The First MAXI/GSC Catalog in the High-Galactic-Latitude Sky

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We present the first source catalog of the Monitor of All-sky X-ray Image (MAXI) mission at high Galactic latitudes ($|b| > 10$ deg), produced from the first 7 months data (2009 September 1 to 2010 March 31) of the Gas Slit Camera (GSC) in the 4-10 keV band. We develop a systematic analysis procedure to detect faint sources from the MAXI data, by utilizing maximum likelihood image fitting method, where the image response, background, and detailed observational condition are taken into account. Our catalog consists of 143 X-ray sources above 7 sigma significance level down to a limiting sensitivity of 1.5×10^{-11} ergs cm^{-2} s^{-1} (1.2 mCrab). From cross-correlation with other catalogs, we identify 38 Galactic/LMC/SMC objects, 47 galaxy clusters, 39 Seyfert galaxies, and 12 blazars. The source counts of extragalactic objects are in good agreement with the HEAO-1 A-2 results.

1. INTRODUCTION

What is MAXI/GSC?

- An all-sky X-ray monitor on the ISS (Fig. 1)
- Observing nearly the whole sky every 92 min.
- Covering 2-30 keV band
- Expected to achieve so far the best sensitivity in the 2-10 keV as an all-sky monitor (Fig. 2)

Fig. 1 MAXI on the ISS.

Swift/BAT (14-195 keV) 2004~

HEAO-1 A-2 (2–10 keV) 1977~1979
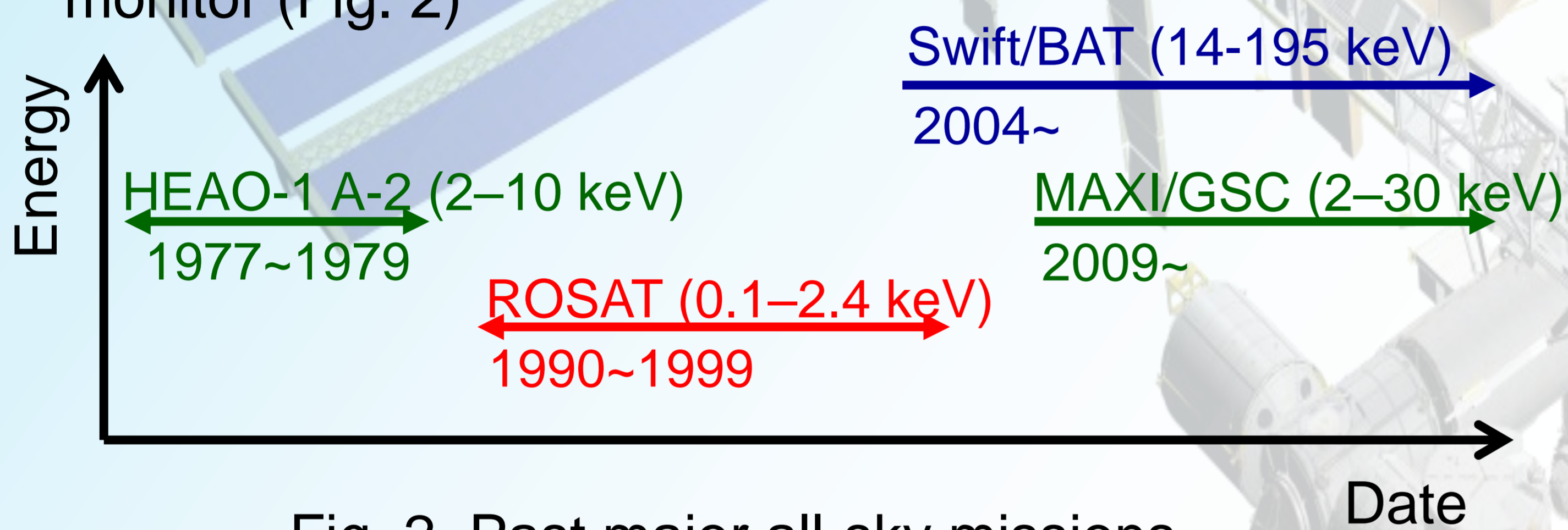
MAXI/GSC (2–30 keV) 2009~

ROSAT (0.1–2.4 keV) 1990~1999

Fig. 2 Past major all-sky missions

2. ANALYSIS

Analysis is made for the projected images in the sky coordinates with a region size of 14 deg x 14 deg (top panel of Fig. 3).

