# OH MEGAMASERS AND ACTIVE GALACTIC NUCLEI

R.P.Norris
CSIRO Division of Radiophysics
PO Box 76, Epping, NSW 2121,
Australia

ABSTRACT. OH megamasers are believed to be active galaxies in which a substantial fraction of the OH gas in the disk of the galaxy is stimulated by the intense far-infrared flux from the active nucleus. The result is that the galactic disk acts as a maser amplifier, producing in the OH line an amplified image of the radio continuum source in the nucleus. Megamasers promise to be powerful tools for the study of active galaxies, provided we can determine what it is that turns an active galaxy into a megamaser. Here I examine the archetypal megamaser galaxy Arp220 and ask the question: what makes it different from other active galaxies?

## 1. OH MEGAMASERS.

The first megamaser was discovered when Baan et al. (1982) discovered intense OH emission from the peculiar galaxy Arp220 (IC4553). This galaxy was independently found by IRAS (Soifer et al. 1984) to have the highest infrared excess of any galaxy in the UGC catalogue, and it is now known to have a total luminosity which ranks it amongst quasars, but a level of extinction which gives it an undistinguished optical appearance.

Six other OH megamaser galaxies have since been found (Norris et al., 1986, and references therein), and each is distinguished by a high infrared luminosity ($10^{11}$-$10^{12}$ $L_o$) and a remarkably uniform infrared colour temperature (55-71 K). Hundreds of other active galaxies have been searched by various groups with a spectacular lack of success which implies that megamasers require very special conditions. The colour temperature undoubtedly represents one of these conditions, since only a small fraction of active galaxies have a temperature in this range. This suggests that the population inversion is accomplished by a far-infrared pumping mechanism, perhaps operating through the 35μm or 80μm OH transitions.

A megamaser also requires a radio input, which in the case of Arp220 is provided by a central radio continuum source in the galaxy. Theory indicates that other megamaser galaxies operate in a similar manner. Thus OH megamasers seem to occur in galaxies which contain an active radio nucleus and a cool but infrared-bright disk. However, the large number of galaxies which satisfy these criteria and yet do



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not exhibit OH megamaser emission attests to the existence of some other condition - perhaps that of orientation or gas density.

## 2. ARP220

Arp220 contains at its nucleus a pair of compact radio sources. Their size at 1.3cm (Norris, 1987) is about 50 pc, whereas VLBI results (Diamond et al., in preparation) suggest an even smaller size. These and other results have been interpreted by Norris (1987) as evidence that Arp220 possesses two active nuclei separated by about 350 pc. This directly supports the hypothesis, advanced by Joseph et al. (1984) on the basis of molecular hydrogen observations, that Arp220 is the result of a merger. These and other observations suggest that Arp220 contains in its core a pair of compact accreting objects, but that these are surrounded by regions of starburst activity.

This conjunction of Seyfert and starburst activity is becomingly increasing attractive for all types of active galaxy. It should therfore be noted that the essence of the megamaser phenomenon is a requirement for both starburst activity (to accompany the dust and molecular column density) and Seyfert activity (to provide the central radio source). Thus megamaser galaxies perhaps represent some extreme example of the the generic active galaxy phenomenon.

## 3. CONCLUSION.

Megamasers pick out those galaxies which are disrupted by both starburst and Seyfert activity. In this respect they represent extreme cases of what makes an active galaxy, although there is in addition some unrecognised condition necessary for megamaser activity. Identifying this condition would permit us to wield the megamasers as powerful tools for the study of active nuclei.

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