THE B3-VLA SAMPLE

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1. Introduction

The use of radio sources to identify the most distant object in the Universe has been proved to be a very successful approach in observational cosmology. Studies of high flux, powerful 3CR and 1-Jy galaxies show dramatic evidence for color and luminosity evolution, reaching to look-back times 80% of the Hubble time. In order to disentangle the selection effect, correlation with redshift, and correlation with radio power, it is necessary to obtain well defined, *complete* samples of radio galaxies at a large range of redshifts, and with a wide baseline of radio power. We need the identifications of complete samples in the flux range of a factor 10 smaller than 3CR sample. The B3VLA sample (Vigotti et al. 1989) is a subset of 1050 sources selected in restricted areas at high galactic latitudes from the B3 survey, which is complete down to S(408 MHz)=100 mJy. For the B3VLA sample detailed VLA maps were obtained at 1.4 GHz using A, C and D arrays. We are conducting a long-term effort to provide optical ID's and redshifts for well-defined, complete subsamples of the B3VLA survey (Djorgovski et al. 1990, Vigotti et al. 1990, Thompson et al., 1994), a similar effort is being conducted independently by others. We present here the "status of the art" for the B3VLA sample: a new low flux sample of 124 QSS selected at meter wavelenghts, a sample of 194 radio galaxies (77 with measured redshift) and a sample of 732 Empty Fields (EF : no optical counterpart on POSS I plate).

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2. New Radio observation

The whole sample has been observed in 1994 with the 100m. Effelsberg radiotelescope at 10.6 GHz. As preliminary results we found that the median spectral index in the high-frequency range is shifted by -0.4 from the low frequency one, a figure close to -0.5 as one would expect for a continuous injection model. We observed 64 high-redshift B3VLA radio sources at 230GHz using the bolometer of the IRAM radiotelescope. A total of 13 objects was detected. The radio continuum spectra between 151 MHz and 230 GHz have been compiled for all sample sources. It is found that the observed mm flux densities generally fall on, or below, the extrapolated centimeter radio continuum spectra; this is interpreted in terms of a predominance of nonthermal radiation even at these wavelengths. Excess emission has been detected in only two sources. Attributing this excess to thermal emission from dust, we estimate the mass of the involved dust component to be around a few $\times 10^9\ M_{\odot}$.

3. Quasar Sample

172 Quasar candidates were identified on POSS I prints (down to 20.5 red mag) using only the positional coincidence between the optical position and the structural informations of A-configuration (1" resolution) and C-configuration (5" resolution) VLA maps. The sample was divided in 120 blue starlike objects (B) and 52 red or neutral color (B - R $\geq$ 1) starlike objects (N). So any color bias was avoided. For all the candidates (except 35 with literature redshifts available) spectra were obtained at the 3.5m. telescope of Calar Alto (Vigotti et al. 1990, Vigotti et al. 1996 in preparation). The 120 B-QSS candidates splits in 109 QSS - 1 Galaxy - 2 BL Lac - 5 star - 3 Featurless while the 52 N-QSS candidates splits in 15 QSS - 23 Galaxy - 1 BL Lac - 12 star - 1 Featurless. The sample, whose median redshift is 1.25, is almost complete for $S_{408} \geq 0.8 Jy$; from a visual inspection to the histogram of the magnitudes we expect $\leq$ 4 QSS with magnitudes fainter than POSS-I limit. In the flux bin from 0.8 Jy to 100 mJy we have 60 QSS, the sample is estimated to be 85% complete and $\sim$ 10 QSS may have magnitudes $r > 20.5$. To test the AGN unified models Quasar samples selected at meter wavelengths are extremely useful, because the selection of sources is largely based on their lobe emission.

4. High Redshift Radio Galaxies

From the complete B3VLA sample, we selected a statistically complete subsample of steep-spectrum EF with $\alpha_{408} \leq -0.9$, small angular size ($\leq$ 20 arcsec), $S_{408} \geq 0.8$ Jy sources. There are 109 Empty Fields (EF) which satisfy these criteria. We have already identified 90% of the sample on deep Gunn r and i CCD images obtained with the Hale 200-inch and with the 60-inch telescopes at Palomar. Up to now we have 60 redshifts ranging from $z = 0.5$ to $z = 3.2$. Only one quasar was discovered in the EF sample, therefore we can safely state that QSS are a small percentage of the EF. The redshifts were obtained at the Palomar 200-inch telescope and at the KECK telescope.

5. Results

The optical study of the EF sample is far to be complete, but we have enough data to make some preliminary comparison. We have combined the high-flux well defined 3C radio galaxies sample with the moderate-flux radio galaxies from B3VLA sample. The Hubble diagrams in the K color show a remarkably smaller scatter than in r band, which for most of these galaxies probes the restframe UV, and is thus more susceptible to the effect of AGN, star formation, or dust. We found a weak correlation between the absolute magnitude in K and r band and the radio power; furthermore a strong correlation is present between the line luminosity and radio power. These two effects are mostly due to an active nucleus, an hidden quasar, which is also responsible for the radio emission. Finally, we examine the behavior of the optical and radio PA alignment. For the B3VLA sources the distribution of the optical-radio alignments, (i.e., absolute PA differences) is nearly uniform. This is in a striking contrast with the situation for the more powerful 3C radio galaxies, where the alignments are quite strong. Combining the B3 and 3C data sets we see that the alignment is prominent in both the high-power and high-redshift sample, as expected, due to the strong correlation between power and redshift in flux limited samples. Then we take the high-redshift ($z > 0.8$) half of the combined B3+3C data set, and split it by median power ($\log P = 27.62$). In this high-redshift sample the high-power subset shows the alignment effect whereas the low-power subset does not. We do a similar test taking the high-power ($\log P > 27.0$) half of the combined B3+3C data set, and split it by median redshift ($z = 0.92$). In this high-power sample the high-redshift subset shows the alignment effect whereas the low-redshift subset does not.

References

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