

A Study of Giant Radio Galaxies

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Abstract. Multi-frequency radio observations have been made of a sample of 17 giant radio galaxies, many of whose structures were not well determined earlier. These sources were observed with the VLA D- and B/C arrays at C and L bands respectively. Two of the sources were also observed with the GMRT at 610 MHz. We present some of the radio images, and discuss their evolution and consistency with the unified scheme for radio galaxies and quasars.

Keywords : galaxies: active – galaxies: nuclei – radio continuum: galaxies

1. Introduction

The giant radio sources (GRSs), defined to be those with a projected linear size ≥ 1 Mpc ($q_0=0.5$ and $H_0=50 \text{ km s}^{-1} \text{ Mpc}^{-1}$), represent the late stages of the evolution of double-lobed radio sources. These sources are the largest single objects in the Universe and are extremely useful for studying a number of astrophysical problems such as the evolution of radio sources and the properties of the intergalactic medium. In this paper, we present some of the results of our observations of a sample of giant radio galaxies with the VLA and the GMRT, and discuss some of the implications.

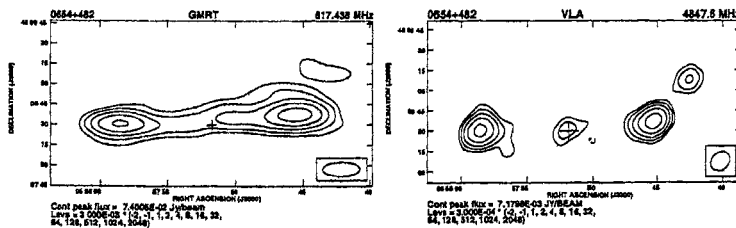


Figure 1. GMRT 610-MHz and the VLA 5-GHz images of B0654+482.

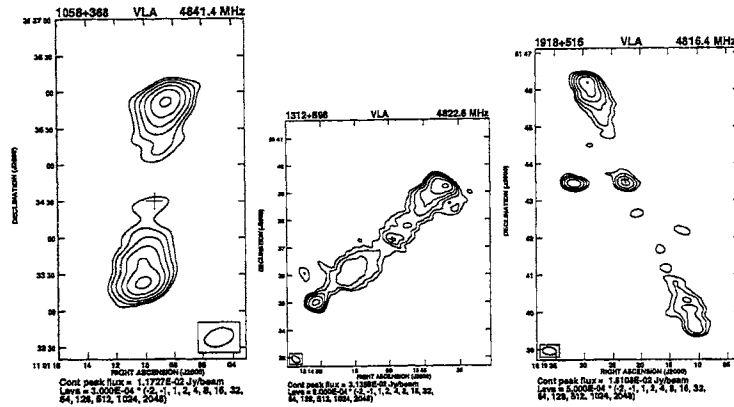


Figure 2. VLA 5-GHz images of B1058+368, B1312+698 and B1918+516.

2. Results and Discussion

The GMRT and VLA images of B0654+482, a giant radio galaxy identified from the 7C survey (Cotter et al. 1996), are presented in Fig. 1. The GMRT image at 610 MHz shows a continuous bridge of emission between the two lobes, while the VLA image at 5 GHz shows evidence of a core component. Radio images at 5 GHz of another three galaxies, B1058+368 from the 7C survey, B1312+698 (DA340) and B1918+516 from WENSS are presented in Fig. 2. These sources belong to class II of the Fanaroff-Riley classification scheme, and two of these show clear evidence of radio cores. In both figures, the crosses mark the positions of the optical galaxies.

We have estimated the equipartition magnetic fields for all the 17 sources, and the spectral ages for those which show significant evidence of spectral steepening. We find that for these giant radio sources, inverse-Compton losses dominate over synchrotron losses, consistent with earlier studies (e.g. Ishwara-Chandra & Saikia 1999). This is unlike the case for the smaller sources where synchrotron losses are more significant. The spectral ages are $\geq 10^7$ yr, consistent with the scenario where double-lobed radio sources evolve from the most compact steep-spectrum sources to the normal double-lobed radio sources and then on to the GRSs. All but two of the objects in our sample are associated with galaxies; and their weak cores suggest a large angle of inclination to the line of sight, as expected in the unified scheme.

References

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