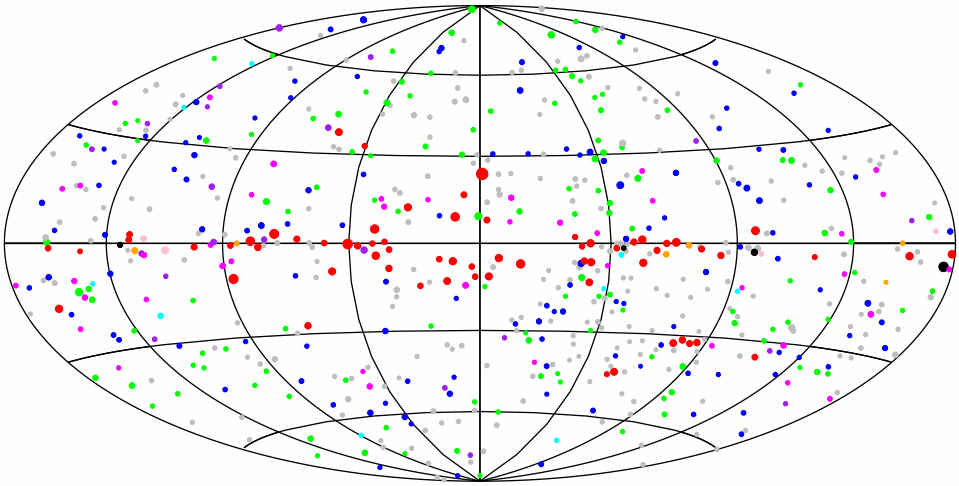

Fig. 1. The locations of all MAXI sources in Galactic coordinates, including those of Hiroi et al. (2013) obtained from the 37 month data at high Galactic latitudes. Each radius is proportional to the logarithm of the flux. The Different colors correspond to different types; galaxies (cyan), galaxy clusters (green), Seyfert galaxies (blue), quasars (purple), cataclysmic variables (purple), stars (orange), X-ray binaries (red), pulsars (black), supernova remnants (pink) and X-ray sources without counterpart in Swift/BAT 70-month catalog (Gray).

Table 1. Categories of Cataloged Sources

Category	Number of Sources
Galaxies	1
Galaxy clusters	11
Seyfert galaxies	19
Quasars	6
Cataclysmic variables	11
Stars	6
X-ray binaries	45
(Neutron star)	(25)
(Black Hole)	(6)
Pulsars	4
Supernova remnants	4
Unmatched	42

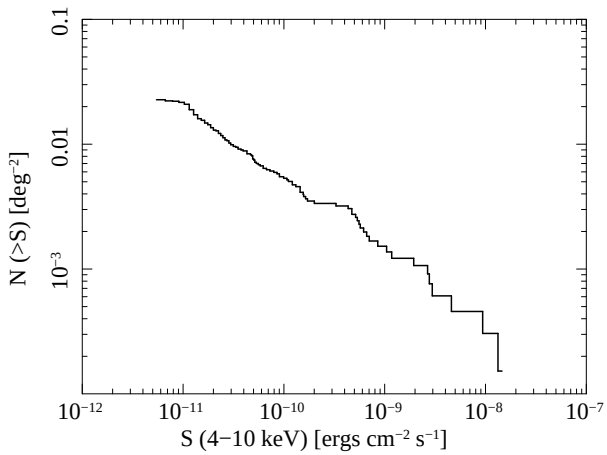

Fig. 2. The log N–log S relationof the MAXI/GSC sources in the Galactic plane region.

S relation in the low Galactic-latitude ($|b| < 10°$) sky outside the Galactic center region, where the number density N of all sources with 4–10 keV fluxes above S is plotted. The slope is close to unity.

4. Future Work

We are working to produce a MAXI/GSC low Galactic-latitude catalog utilizing the 7-year data (Hori et al. 2017, in preparation), which will update the results presented here. To overcome the difficulties in detecting faint objects around bright sources, we must model the PSFs as accurately as possible. We are re-calibrating the PSF profiles by referring to the onboard data in detail. This new PSF database will be utilized for all future works of catalog production (including that at high Galactic-latitudes) and light curve extraction from MAXI/GSC data.

References

Revnivtsev et al. 2006, A&A, 452, 169
Hiroi et al. 2013, ApJS, 207, 36