INFRARED EMISSION FROM RADIO GALAXIES

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ABSTRACT. Observations with the IRTF and IRAS indicate that there are at least two different mechanisms for the generation of infrared emission from radio galaxies.

I. Observations

We have studied the infrared emission from a sample of 57 low-luminosity radio galaxies drawn from the 408 MHz Bologna B2 survey. These radio sources are all identified with galaxies brighter than 15.7 m_{pg} (Colla *et al.* 1975). Most of the galaxies are elliptical; their mean redshift is 0.034. Our 12–100 μm IRAS data are all derived either from pointed observations or from a reanalysis of the survey data using the "ADDSCAN" procedure. Of the 56 galaxies in our sample that were surveyed by IRAS, 23 were detected at least one wavelength.

At the IRTF we used the standard single channel photometers with a 5.5 arcsec beam. We detected 15 out of 45 sample galaxies at 10 μm above a level of 2 σ. We made 1–4 μm follow-up observations of 10 of these.

II. Results

We detected no obvious connections between the infrared flux density and the total radio flux density of the galaxies but found a small but significant correlation between the 60 μm fluxes and the 21 cm core fluxes of these galaxies as measured at the VLA by Fanti *et al.* (1987). The core flux excludes the emission from the extended radio lobes that many of these galaxies possess. The infrared and radio fluxes are plotted against each other in Figure 1, together with a pair of diagonal lines corresponding to different ratios of infrared to radio flux density. It may be seen that there is a range of about 1,000 in this ratio among the galaxies in the sample.

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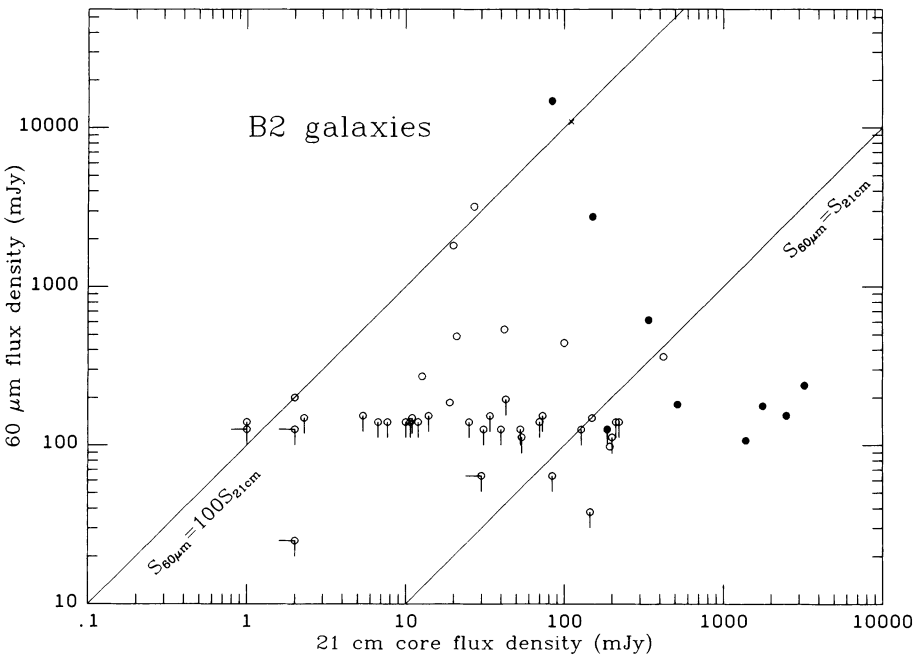

Fig. 1. Relationship between 60 μm and 21 cm core flux density for radio galaxies in the B2 catalog. Filled circles are radio galaxies in which more than 50% of the 21 cm flux density comes from the core; open circles are galaxies dominated by extended emission. The cross represents a galaxy with a disklike morphology.

Galaxies located close to the upper line have 60 μm fluxes about 100 times greater than their radio fluxes. Such ratios are commonly found in a wide variety of spiral galaxies (Helou *et al.* 1984); the similarity suggests in that these particular galaxies the infrared emisssion arises from heated dust that is in an environment similar to that in spiral galaxies. This hypothesis is supported by the fact that the four galaxies with the strongest infrared emission are all known to exhibit peculiar, dusty, or disklike morphology.

Galaxies located in the lower right-hand corner of the figure have core radio flux densities that exceed their 60 μm flux densities. It is significant that as a group they are all core-dominated at 21 cm; two of them are well-known BL Lac objects. The physical conditions in the emitting regions of these galaxies are clearly quite different from those in the disklike systems and are presumably dominated by nuclear processes. We cannot tell from the present evidence whether the emission mechanism for the 60 μm radiation is synchrotron radiation, or thermal reradiation by dust.

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