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The eROSITA source detection pipeline and all-sky survey simulations

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Abstract

We present simulations of the eROSITA all-sky survey and first results of the eROSITA SASS source detection pipeline. The simulations are based on hydrodynamical simulations of cluster X-ray emission and a standard AGN logN-logS to simulate point sources (see also poster by H. Brunner et al.). The X-ray sky images were folded with the eROSITA survey PSF and randomized. Simulations with an exposure of 2 ksec represent typical all-sky survey fields. The deeper survey regions near the ecliptical poles are represented by simulations with 20 ksec exposure.

The eROSITA source detection pipeline

Several source detection algorithms are currently being developed or tested for use in the eROSITA pipeline:

1) Bayesian background-source separation (see poster by F. Guglielmetti).

2) A pipeline consisting of box detection, background fitting, and PSF fitting as used by the XMM-Newton SAS (this poster).

3) Wavelet deconvolution and detection.

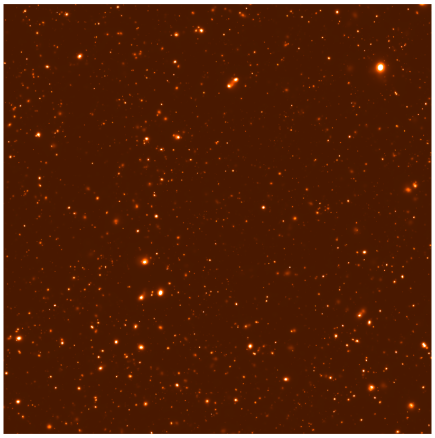

Fig. 1: X-ray emission in 3.6x3.6 deg FOV of hydrodynamical large scale structure simulation.

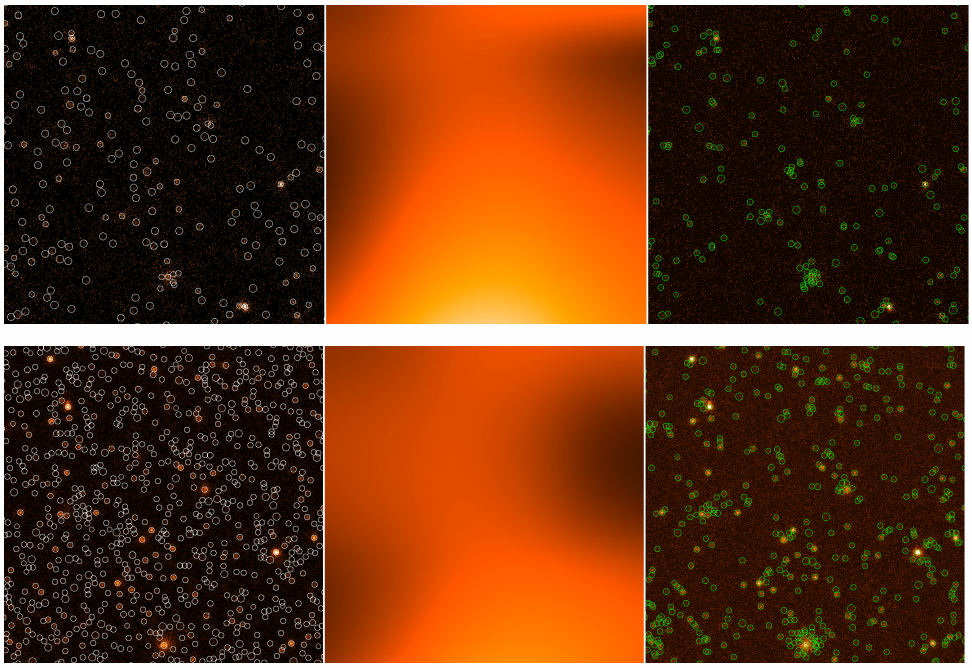

Fig. 2: Sliding box detection runs on 2 ksec simulations (top) and 20 ksec simulations (bottom). Each image is 45' x 45' wide.
Left: X-ray images with source positions of local box detection run (SASS task ERBOX).
Center: Background map created by removing local box detect sources and fitting a 2 dimensional spline to the remaining image areas (task ERBACKMAP).
Right: 2nd stage (map detect) source list overlaid on X-ray images. The second stage of ERBOX makes use of the maps created by ERBACKMAP.

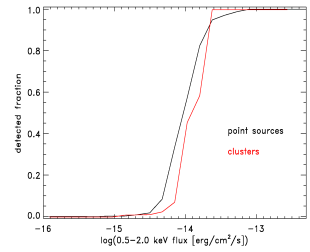

Fig. 3: Detected fraction of point sources in 2 ksec simulation after the box detection stage as a function of input flux in the 0.5-2.0 keV band. The solid black curve represents point source detections, the red curve extended sources. The point source detection limit (50% probability) is reached at 10^{-14} erg/(cm^{2}s).

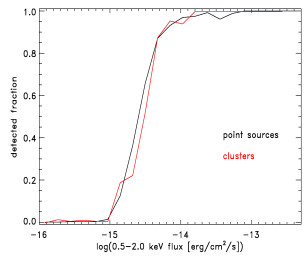

Fig. 4: Same as Fig 3 for 20 ksec. The point source flux limit is 2.5 x 10^{-15} erg/(cm^{2}s). For both exposure times the detection limits for cluster sources are only slighter higher than for point sources