STEP1: Searching source candidates

- making a simulated background model
- smoothing the real data and background data images
- creating a significance map (middle panel of Fig. 3)
  significance = "(real - background)/sqrt(real)"
- picking up signals above 4 sigma
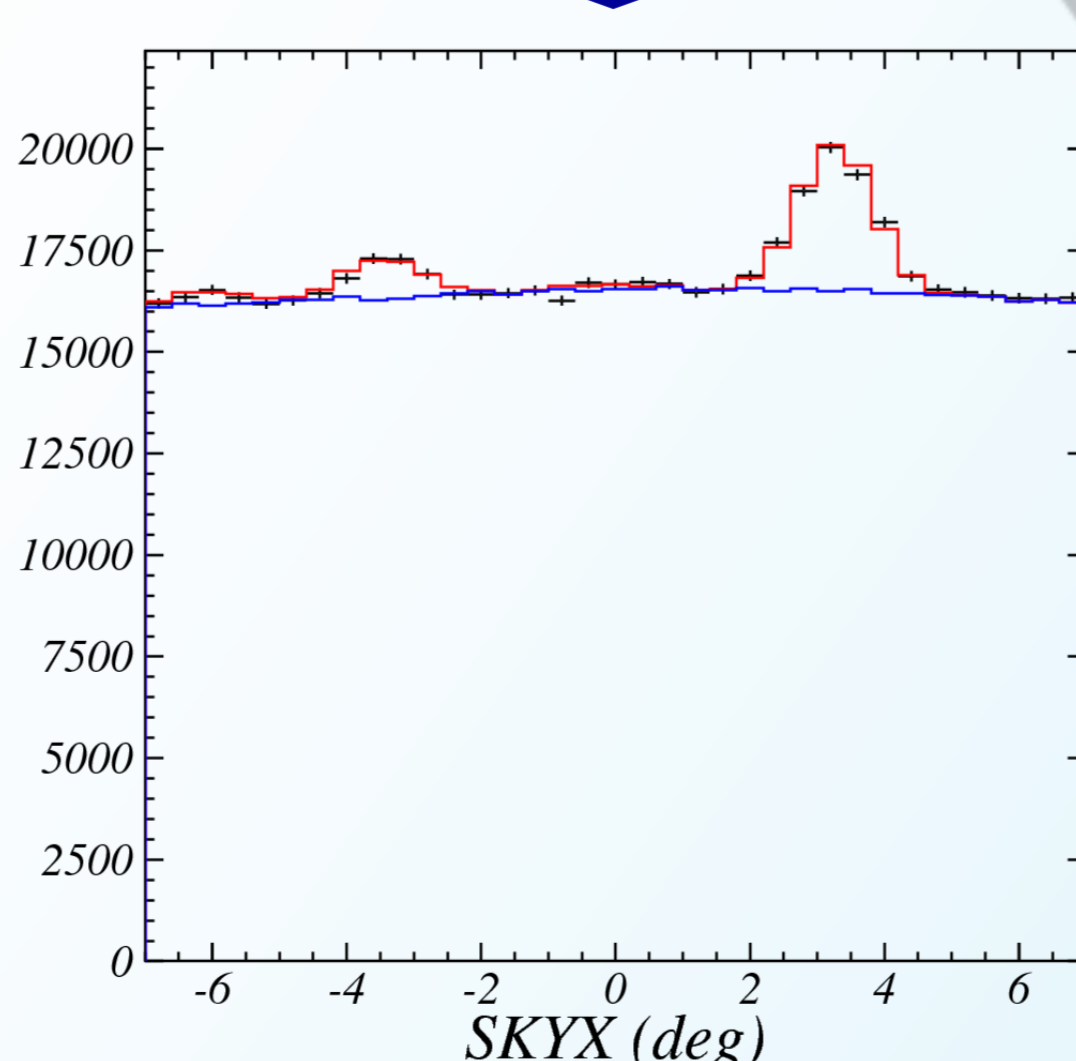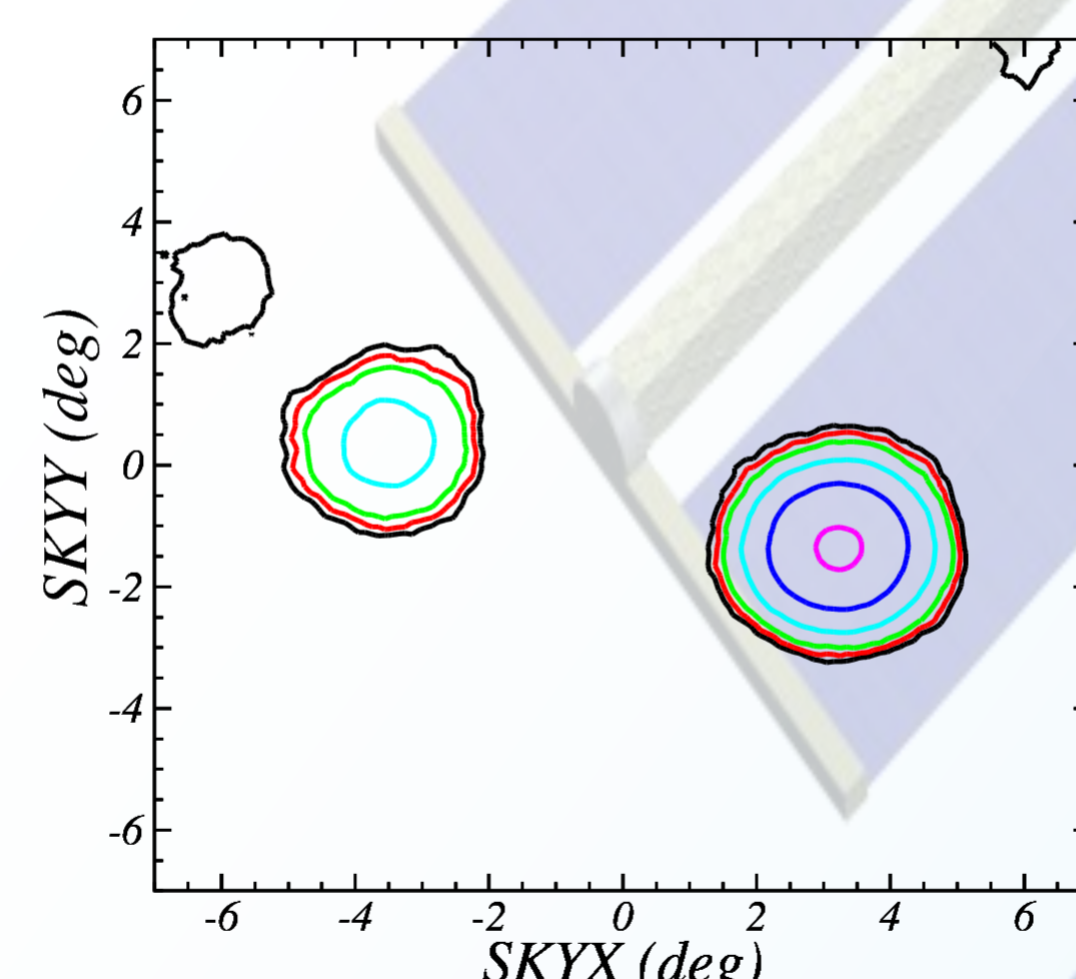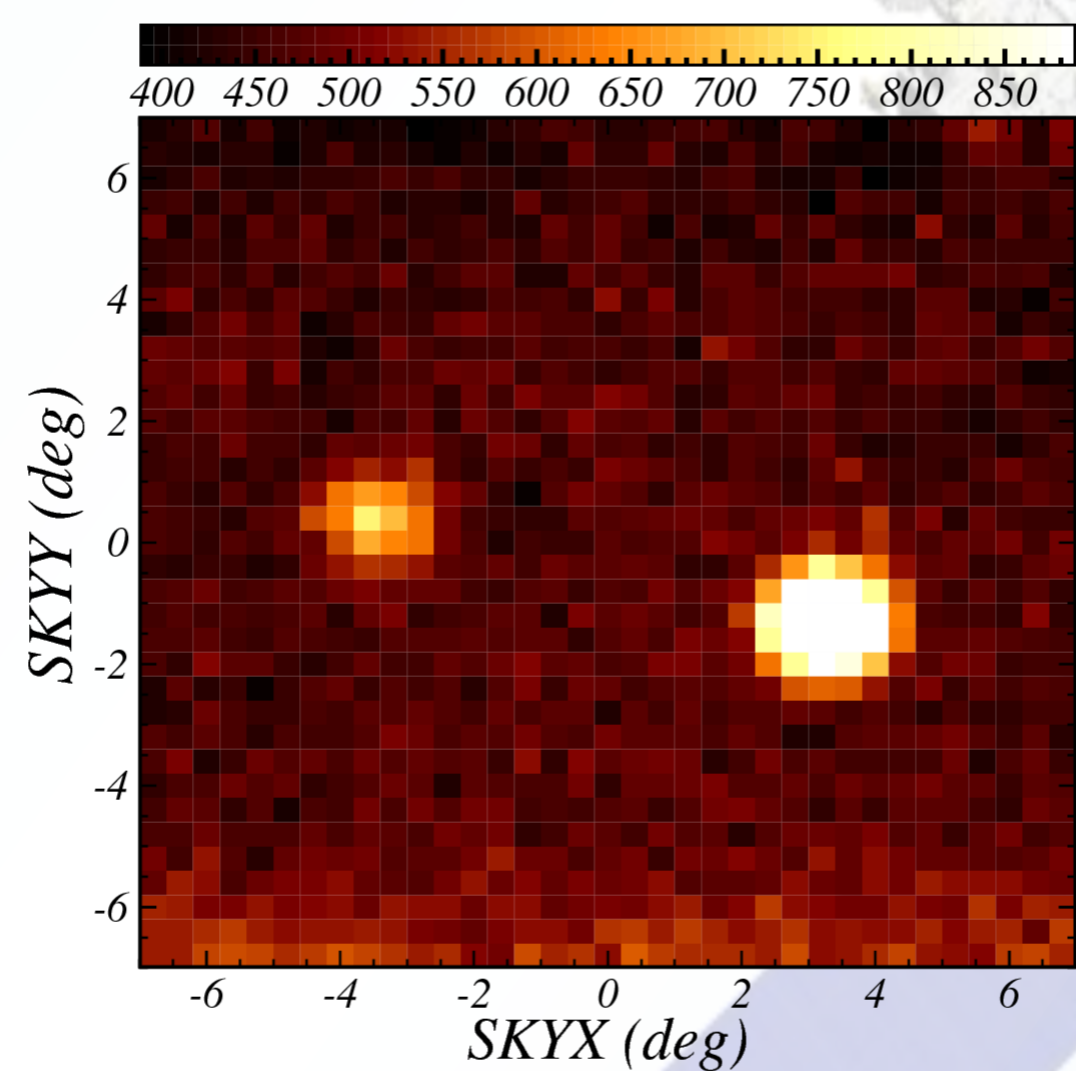
STEP2: Determining flux and position

