

The Palermo Swift-BAT Hard X-ray Catalogue: Results after 54 months of sky survey

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Abstract. We present the 2nd Palermo *Swift*-BAT Catalogue, obtained using 54 months of BAT survey data. The catalog contains 1258 BAT source candidates, of which 1049 have been associated with a known counterpart.

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INTRODUCTION

The *Swift*-Burst Alert Telescope (BAT) is mainly devoted to the monitoring of a large fraction of the sky (50%-80% per day) for the occurrence of Gamma Ray Bursts, providing the opportunity for a substantial gain of our knowledge of the sky in the hard X-ray domain. From the analysis of the first 39 months of BAT survey data we produced, using a dedicated software [1], the 1st Palermo *Swift*-BAT hard X-ray catalogue [2], that contains a list of 754 identified hard X-ray sources. Here we present the Second Palermo *Swift*-BAT hard X-ray catalogue (<http://bat.ifc.inaf.it>), obtained from the analysis of the data relative to the first 54 months of the *Swift* mission.

THE 54 MONTHS CATALOGUE

We created all-sky maps in three energy bands: 14–150 keV, 14–70 keV, 14–30 keV and performed a blind search with a detection threshold of 4.8σ . After merging the three detection lists we obtain a final number of 1258 detections. In order to identify them, we have applied two different strategies.

1. Search for bright sources in the *Swift*-XRT archival observations covering the sky position of the BAT source candidates. A source detected inside a $6.0'$ error circle was associated with the BAT excess if its count rate was above 8×10^{-3} c/s. In the few

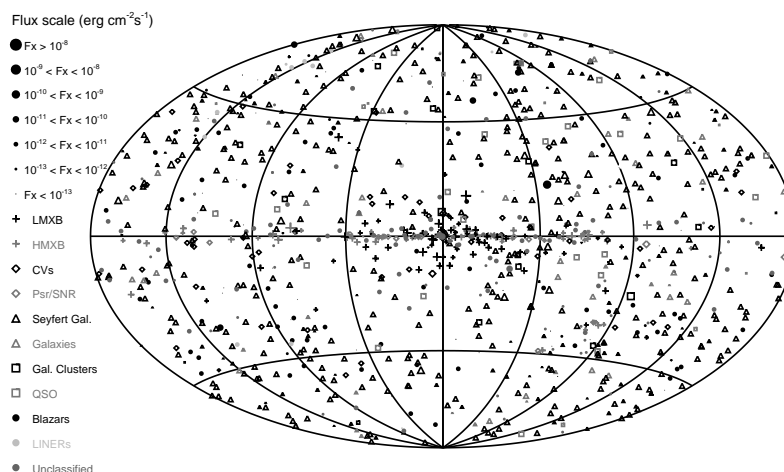


FIGURE 1. Distribution of the 1049 sources of the Second Palermo Swift-BAT catalogue, coded according to the object class, with the size of the symbol proportional to the 14-150 keV flux

cases where more than one source was within the BAT error circle, we selected the hardest one. A similar method with appropriate count rate thresholds was applied to field observations of Chandra, XMM-Newton, SAX, ASCA and Rosat. With this strategy we identify 915 sources with $\lesssim 1\%$ of expected spurious associations

2. Cross-correlation of the remaining excesses (343) with selected SIMBAD catalogues (Cataclysmic Variables, High mass X-ray binaries, Low mass X-ray binaries, pulsars and Supernova remnants, Seyfert galaxies, Clusters of galaxies, QSOs), with the BZCat [3] and with the ROSAT Bright and Faint sources catalogues [4]. To validate the association we require a distance between the catalogue source and the BAT excess lower than $4.2'$ (except for the QSOs and ROSAT Faint catalogue sources, for which we restricted the distance to $2'$). With this strategy we identify 134 sources with $\sim 5\%$ of expected spurious associations.

The final catalogue contains 1049 sources with an associated counterpart (Fig. 1). and includes 62.5% extragalactic objects, 22.5% Galactic objects, 15% known X-ray emitters whose nature has not been determined yet.

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