

Far-infrared-radio relation in cluster galaxies at intermediate redshift

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The radio luminosities at 1.4 GHz is tightly correlated with the far-infrared luminosities for various galaxy types (e.g. [16, 6, 2]) over a wide range of redshift (see e.g. [5, 1, 15, 8, 7]). The relationship is widely believed to be driven by the internal star formation activity. Radio emission from these galaxies are predominantly produced from the synchrotron emission of cosmic-ray electrons accelerated in supernova shocks. The infrared emission is due to ultraviolet light from young massive stars that is absorbed and re-radiated by dust [3]. A correlation is found also in local clusters but cluster galaxies appears to have excess radio emission relative to the amount of far-infrared emission [9, 13, 11]. In this work, we measure the far-infrared-radio relationship in a massive cluster to test how this relationship changes at intermediate z between the field and a high-density cluster environment.

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1. Motivation

The main motivation in conducting this work consists of: (i) a number of work in the local Universe have reported that cluster galaxies appears to have excess radio emission relative to the amount of far-infrared emission [9, 13, 11], (ii) so far, there is no investigations for the far-infrared-radio relation in clusters at higher z , (iii) thus this work aims to explore, for the first time, deviations or lack thereof of the far-infrared-radio relation in intermediate redshift cluster galaxies sample. In this contribution, we present results of studies performed for a massive galaxy cluster MS0451.6-0305 (hereafter, MS0451-03) at $z \sim 0.538$.

2. Observations & Method

The multi-wavelength data used in this work consists of: (i) optical spectroscopic redshift from Keck [4] and from the literature (an optical image of cluster MS0451-03 is displayed in Figure 1), (ii) VLA radio continuum observations at 1.4 GHz, and (iii) Spitzer MIPS and IRAC super mosaic imaging.

Radio data reduction and analysis were entirely carried out using the NRAO AIPS package. The $L_{1.4\text{GHz}}$ were derived following the method of [10]. The IR photometry and data analysis were done using Spitzer MOPEX APEX software. The L_{IR} were derived following the method of [14].

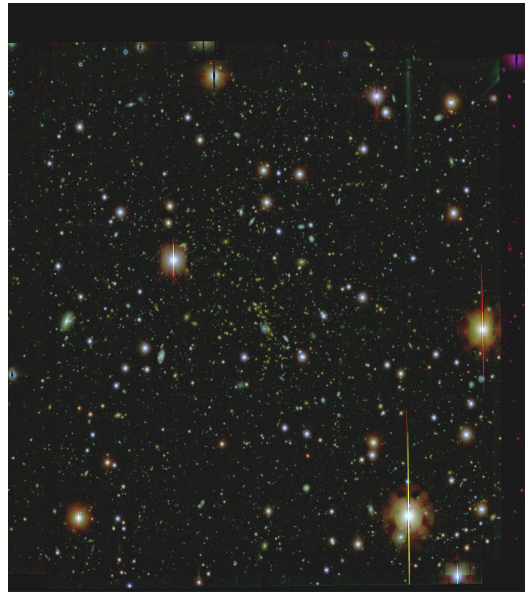


Figure 1: Galaxy Cluster MS 0451.6-0305 at $z=0.538$.

3. Results & Summary

We present our results in Figure 2 (for more details see [12]). The relationship between the

rest frame radio luminosity at 1.4 GHz ($L_{1.4\text{GHz}}$) and the FIR luminosity ($L_{60\mu\text{m}}$) is shown. The solid line indicates the formal linear least-square fit of the cluster galaxies (see [13]) while the field relation (see [17]) is drawn using the dashed line.

In summary, we have constructed the far-infrared-radio relation for all sources with spectroscopic redshift using the Spitzer and VLA observations. We have found a correlation between the two parameters for the cluster star forming galaxies. We have measured q_{FIR} -value of 1.80 ± 0.15 with a dispersion of 0.53 for cluster galaxies which is in broad agreement, within uncertainties, with those for low z clusters (see [12]).

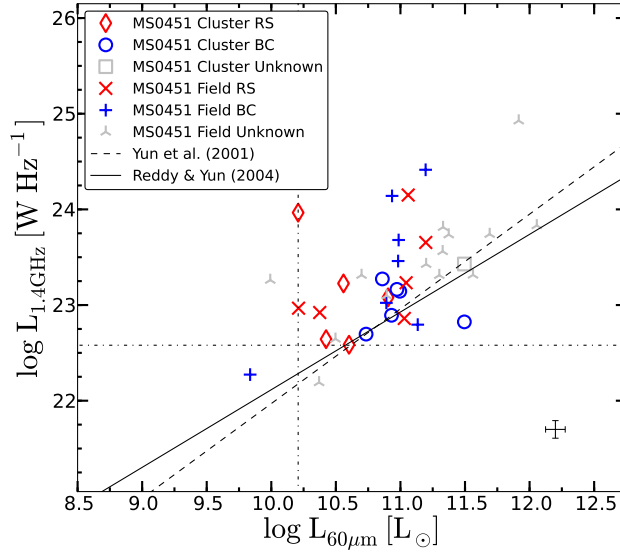


Figure 2: The rest frame radio luminosity at 1.4 GHz ($L_{1.4\text{GHz}}$) and the FIR luminosity ($L_{60\mu\text{m}}$) (see [12]).

4. Future Work

For further work, we: (i) shall expand the present sample into larger samples drawn from redMaPPer/ACT cluster sample in the SDSS Stripe 82 region and study the properties of star formation and AGN activity in clusters; (ii) shall use upcoming radio facilities such as MeerKAT/SKA which will enable us to further expand our sample to cover even more massive clusters at higher z to probe low luminosity star forming galaxies.

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