# ROSAC: Studying the clustering properties of X-ray selected AGNs

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**Abstract.** We present the first ROSAC results of an AGN clustering analysis. This study comprises a sample of 200 AGNs, 75% of which being at low redshifts z<0.5, in the Ursa Major constellation. The spatial 2-point-correlation function (SCF) as well as the minimal spanning tree (MST) technique were applied. Some evidence for clustering is found in the SCF, although with low significance. Using the MST technique, we could find two AGN groups. This result is preliminary and the exact significance will be tested with careful simulations.

## 1 ROSAC: A ROSAT based Search for AGN Clusters

The ROSAT All-Sky Survey (RASS) provides an excellent opportunity to study AGNs at low-redshifts. For the identification of RASS sources, objective prism and direct plates from the Hamburg Quasar Survey were used, giving a list of AGN candidates. The AGN nature of these candidates has to be confirmed by follow-up spectroscopy. Our confirmation rate for AGN candidates is $\approx 95\%$, which makes this identification strategy powerful for creating AGN samples.

The ROSAC project makes use of this work to study the spatial properties of low-redshift AGNs. In particular the search for clusters or groups of AGNs and the determination of the 2-point-correlation function come to the fore. Three regions in the constellations Ursa Major (UMa), Coma Berenices, and Pisces were selected due to a) low hydrogen column densities, b) large numbers of known redshifts to reduce the observing time, and c) the presence of interesting structures found in a first minimal spanning tree analyses. The most advanced 'subsample' today is that in UMa with a completeness of 87%. This region covers an area of 363 deg$^2$ and consists of 200 confirmed AGNs. A first clustering investigation within the

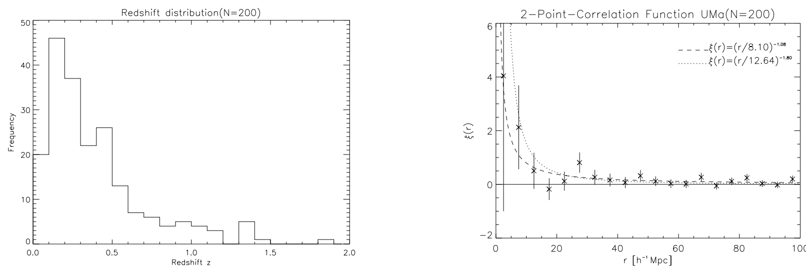


Figure 1: Redshift distribution and 2-point-correlation function $\xi(r) = (\frac{r}{r_0})^{-\gamma}$: $\chi^2$-fits with $r_0$ as free parameter (dotted line) and with two free parameters (dashed line) are shown. The error bars are poissonian.

scope of the ROSAC project is restricted to UMa (Fig. 1).

## 2 Clustering Analyses

The 2-point-correlation function $\xi(r) = \frac{N_{AGN}}{N_{Random}} - 1$ was applied. Clustering properties of AGNs in the low redshift regime are uncertain. Only a few investigations of small samples and with lower surface densities than the ones of the ROSAC project have been conducted so far. Specifically, the two studies of X-ray selected AGNs (Boyle & Mo 1993, Carrera et al. 1998) did not show clustering on small scales.

The results of our investigation are outlined in Fig 1. A power law $\xi(r) = (\frac{r}{r_0})^{-\gamma}$ was fitted to the data. The correlation length gives $r_0 = 8.1^{+2.7}_{-3.9}$ and $\gamma = 1.08^{+0.45}_{-0.23}$, which is consistent with the favoured value of $r_0 = 6.0$ for AGNs.

Additionally, a search for groups of AGNs was carried out using the minimal spanning tree (MST) technique. Earlier studies could find 18 groups of AGNs in total. All of these groups were confirmed by the MST technique. We could detect two further AGN groups comprising 21 and 14 members at mean redshifts of 0.081 and 0.222. Further work is necessary to quantify the exact significance of these results.

## 3 Future prospects

The final ROSAC project will result in a sample of about 700 AGNs with surface densities between 0.3 and 0.5 AGNs/deg$^2$ at redshifts z<0.5. Consequently, the incorporation of the two other regions, which means 500 objects additionally, would provide a much better sample to study AGN clustering.