RADIO-OPTICAL ALIGNMENTS IN NEARBY COOLING FLOW CLUSTER CENTRAL GALAXIES

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1. Summary

The centers of dominant cluster galaxies in cooling flows are often unusually blue, they have spatially extended nebular line emission and bright, FR I radio sources (Fabian 1994). As a class, they are the most rapidly evolving giant elliptical galaxies known. Among the most interesting of these objects, the Abell 1795 ($z = 0.06$) and Abell 2597 ($z = 0.08$) central cluster galaxies have very blue, lobe-like structures that are located along their FR I radio lobes (McNamara & O'Connell 1993). This discovery was surprising because correlations between the radio source and blue optical continuum were thought to occur exclusively in powerful, FR II radio galaxies at redshifts $z > 0.6$ that show the alignment effect. By analogy with the distant radio galaxies, the blue lobes are thought to be regions of star formation that were triggered by the passage of the radio source (De Young 1995), or scattered light from an obscured, anisotropically radiating active nucleus that is beaming its light obliquely to the line of sight (Sarazin & Wise 1993; Crawford & Fabian 1993; Sarazin et al. 1995). Scattered light is usually polarized. Therefore, polarization measurements of the aligned optical continuum should provide a strong test of the scattering hypothesis.

McNamara et al. (1995) have obtained U-band polarimetry of the blue lobes in the Abell 1795 cluster central galaxy. They found an upper limit to the degree of polarization of the light emitted from the lobes of $< 7\%$. The accuracy of this measurement is limited by the presence of diluting background starlight. This limit is inconsistent with the lobes being scattered light that originated in an obscured, anisotropically radiating nucleus, unless the radiation is beamed and is viewed at an angle $< 22^o$ to the line of sight, which is unlikely. The absence of a detailed correspondence between

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the radio lobes and optical lobes and the absence of a polarized signal is also inconsistent with synchrotron light.

The blue optical lobes are probably regions of vigorous star formation. If a burst of star formation were triggered by the expanding radio lobes, the age of the burst population should be $\sim 10^7$ yr. The star formation rate in both lobes, assuming the Local IMF, would then be $\sim 20\ M_\odot\ yr^{-1}$ and the stellar mass of the lobes would be $\sim 10^8\ M_\odot$. The large cooling flow in A1795 may be fueling the star formation and the radio source or the fuel may have originated from one or more gaseous cluster galaxies that recently fell into the cluster's core. This result strongly suggests that the radio sources in central cluster galaxies may be a significant factor driving the evolution of their stellar populations.

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