A COMPLETE SAMPLE OF RADIO GALAXIES

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We report here some preliminary results of a multi-wavelength study of a complete sample of radio galaxies. The sample is comprised of 93 radio sources from the Parkes 11 cm catalog which are identified with galaxies of 17th magnitude or brighter in the declination zone -17° to -40°. Our objective is to cross-correlate the radio, infrared, optical, and other properties of a properly defined sample of radio galaxies.

By going to relatively low flux densities and using an optical magnitude limit we are approximating a volume-limited sample and consequently have a class of objects which are more representative of radio galaxies as a whole than the 3C sample. Since the 3C radio galaxies are generally of high luminosity, many are also very distant and therefore difficult to study optically. Another common difficulty in the study of radio galaxies is that radio astronomers usually only have access to the heterogeneous optical data which happen to be published on the relevant galaxies and vice-versa. It is the objective of the present work to obtain uniform and comprehensive data at radio, infrared, and optical wavelengths of a complete sample of relatively nearby radio galaxies.

We have mapped all the galaxies in the sample using the VLA, with supplementary data for the larger sources from Molonglo, Fleurs, and Parkes. Near-infrared photometry is being done using the 3.6m telescope at La Silla, and UKIRT. Spectrophotometry of all the radio galaxies and many of their companions has been completed using telescopes at La Silla and Las Campanas, and the AAT. In addition we have UV and X-ray data for several of the galaxies.

This sample contains a smaller fraction of classical double radio sources than the 3C sample; these galaxies exhibit more distorted radio structures and are of lower radio and optical luminosity. 90% of them are within $z = 0.1$. Radio cores, mostly of the flat-spectrum type, have been detected in 80% of the galaxies. Only 6% have obvious radio jets, although there may be some indication of possible jet structure in as many as a third of them. Half of these radio galaxies are smaller than 75 kpc, as

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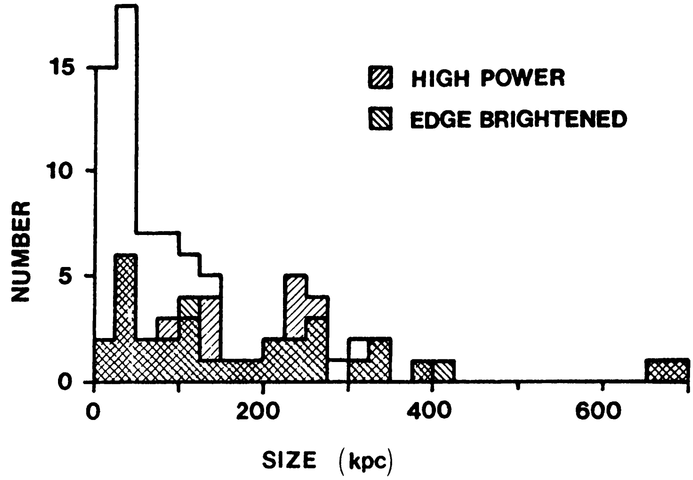

Figure 1. Linear size distribution. High power means $\geqslant 10^{24}$ WHz^{-1} at 5000 MHz; edge brightened corresponds to Fanaroff and Riley (1974) class II.

shown in fig. 1, and the high-power, edge-brightened sources are the biggest. In the infrared about 20% of the galaxies are abnormal in H-K, and 30-40% in K-L (fig. 2). 40% have so far been found to have optical emission lines, and almost all of these are narrow; those galaxies with the strongest radio cores all have emission lines.

Fig. 3 shows that there is a preference for the radio major axis to be parallel to the optical minor axis, as Guthrie (1979) and Palimaka et al. (1979) also found. This preference may be somewhat stronger for isolated and/or more flattened galaxies.

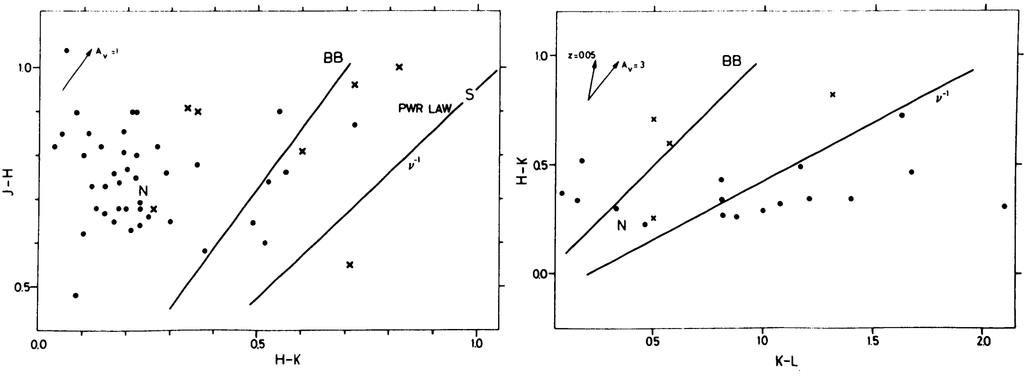

Figure 2. Near-infrared photometry for a sub-sample of the radio galaxies. "N" and "S" indicate where normal and Seyfert (i.e. active) galaxies occur in such plots. Crosses denote spirals and S0s, and filled circles denote ellipticals.

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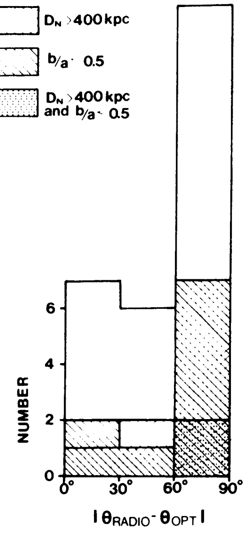

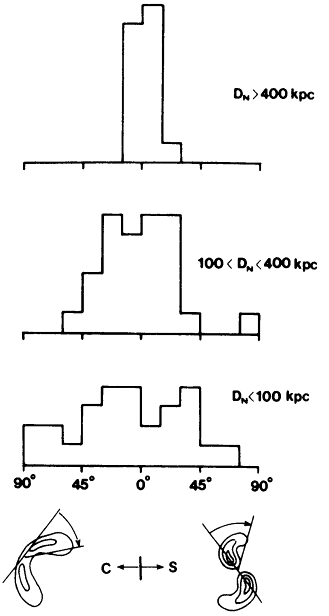

Figure 3 (left). Comparison of the position angles of the radio and optical major axes for 30 galaxies with optical axis ratio b/a $\leqslant$0.9.
Figure 4 (right). Histograms of the C and S distortions for different values of D_N, the (projected) distance to the nearest galaxy.

In fig. 4 it can be seen that both the "C" and "S" distortions of the extended radio structure (mirror symmetry and inversion symmetry respectively - cf. Ekers, this volume) occur only when other galaxies are nearby (within a few hundred kiloparsec). The isolated radio galaxies are much less distorted, more symmetrical, more edge-brightened, and exhibit higher contrast in their radio brightness distribution. It is well known that the C-distortion is related to a high density of galaxies; radio galaxies in Abell clusters almost all exhibit C-type distortions (Ekers et al., 1982). The S-distortion, on the other hand, is more often associated with the presence of a single nearby galaxy than with a high density of galaxies. The close passage of another galaxy could perhaps cause the S-distortion by indirectly influencing events in the nucleus, although these galaxies are not exceptional in their radio power, infrared excess, or optical line emission; alternatively, the S-distortion may be produced in the outer regions by tidal effects and re-collimation of the beam.

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