Galaxies at High Redshift and Their Evolution Over Cosmic Time
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The High-Redshift Clusters Occupied by Bent Radio AGN (COBRA) Survey

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Abstract. The number of confirmed, high-redshift galaxy clusters is very low compared to the number of well-studied clusters nearby. Bent, double-lobed radio sources are frequently found in galaxy clusters, and thus can be used as tracers for efficiently locating high-redshift clusters. Using our Spitzer Snapshot Survey, we have identified approximately 300 potential new clusters with redshifts $0.7 < z < 3$. These objects make up the high-redshift portion of the Cluster Occupied by Bent Radio AGN (COBRA) survey. We have created color-magnitude diagrams using infrared and optical data. Using the colors of the radio source host and the red sequence we can estimate redshifts for our clusters, as well as examine the evolution of the cluster galaxies over a large range of cosmic time.

Keywords. galaxies: active, galaxies: evolution, galaxies: clusters: general, galaxies: high-redshift, infrared: galaxies, radio continuum: galaxies

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Bent, double-lobed active galactic nuclei (AGN) are associated with galaxy clusters up to 80% of the time at low-redshift (Wing & Blanton 2011). They can easily be seen to high-redshift (up to $z \sim 3$ in the 1.4 GHz VLA FIRST survey), and therefore can act as tracers for distant clusters. We have assembled a sample of 646 bent radio sources with host galaxies too faint to be detected in the Sloan Digital Sky Survey, and have observed them in the infrared at 3.6 μm with the *Spitzer* Space Telescope.

To determine how many of the radio sources are in potential clusters, we counted the number of sources in the *Spitzer* 3.6 μm images within a one (or two) arcminute radius centered on the radio source and compared that to the mean number of background counts. To be considered part of a cluster, the field surrounding the radio source must have an overdensity of 10 sources or more within one arcminute or an overdensity of 20 sources or more within two arcminutes. There are 282 fields with overdensities, giving a cluster association rate of 44%. We observed 135 fields at both 3.6 μm and 4.5 μm, so we were able to determine a photometric redshift for these sources using the galaxy model code `EzGal` (Mancone & Gonzalez 2012). The redshift distribution peaks at $z \sim 1$.

References

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