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Interaction of the WAT Source in A3395 with the Intracluster Medium

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Abstract. Using X-ray observations from Chandra and XMM-Newton and radio observations from the Australia Telescope Compact Array (ATCA), we have examined the merging environment of the bimodal cluster Abell 3395. From X-ray data we have produced thermodynamic maps of the cluster. The Wide Angle Tail (WAT) galaxy seen in the radio is slightly offset from the X-ray emission peak of the southern part of the cluster. The unsharp masked Chandra image of the cluster does not show any deficit in the X-ray flux near the location of the source possibly because the thermal plasma has leaked into the cavities.

Key words. Galaxies: clusters: general—galaxies: clusters: individual: (A3395)—galaxies: clusters: intracluster medium—X-rays: galaxies: clusters—radio continuum: galaxies.

1. Introduction

Clusters of galaxies are believed to form hierarchically in a sequence of cosmic structure formation where small groups of galaxies merge to form larger and richer systems. Mergers in galaxy clusters can produce large inhomogeneities in temperature, can produce shocks, bulk gas flows and turbulence in the intracluster medium (ICM) and can disrupt the cooling flows. Large bulk motions created by mergers, causing relative velocities between the systems that exceed $\sim$1000 km s^{-1}, have been thought of as the main reason for the bent jets of the WAT radio sources usually associated with the dominant galaxy of the group or clusters of galaxies (Roettiger *et al.* 1996).

A3395, located at R.A.(J2000) = $06^{\rm h}27^{\rm m}31.1^{\rm s}$, Dec.(J2000) = $-54^{\rm d}23'58''$ ($l = 262.9589$, $b = -25.007$), is a regular cluster of galaxies with 54 members and richness class 1 (ACO Catalog, 1989). It has two well-known components A3395 N and A3395 S and has a red-shift of 0.0498.

2. X-ray and radio maps

Our analysis of the X-ray images of the cluster shows four principal regions of emission: NE, SW, W and a filament connecting NE to W. The 1348 and 2374 MHz ATCA radio images of the cluster show the presence of a WAT galaxy slightly offset

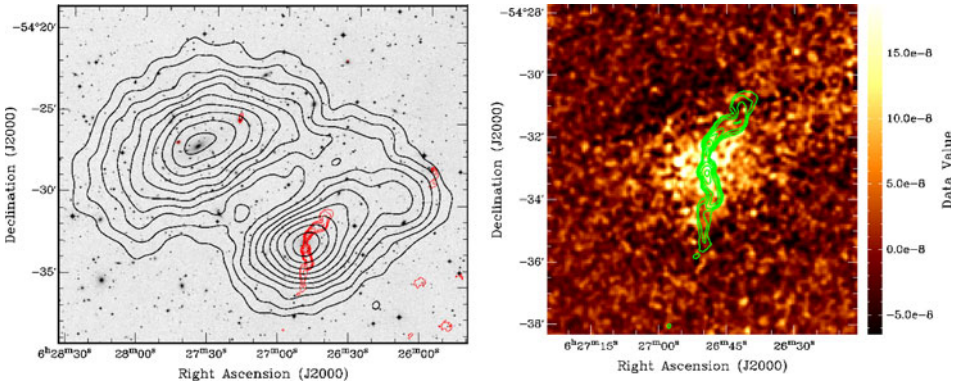

Figure 1. *Left*: A3395 image from the SuperCOSMOS survey with overlaid X-ray contours (black) and ATCA 1348 MHz radio contours (red). *Right*: Chandra unsharp-masked image of the WAT source in A3395 overlaid by the ATCA 1348 MHz radio continuum contours (green).

from the X-ray emission peak of SW subcluster and also a Head–Tail (HT) galaxy at the periphery of the W region, which are signatures of interaction of the radio sources with the ICM (Figure 1: left). A fit to the radio spectrum of the WAT source using the Jaffe & Perola (1973) model, suggests a spectral age of ∼10 Myr. The thermodynamic maps of the cluster derived based on spectral analysis show evidence for shock fronts between the NE–SW, SW–W, and NE–W subclusters. The un-sharp masked Chandra image of the WAT source does not show any deficit in the X-ray flux near the location of the WAT source (Figure 1: right) which can be because the thermal plasma has leaked into and filled the cavities. The minimum energy pressure is calculated to be slightly less than the external X-ray pressure. However, pressure equilibrium can be achieved by considering a larger contribution from heavier particles, integration to much lower energies, and additional pressure due to gas entrained and heated by the jets.

References

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