RADIO EMISSION FROM THE SEYFERT GALAXY NGC 5548

J. S. Ulvestad*, A. S. Wilson**, and D. G. Wentzel**
*NRAO - Charlottesville
**Astronomy Program, University of Maryland

ABSTRACT. Weak radio emission from the type 1.5 Seyfert galaxy NGC 5548 has been mapped with high resolution at the VLA at both 1465 and 4885 MHz. The galaxy contains the largest (5.9 kpc) triple radio source known in a Seyfert galaxy. The central component of that triple is unresolved (<0.39x0.15 kpc) and has a flatter spectrum than the well-resolved outer lobes. In addition, the field surrounding NGC 5548 and two of the sources in that field have been mapped at 1465 MHz; the field sources are unlikely to be physically associated with NGC 5548.

NGC 5548 is a Seyfert galaxy whose optical spectrum shows relatively narrow forbidden line emission and both narrow and broad emission components in the permitted lines. The galaxy, which lies at a distance of 100.7 Mpc (assuming H_0 = 50 km s^{-1} Mpc^{-1}), is a strong source of both x-rays and infrared radiation. It is a somewhat peculiar spiral having an inner disk and outer rings (Su and Simkin 1980) and has an apparent axial ratio of ~0.8.

An early VLA map of NGC 5548 at 4885 MHz was made by Wilson and Willis (1980). It showed the radio source to be triple, with two extended lobes straddling an unresolved component coincident with the optical continuum nucleus. This "nuclear radio source" has a total extent of 12" (5.9 kpc) in p.a. 165°. Van der Kruit (1971) and de Bruyn and Wilson (1978) also noted the presence of two additional sources lying outside the optical galaxy and aligned roughly E-W across its nucleus. One source lies 1!7 to the west (p.a. 270°) and the other is 4!1 to the southeast (p.a. 113°) of the nucleus.

NGC 5548 and the surrounding field were observed in a total of 4 runs on the partially completed VLA during 1979 and 1980. High-resolution maps of the nuclear radio source were made at 1465 and 4885 MHz. These maps show an unresolved central component together with two well-resolved outer lobes. Comparison of 1465 and 4885 MHz maps convolved with the same beam shows a spectral index of ~0.4 ($S_\nu \propto \nu^{-\alpha}$) for the central core and ~0.7 to ~1.0 in the outer lobes. The total

D. S. Heeschen and C. M. Wade (eds.), Extragalactic Radio Sources, 191–192.

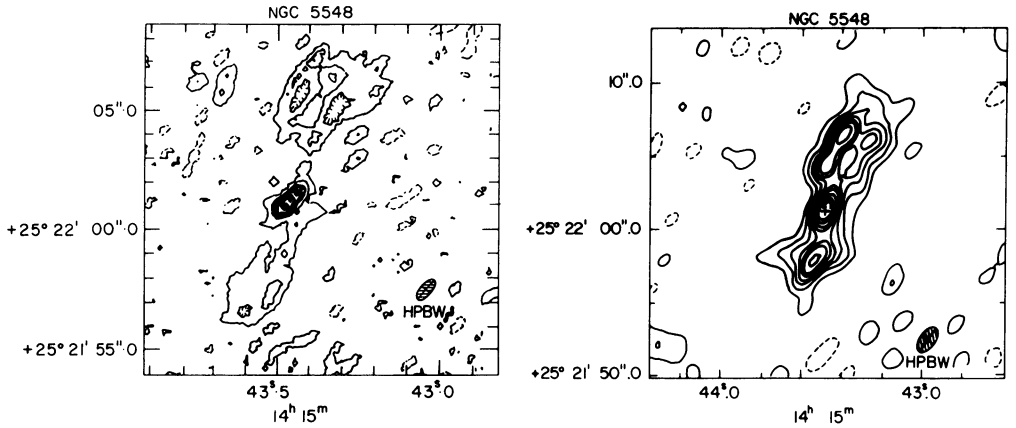

Figure 1. NGC 5548 at 4885 MHz (left) and 1465 MHz (right).

flux densities for the nuclear source, which is shown in Figure 1, are 23 and 8 mJy at 1465 and 4885 MHz, respectively. The corresponding powers are 2.2×10^{21} and 7.6×10^{20} W Hz^{-1} sr^{-1} at the two frequencies. Thus NGC 5548 contains not only the largest, but one of the weakest double or triple radio sources yet detected in a Seyfert galaxy.

Radio sources such as the nuclear source in NGC 5548 have been attributed to ejection of material from the inner nucleus or to bursts of star formation followed by multiple supernovae. In the first case, matter flowing from the inner nucleus may generate the radio emission in shocks where optical line-emitting clouds are encountered. Alternatively, a supernova rate of ~3-4 per year would be necessary to produce the amount of radio emission observed in NGC 5548.

A 20'-square field centered on NGC 5548 was mapped at low resolution at 1465 MHz, and the two field sources were mapped at high resolution. The field contains no low surface brightness features that might indicate a relation between the external sources and NGC 5548. The western and eastern field sources are extended and have total 1465-MHz flux densities of 34 and 21 mJy, respectively. Since neither source can be identified optically, the possibility of association with NGC 5548 cannot be ruled out, but seems unlikely.

We thank R. A. Sramek for participating in the observations and A. G. de Bruyn and S. M. Simkin for supplying optical photos of NGC 5548.

REFERENCES

de Bruyn, A. G., and Wilson, A. S.: 1978, Astron. Astrophys. 64, pp. 433-444.
Su, H. J., and Simkin, S. M.: 1980, Astrophys. J. 238, pp. L1-L5.
van der Kruit, P. C.: 1971, Astron. Astrophys. 15, pp. 110-122.
Wilson, A. S., and Willis, A. G.: 1980, Astrophys. J. 240, pp. 429-441.