Title : will be set by the publisher
Editors : will be set by the publisher
EAS Publications Series, Vol. ?, 2002

THE MULTI-WAVELENGTH STUDY OF TWO UNIQUE RADIO GALAXIES

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Abstract. We are studying the two unique radio galaxies Hercules A and 3 C310. We are trying to determine whether the unusual and similar structure and behaviour of these two radio galaxies originate in a similar fashion or not. We try to find why these sources are different from double lobed AGNs. This research is being made by using multiwavelength observations across the electromagnetic spectrum.

1 Introduction

Hercules A is a powerful, extended radio galaxy at a low redshift of z = 0.154 (see Fig. 1, left). We have been studying it in the radio extensively and also in the X-rays (Gizani, 1997; Gizani & Leahy, 1999; Gizani & Leahy in preparation; Gizani, Garrett & Leahy, 2000 and 2001; Gizani, Garrett & Leahy in preparation). **3C310** is also a powerful radio galaxy at z = 0.054 (see Fig. 1, right). The source is not studied as well as Hercules A.

Overall both sources present more than interesting *similarities*. They: have double optical nuclei with similar absolute magnitude in R-band; Are hosts of clusters with similar gas temperature and there is a contribution from a point source in their X-ray emission; Have sharply bounded double lobes; Are classified as FR I/2; Present lobe asymmetry with respect to brightness, depolarization and spectral index; Have no compact hotspots. Instead they are probably the only two radio galaxies that show large multiple circular radio features (rings) interior to the lobes and not just phenomena of the boundaries. The rings and other high-brightness structures have much flatter spectra than the surrounding diffuse lobes (a renewed outburst from the active nucleus?); The projected B-field followes the edges of the rings; Are steep spectrum sources (a$\sim$1.4); The thermal pressure at the distance of their radio lobes is larger than the lobe minimum pressure.

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DOI: (will be inserted later)

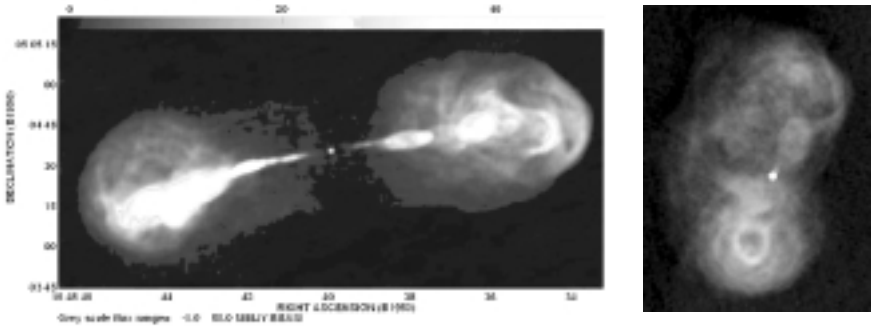

Fig. 1. Left: *VLA* grey scale map of the radio emission from Hercules A at λ20 cm at 1.4 arcsec resolution (Gizani & Leahy (1999)). Right: *VLA* grey scale map of the radio emission from 3 C310 at λ21 cm at 4 arcsec (Van Breugel & Fomalont (1984)).

Some of their *differences* are: 3C310 is smaller, less powerful than Hercules A in the radio; However it has a stronger radio core with a flat spectrum, The core of Hercules A has a steep spectrum, which is unusual; It is less luminous in the X-rays than Hercules A. The central electron density of the Hercules A cluster is greater than of the 3C310 cluster; The thermal pressure of the Hercules A cluster is larger. Therefore the confinement of its lobes by the intracluster medium is greater.

2 The Project

The purpose of our work is to investigate in detail these two radio galaxies and their environments in pc- and kpc-scales, interprete the morphology features they present, investigate the conditions of their formation, understand the physical mechanisms that take place interior and exterior to them, clarify the similarities and differences of the non-determined intermediate class of the Fanaroff-Riley classification and add information to complement essentially the Unified Schemes Theory.

For this reason we are undergoing a major multiwavelength observational campaign across the electromagnetic spectrum, from the radio to Gamma-rays through infrared, optical and X-rays. The observational results will also be used to simulate the powerful and unique jets of Hercules A together with its ring- and helical-like features. We will also be able to test existent and make theoretical models to explain the morphology and physics of these two radio-galaxies.

References

Gizani, N.A.B. 1997, 'Environments of Double Radio Sources associated with Active Galactic Nuclei', PhD thesis, Jodrell Bank Observatory, University of Manchester, UK.

Gizani, N. A. B. & Leahy, J. P. 1999, NewAR, 43, 639

Gizani, N.A.B., Garrett, M. & Leahy, J.P., 2001, Proc. Astron. Soc. Aust., in press