

THE SEARCH FOR A NEW BL LAC SAMPLE

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1. Introduction

The number of BL Lacs discovered in the last 20 years is very small (~ 200) if compared to that of quasars. Owing to their featureless optical spectrum, BL Lacs have been discovered mainly in radio (RBL) and X-ray surveys (XBL). The limited statistics available prevents a detailed study of the properties of BL Lacs and, in general, all the conclusions based on the present data sets are affected by large uncertainties. Yet, current results are intriguing, for instance RBL and XBL are found to have a cosmological evolution that differs not only in magnitude but most of all in sign (e.g. Stickel et al., 1991 and Wolter et al., 1994 and reference therein). Therefore, we have initiated a project aimed at discovering a significant number of new BL Lac objects (~ 100), exploiting the fact that they are both radio and X-ray emitters and in particular the fact that they occupy a well defined region in the $\alpha_{ox}-\alpha_{ro}$ plane. The method we use rests on the expertise grown during the construction of the EMSS sample (Gioia et al. 1990, Stocke et al. 1991) and is described in detail in Wolter et al. (1995).

2. The search method and first results

By cross-correlating X-ray and radio source catalogs, we construct a sample of Radio Emitting X-ray sources (REX). The fraction of BL Lacs in this sample is expected to be of the order of 30% of the radio loud ($\alpha_{ro} \geq 0.3$) objects, the remainders being mainly radio emitting quasars and Seyfert galaxies. Optical counterparts are then identified on the Palomar digitized plates, and subsequently classified by optical spectroscopy.

To uniquely pinpoint the optical counterpart, and therefore minimize the required telescope time, we need to have a positional accuracy of the order of a few arcsec for at least one of the two catalogs. This also reduces

the number of spurious X-ray – radio associations. Presently, the available X-ray data over large areas of sky (ROSAT PSPC) have larger error boxes. However, two large surveys of the sky currently under way with the VLA will produce lists of sources with the required positional accuracy. We have thus decided to use all the public and suitable ROSAT PSPC data, of which catalogs have appeared recently (ROSAT NEWS n.32, 1994; and White, Giommi, & Angelini 1994), and the NVSS survey (Condon et al., 1995), that will eventually cover the whole sky north of $\delta = -40^\circ$.

Results of the optical follow up of the first REX observations are very encouraging. Sample spectra obtained at San Pedro Martir (Mexico) in April 1995 are presented in Ruscica et al. (this conference) and will be discussed in detail elsewhere. The success rate of the project is as expected: out of 26 REX observed we found 8 candidate BL Lacs, 14 AGN, 3 galaxies, and 1 object that need further investigation (a probable star). We plot in Fig. 1 the position of the 8 newly found BL Lacs in the $\alpha_{ox}-\alpha_{ro}$ plane.

Among the BL Lac candidates we are finding a mixture of objects of the XBL and RBL type, and this will help in favouring one of two competing theoretical models of the emission in BL Lac objects (cf. Maraschi et al. 1986, Padovani and Giommi, 1995). This sample, unbiased and statistically complete, allowing a direct determination of the absolute properties and relative density of XBL and RBL in the sample, would be instrumental in studying the luminosity function and cosmological evolution of BL Lac objects as a class, and of radio-loud AGNs in general.

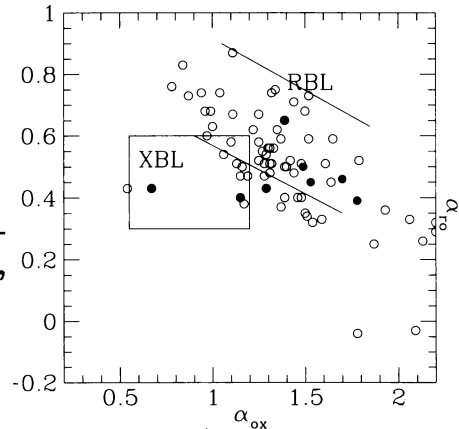


Figure 1. The α_{ox}/α_{ro} plane: empty circles are all the REXs, while black circles are the 8 new BL Lac candidates.

References

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