A MULTIFREQUENCY DATABASE OF ACTIVE GALACTIC NUCLEI

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1. The Database

We have assembled a large multifrequency database of AGN by collecting data at all frequencies ranging from the radio to the γ-ray band to tackle some fundamental questions of AGN research. We have started from the latest AGN catalogue of Veròn-Cetty & Veròn (1996), which includes 11,442 quasars and active galaxies, and gives optical magnitudes, redshift, and some radio information. To this we have added: 1. the BL Lac catalogue of Padovani & Giommi (1995), updated with some recently discovered BL Lacs (266 sources); 2. the radio galaxies in the 1 Jy, S4, and S5 radio catalogues, mostly not included in the Veròn-Cetty & Veròn compilation. The resulting database totals 12,020 AGN.

The AGN database was cross-correlated with radio, infrared, X-ray and γ-ray catalogues, including the TEXAS, FIRST, NVSS, NORTH 20 cm, PKS, PMN, GB6, S4, S5, 1 Jy catalogues, the IRAS PSC and FSC catalogues, the *EXOSAT* CMA, the *ROSAT* RASS-BSC and WGA, *Einstein* Slew, EMSS, IPC catalogues, and the *GRO* EGRET catalogue. Extra data from the literature were also added, namely: individual radio fluxes (6 and 20 cm) for radio-quiet AGN not included in radio catalogues ($f_r \lesssim 1-30$ mJy); individually published ROSAT X-ray data not included in the RASS-BSC.

From the various fluxes we derive for the objects with appropriate data: luminosities at various frequencies; effective spectral indices α_{ro}, α_{ox}, α_{rx}; radio spectral index at a few GHz; X-ray spectral indices in the *ROSAT* band from the hardness and softness ratios (for the WGA sources; soon to come for all RASS-BSC sources). The classification of the sources in various AGN classes, initially based upon that of Veròn-Cetty & Veròn, has been refined and improved upon, in many cases also by checking the original papers.

2. Preliminary Results

It is clear that such a large database can be used in a variety of ways and to address various problems. Padovani (1997) has presented some preliminary results on the percentage of AGN detected in a given band as a function of frequency and on the strikingly different redshift distributions of broad- and narrow-lined radio-quiet AGN. Here we briefly discuss the discovery of radio quasars with multi-frequency spectra similar to those of HBL, that is to those of BL Lacs having an X-ray-to-radio flux ratio $f_x/f_r \geq 10^{-11.5}$ (with f_x in the $0.3 - 3.5$ keV range in erg cm^{-2} s^{-1} and f_r in Jy).

The fact that basically all radio quasars seemed to end up in the $\alpha_{ro} - \alpha_{ox}$ plane in the same region as the BL Lacs of the LBL type ($f_x/f_r \leq 10^{-11.5}$; mostly selected in the radio band) has always been a puzzle. Why were not there some quasars with multifrequency spectra such that their position in the $\alpha_{ro} - \alpha_{ox}$ plane would partly overlap with that typical of BL Lacs of the HBL type (mostly selected in the X-ray band)?

It is clear that these quasars are selected against by radio and optical selections: if they exist, they should have $\alpha_{ro} \approx 0.3 - 0.4$, as HBL, while most radio sources have $\alpha_{ro} \approx 0.6$ and radio-quiet AGN have $\alpha_{ro} \approx 0$. A large quasar sample with multifrequency data is then clearly needed. To define the region in the $\alpha_{ro} - \alpha_{ox}$ diagram *typical* of HBL, one also needs radio/optical/X-ray information for the largest possible number of BL Lacs. Both problems can be overcome by using a large multifrequency database, such as the one we have put together. This includes radio/optical/X-ray fluxes for 188 confirmed BL Lacs, 137 of which are HBL (based on their f_x/f_r ratio). The region in the $\alpha_{ro} - \alpha_{ox}$ plane typical of HBL was then defined simply by taking an area within 2σ of their mean values of α_{ro}, α_{ox}, α_{rx}.

Within this area, we found 115 radio quasars, i.e. about 17% of all radio quasars with radio/optical/X-ray data in our database. Of these, 49 (43%) are flat-spectrum radio quasars, 39 (34%) are steep-spectrum radio quasars, while 27 (23%) have no radio spectral index information. As expected, this class of radio quasars, which we provisionally call "HBL-like" quasars, is not particularly strong in the radio band, with $f_{5GHz} \sim 50 - 100$ mJy (none has $f_{5GHz} > 1$ Jy). Judging from their names, at least 20% of HBL-like quasars are X-ray selected (mostly from the EMSS and RASS).

Finally, as HBL are known to have relatively steep X-ray spectra, probably because of a dominance of synchrotron emission in the X-ray band, it is interesting to see if this applies to HBL-like quasars as well. We have then derived the X-ray spectral index distribution for the 40 HBL-like quasars in the WGA catalogue for which α_x can be determined from the hardness ratio (with 1σ uncertainty $\lesssim 0.5$). The mean value is $\langle\alpha_x\rangle = 1.50\pm0.07$, perfectly consistent with that of HBL (Padovani & Giommi 1996) and much steeper than that of the remaining 221 radio-loud quasars in the WGA catalogue, which have $\langle\alpha_x\rangle = 1.16 \pm 0.04$, consistent with that of LBL.

References

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