- performing an image fitting (bottom panel of Fig. 3)
- models:
  - point spread functions (PSFs)
  - background
- defining detection significance (s_D) as below, and adopt $s_D > 7$ as the detection criterion
  detection significance (s_D) = (best-fit flux)/(its 1σ statistical error)

Fig. 3 An example of real data image (top), its significance map (middle), and Its projection onto the SKYX-axis with the best-fit model (bottom).
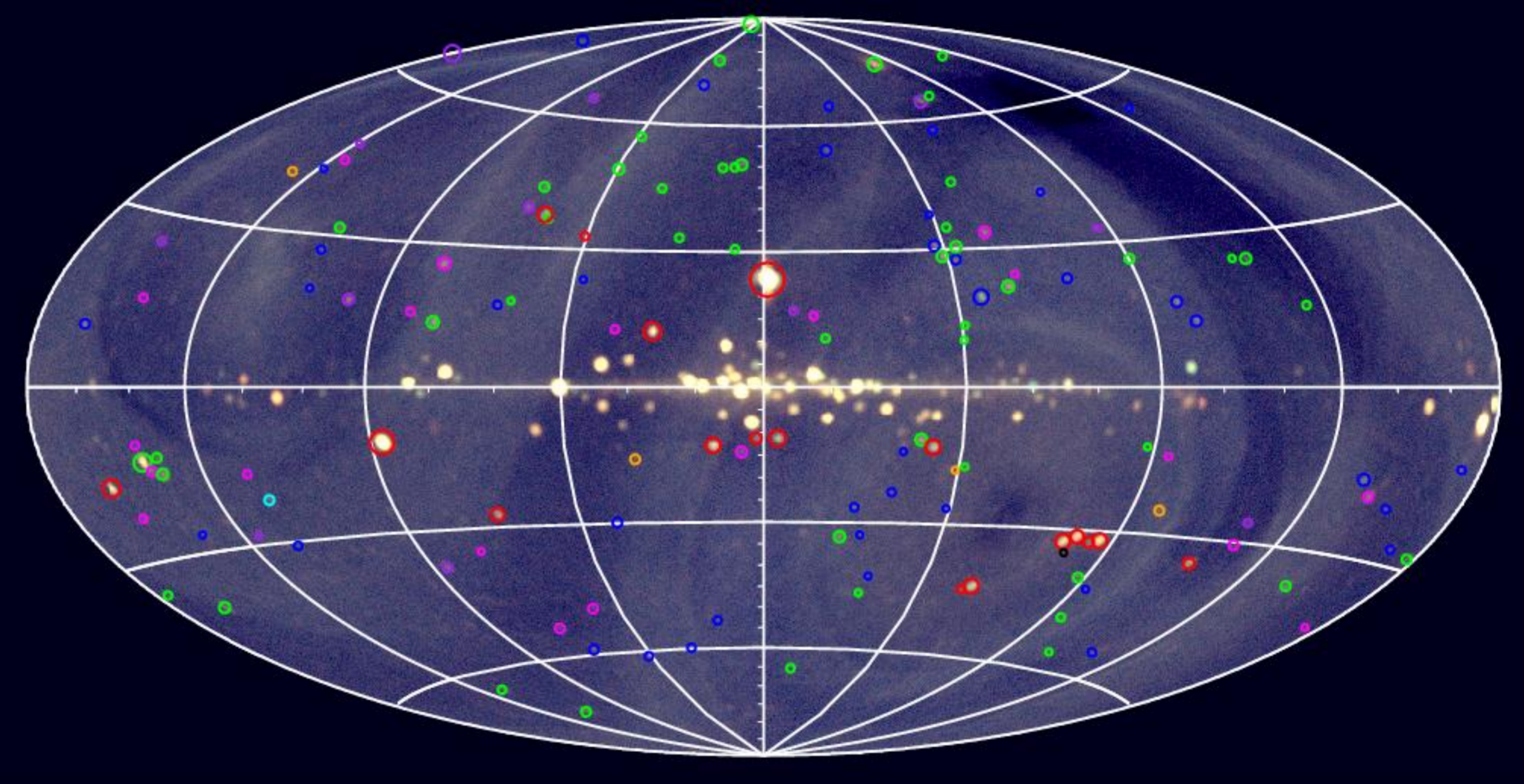
3. RESULT

Fig. 4 Locations of cataloged sources with $s_D > 7$ in the Galactic coordinates.

Total: **143** sources

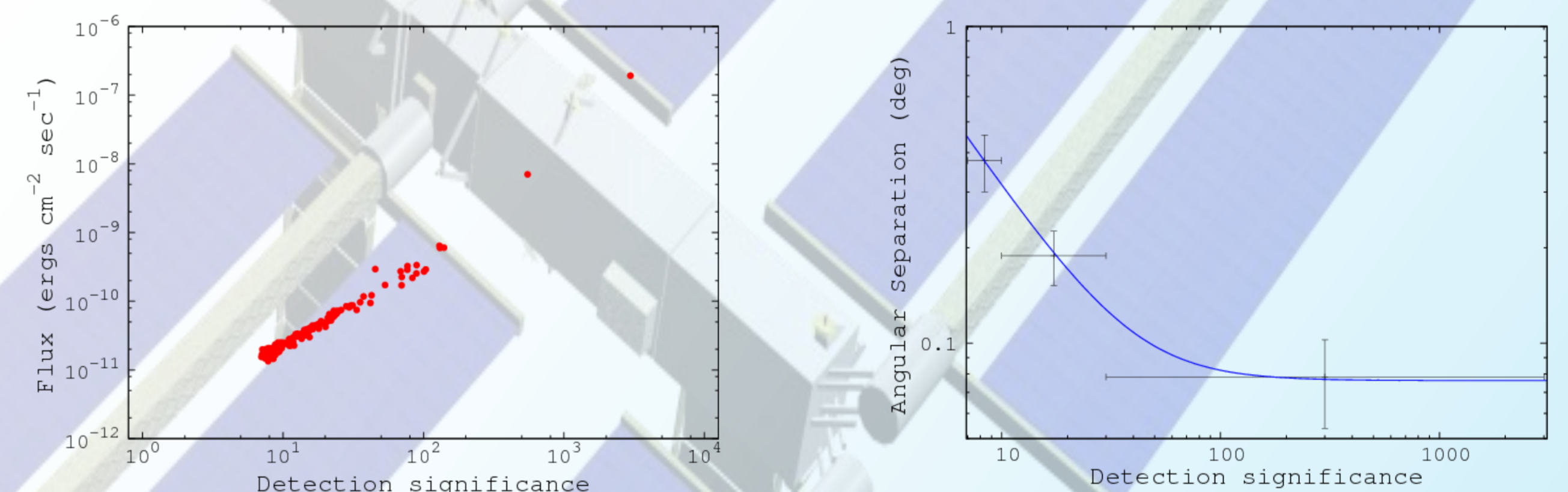|	
○ unidentified: 1	○ galaxies: 1
○ galaxy clusters: 48	○ Seyfert galaxies: 39
○ blazars: 12	○ CVs/stars: 20
○ X-ray binaries: 18	○ confused: 4

