An extended galactic plane survey of the third quadrant ($180° < l < 280°$)

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The ROSAT PSPC with its large field of view and its angular resolution is well suited to pursue flux-limited surveys. However, most of the surveys already performed have been limited only to the inner central region of the PSPC field of view, where it has better characteristics in terms of angular resolution and sensitivity, and also because of the difficulties in properly performing source detection in the outer region of the PSPC field of view where most of the available area lies. Damiani et al. (1997a,b) have recently developed an innovative source detection algorithm based on wavelet transforms that, incorporating for the first time detector exposure maps in the source searching technique, allows us to detect sources, determining their *intensity and extension* and to assess the limiting sensitivity across the *entire* PSPC field of view. Extensive simulations have allowed to determine the expected number of spurious sources as a function of source acceptance threshold probability, as well as source detection efficiency as a function of PSPC off-axis angle. Taking advantage of this detection algorithm as well as of the approach developed to evaluate Log N – Log S values from the derived source list, rates, image sensitivity maps and detection efficiency (Damiani, Sciortino & Micela 1997, this volume) we have undertaken an *Extended Survey of the Third Quadrant of the Galactic Plane.*

Our survey is based on the same set of 9 moderately deep PSPC pointed images whose central regions were previously analyzed by Morley et al. (1995, 1997, hereafter *TQGPS*). We have analyzed the fields in the Soft (0.2-0.41 keV), Hard (0.41-2.01 keV) and Broad (0.2-2.10 keV) bandpasses separately and have detected 49 Soft, 225 Hard and 193 Broad sources above the source significance threshold of 4.7σ in the entire PSPC field, corresponding to no more than 0.33 spurious sources in each PSPC field, i.e. less than 3 spurious sources for each band in the survey area of ~ 24.5 deg^2. By analyzing the outer part of the PSPC images, i.e. by increasing by almost a dex the surveyed area, we have increased by almost a factor 3 the number of sources with respect to those found in the *TQGPS*. Most of the added area contributes with sources in the 0.005-0.02 cnt/sec range, a factor 2-3 below the typical RASS limiting rate on the Galactic plane. Considering only the central 35 arcmin radius region, where the angular resolution still remains reasonably good, the surveyed area is increased by a factor 4 with respect to the *TQGPS* and the number of sources is increased by a factor 1.6. Most of the Broad band sources have also been detected in the other bands.

Since most of the new sources have rates higher than those reported in the *TQGPS*, our derived Log N – Log S is better defined for rates higher than 0.002 cnt/sec (i.e. below the limiting rate chosen in the *TQGPS*), but we can also extend the Log N – Log S, at least a factor 2, below this limiting sensitivity. We confirm that the shape of the Log N – Log S is consistent with $N(>S) = N_\circ (S/S_\circ)^\alpha$, with $\alpha \sim 1.5$, and a source density of $N_\circ \sim 77$ sources/sq.deg at $S_\circ = 0.001$ cnt/sec found in the *TQGPS*. Since we are looking into the galactic plane the contribution of extra-galactic sources to the overall source population is predicted to be below 6%. Hence most of the sources are bound to be nearby (d < 500 pc), most of them are likely associated with very young stars just arrived or about to arrive on the ZAMS (cf. Sciortino et al. 1995, Favata et al. 1997; Guillout et al. 1997).

We have searched X-ray sources detected within the central 35' radius for possible counterparts, looking for positional matches with objects listed in a catalog of more than 1.5 10^6 objects we have assembled for our ongoing studies of ROSAT images. We have found that 2 out of the 17 Soft sources, 7 out of the 125 Broad sources and 9 out of 150 Hard sources have a catalogued object within 35" (chosen to minimize the number of spurious identifications) from their X-ray position.

Moreover, we found that 10 Soft, 63 Broad and 86 Hard sources have at least one GSC star falling within 35" from the respective X-ray position. For most of the counterparts we have limited optical information and we have started an optical follow-up campaign to assess their nature. As a first step we have obtained multi-band CCD photometry of the central 40' radius region of each of the 9 PSPC fields. We plan to continue our identification effort with a campaign of optical spectroscopic measurements.

References

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