THE HAMBURG IDENTIFICATION PROGRAM OF ROSAT ALL-SKY SURVEY SOURCES

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1. Introduction

The ROSAT All Sky Survey (RASS), performed between July 1990 and February 1991, provided about 60,000 X-ray sources in a soft X-ray band (0.1–2.4 keV) with a flux limit of approximately 5×10^{-13} ergs cm^{-2} s^{-1} for exposure times of 400 sec (a typical value in low ecliptic latitudes). A wealth of information can be extracted from the RASS source content and many objects deserve (or have already deserved) extensive follow-up studies. However, this possibility is limited by the fact that the nature of most of the RASS sources is unknown *i.e.*, they are unclassified. A correlation with the SIMBAD data base yields only identifications for about one third of the RASS sources.

2. Optical Identification Program

Since 1991 we use objective prism and direct plates taken by the Hamburg Schmidt telescope located on Calar Alto (Spain) to classify the different object classes in the RASS. The plates were taken in order to conduct an optically based search for AGN. The KODAK IIIa-J emulsion was used which gives high sensitivity from 5400 Å down to the atmospheric cut off at 3400 Å. The unusual continuum in comparison to stars in this wavelength range and strong emission lines enable the classification of AGN. With a typical ratio of $\log(f_X/f_B) = 0.55$ (Bade *et al.*, 1995) AGN down to 6 $\times 10^{-13}$ ergs cm^{-2} s^{-1} at the plate limit of B $\approx$ 18.5 are reachable. Because this value is near the RASS limit, principally all typical AGN can be identi-

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fied on our prism plates. But this value also implies that AGN with higher $\log(f_X/f_B)$ are below the plate limit.

Follow-up observations have shown that the success rate of the AGN classifications is above 95%. Besides AGN, several galactic X-ray sources (cataclysmic variables, M dwarfs, white dwarfs) can also be classified with a high degree of certainty.

To date, we classified 336 fields of $5.5 \times 5.5\,\mathrm{deg}^2$ covering a total area of about $8000\,\mathrm{deg}^2$. The work is based on the Hamburg Quasar Survey (Hagen *et al.*, 1995) which has achieved a full sky coverage with objective prism plates for the northern hemisphere and galactic latitude $|b| > 20°$ this year. The HQS comprises 567 fields and it is planned to extend the identification process to all fields except those with extremely high star density or Galactic absorption $N_H > 10^{21}\,\mathrm{cm}^{-2}$ (leaving then ~ 500 fields).

3. Identification Results

The area surveyed so far contains 10,800 different RASS sources which can be divided into the object classes in Table 1.

TABLE 1. Identification of *ROSAT* Sources

Number Sources	% of Sample	Object Type
3376	31.3%	AGN candidates
2407	22.3%	Bright stars
435	4.0%	M dwarfs
37	0.3%	White dwarfs
703	6.5%	Normal galaxies/Clusters
635	5.9%	Empty fields
3207	29.7%	Unidentified sources

Our identification project is embedded in the Hamburg Quasar Survey (HQS) and the AGN content of the RASS is our main scientific object. Follow-up observations are necessary, and in order to maximize the scientific output two approaches are possible and have been undertaken:

Due to the coverage of large parts of the extragalactic sky, the Hamburg identification program is especially suited for the selection of peculiar object classes which are well discernible on objective prism plates. One example are X-ray loud QSO at $z > 2$, showing the prominent Ly-α emission line in the spectra. Objective prism plates with KODAK IIIa-J emulsion allow the recognition of emission line redshifts up to $z = 3.2$. Most of the X-ray loud QSOs with $z > 2$ are radio loud and have been selected from radio–X-ray

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correlations. Their radio silent counterparts are very rare and can only be identified by optical means.

An important task for identification programs is the compilation of complete flux limited samples. In order to minimize the influence of Galactic absorption on the source selection our group is working on a count rate limited AGN sample in the hard ROSAT band (0.5–2.0 keV) covering 4000 deg^2 and containing several hundred AGN. This sample allows the investigation of the local luminosity function and the study of relations between X-ray and optical properties in a flux limited sample.

References

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