Fig. 5 Estimated flux (left) and 90% error radius (right) of cataloged sources plotted as a function of detection significance s_D.

limiting sensitivity: ~1.5×10^{-11} ergs cm^{-2} s^{-1} (4-10 keV)

4. DISCUSSION

Our result is in good agreement with the HEAO-1 A-2 results by Piccinotti et al. (1982).

Tab. 1 Comparison of source populations at $|b| > 20$ deg

	Galactic	AGN	GCluster
MAXI	21	40	36
HEAO-1	17	29	30

$s_D > 7$

total sources

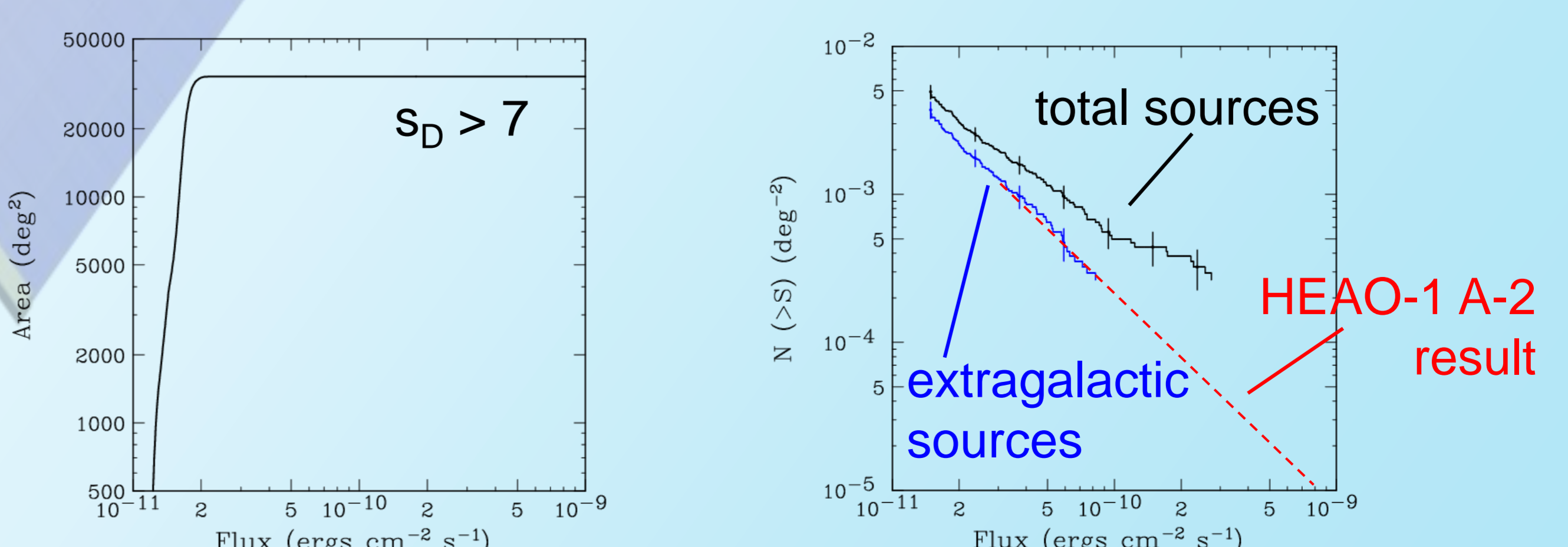extragalactic sources

HEAO-1 A-2 result

Fig. 6 Area curve (left) and log N – log S relations (right) of the 7-months MAXI/GSC survey in the 4-10 keV band at $|b| > 10$ deg