NEAR INFRARED AND RADIO OBSERVATIONS OF DISTANT GALAXIES

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This paper is concerned with the distant radio galaxies in a sample of bright sources selected at 178 MHz by Laing, Riley & Longair (1982). This sample is 96% complete for sources with $\theta < 10'$ and the bias of the 3CR catalogue against sources of large angular size has also been reduced. Deep optical searches have located many candidate identifications, but the probability of a chance coincidence with an unrelated object is appreciable, especially in the faintest cases, unless the area to be searched is small. We have therefore mapped the sources with candidate identifications having $V > 20$, using the VLA at a wavelength of 6 cm (Laing, Owen & Puschell, in preparation), in order to search for radio cores. We have so far located cores in 16/23 sources and set 5σ upper limits of 0.6 mJy for the remainder. None of the cores had been detected previously. In all cases, the cores coincide with optical objects, although one source (3C 340) had been misidentified. Several ambiguities have now been resolved.

The majority of these faint identifications are galaxies with $z > 0.4$ and there is consequently a substantial overlap in luminosity for the galaxies and quasars in the sample. Their space-density distributions have been compared directly by Laing *et al.* (1982), who conclude that the distributions of V/V_{max} for radio galaxies and quasars in the same range of luminosity are indistinguishable, and hence that the populations evolve in similar ways. The evolution is very strong, the mean values of V/V_{max} being 0.66 ± 0.03 for the powerful radio galaxies and 0.69 ± 0.04 for the quasars. If this result holds over a wide range of luminosity and redshift, then the factors which determine the rate of evolution are likely to be independent of the obvious differences in radio structure, nuclear emission, galactic morphology and perhaps environment between the two classes.

Deep identification surveys are extremely efficient at selecting very distant elliptical galaxies: most of those with known redshifts $z \simeq 1$ are in fact strong radio emitters. Whilst this allows us to study the evolution of the spectral energy distributions of elliptical

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galaxies over appreciable look-back times, there is always the worry that radio galaxies are in some way unrepresentative. Lebofsky (1981), Lilly & Longair (1982) and Puschell, Owen & Laing (1982) have recently published near-infrared photometry of an appreciable number of galaxies from the sample of Laing et al. (1982). We refer to these papers for a detailed discussion, but wish to emphasize an unexpected result found by Puschell et al. The calculations of Bruzual (1981) suggest that the spectral shapes of elliptical galaxies in the near infrared should be independent of epoch out to $z \simeq 2$. Our results indicate, however, that powerful radio galaxies at $z > 0.4$ are significantly too blue in the wavelength range 1 - 3 μm, i.e., J - K is less than the predicted value. It is entirely possible that these galaxies are anomalous in some way, perhaps because of non-thermal contributions to their infrared emission, and we therefore plan to study optically-selected and weak radio galaxies at $z \sim 1$ in the near infrared.

References

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