HIGH-RESOLUTION RADIO OBSERVATIONS OF THE X-RAY GALAXY NGC 3862 (3C 264) IN ABELL 1367

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ABSTRACT

The radio source 3C 264, identified with the x-ray-emitting elliptical galaxy NGC 3862 in the rich cluster Abell 1367, has been mapped with resolutions from 2 to 8 arcsec at 1465 MHz using 14 antennas of the VLA. The new data delineate three main structural components: a small-diameter core in the galactic nucleus, a jet-like feature about 900 pc long emanating from the core, and an amorphous emission plateau about 11×6 kpc in radius around, but not centered on, the nucleus. The plateau occupies a region near the intersection of two large-scale radio trails extending from NGC 3862 and covers much of the optical extent of the galaxy on the Palomar Sky Atlas. The unusual amorphous plateau of emission can be interpreted as a rare class of diffusion-dominated structure formed by particles escaping from the moving active nucleus of NGC 3862. It might also however be a rapidly broadening "wide trail" source observed almost along the line of its inner structure.

I. INTRODUCTION

The extended radio source 3C 264 (= 1142+198) is identified with the bright ($V_{26} = 12.74$, Sandage 1972) E0 galaxy NGC 3862 in an outlying but dense part (richness = 2) of the cluster of galaxies Abell 1367. The cluster has been classified as Bautz-Morgan type II–III by Leir and van den Bergh (1977), and NGC 3862 is $\sim 0^{m}7$ fainter than its brightest member, which is NGC 3842. The overall angular size of 3C 264 increases with decreasing radio frequency (Macdonald *et al.* 1968; Northover 1976), implying that there are significant spectral index gradients across the source, and the radio structure (Fig. 1 from Högbom and Carlsson 1974) is elongated, with the galaxy at its southwestern end. Spectral gradients and symmetric placement of the optical identification are a characteristic signature of the "head-tail" radio galaxies, which are also commonly associated with the fainter members of rich clusters of galaxies. Three lines of evidence suggested to us, however, that NGC 3862 might not be a straightforward example of this type of cluster radio source.

First, the highest-resolution maps of 3C 264 in the literature, those with $12'' \times 34''$ resolution at 11 cm and $6''.5 \times 19''$ resolution at 6 cm by Northover (1976), showed emission within 1′ of NGC 3862 to both the northeast and the northwest of the galaxy, whereas the large-scale asymmetric structure lies entirely to the northeast (Fig. 1). The poor north-south resolution, and consequent declination compression of Northover's maps, left open the possibility that 3C 264 might have a "wide-angle" tail structure near NGC 3862 that was swept back into a narrower tail configuration towards the northeast.

Second, optical spectroscopy of NGC 3862 and of other galaxies in Abell 1367 left doubt whether NGC 3862 has a radial velocity significantly different from the cluster mean. Tifft and Tarenghi (1975) derived a mean heliocentric velocity of 6450 ± 130 km s^{-1} for 43 probable cluster members, while Dickens and Moss (1976) favored a mean velocity of 6610 ± 110 km s^{-1} based on 34 probable members (including one high-velocity galaxy near the cluster center). The heliocentric velocity of NGC 3862 itself has been given as 6240 km s^{-1} by Schmidt (1965), and 6592 km s^{-1} by Dickens and Moss (whose data taken by themselves imply that NGC 3862 has a rather low peculiar radial velocity). Unless the space velocity of NGC 3862 is mainly in the plane of the sky, it is unlikely that it has a very high (> 1000 km s^{-1}) peculiar velocity within Abell 1367, as the velocity dispersion of the cluster is only ~ 700 km s^{-1} (Dickens and Moss 1976). It may, therefore, be difficult to construct ram pressure models of its swept-back structure unless (a) the radio-emitting plasma is ejected

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