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A MULTI-WAVELENGTH STUDY OF THE FORMING CLUSTER AROUND THE Z=2.16 RADIO GALAXY MRC 1138-262

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We present multi-wavelength observations of a forming cluster around the z=2.16 radio galaxy MRC 1138-262. We study the populations of Lyα and Hα emitters, extremely red objects and X-ray sources. The field of the radio source MRC 1138-262 has been observed at several wavelengths, including deep imaging through narrow band filters corresponding to Lyα and Hα at z$\sim$2.16 (with FORS and ISAAC respectively), several optical and near-IR broad bands (B, R, I, J, H and K), and finally radio and X-ray emission.

We had initially selected about 50 candidate Lyα emitters from the NB observations and we spectroscopically confirmed 15 of them (Pentericci et al. 2000), resulting in an over-density of galaxies which we interpreted as a forming cluster around the central radio source. Subsequently about 60 Hα emitters were selected and 8 of them have been confirmed to be part of the protocluster (Kurk et al. 2002b). Interestingly, the populations of Lyα and Hα emitters being have very different properties: first is their spatial distribution, with the Hα emitters much more concentrated towards the central part of the field, around the radio galaxy (see Fig. 1). Second, the Lyα/Hα ratios of the sources are such that the Hα emitters must be quite dusty objects, while the Lyα emitters are almost dust free, as expected (otherwise the Lyα emission would be heavily depressed). This can only be partially explained by the selection criteria. Furthermore, from the K-band flux which samples the optical rest-frame emission, we find that the Hα emitters are a few times more massive than the Lyα emitters, while the range of star formation rates derived from the emission line flux (mostly between 1 and 60 $M_\odot$ yr^{-1}), is similar for all emitters All these properties seem to indicate that the emitters are two different populations and not just the opposite tails of a single population with a broad range of properties. One possibility is that the Hα galaxies are on average older that the Lyα emitters, therefore they are more massive and their distribution is more relaxed (Kurk et al. 2002a).

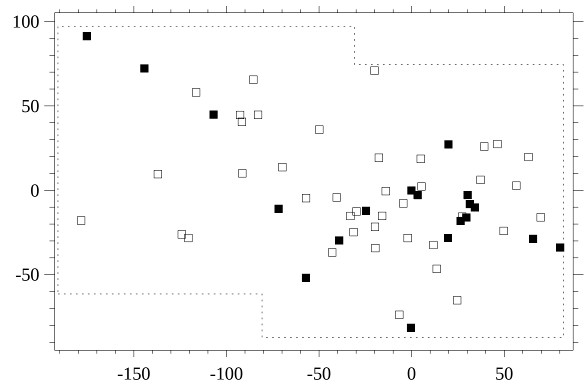

Fig. 1. The positions of the 62 (18) Hα candidate emitters with $EW_0 > 25$ (50) Åindicated by open (filled) squares. The radio galaxy is at the origin. The dotted box shows the 2 ISAAC fields.

In the field we have also found many sources with very red colors (I-K> 5 or even I-K>6), the so called EROs. They have colors expected for passively evolving elliptical galaxies and dusty starburst galaxies at redshift > 1.5. The density of these objects in higher than in field searches and again they tend to be more concentrated towards the center of the field, around the radio galaxy. We therefore speculate that some of these EROs might also be part of the protocluster, but further observations are needed to confirm it.

Finally, we have also observed the field with the Chandra X-ray observatory: besides the radio galaxy we detect emission from 17 other sources, down to a flux of 10^{-15} erg cm^{-2} s^{-1} (Pentericci et al. 2002), about 50% more than what is expected from Chandra deep field counts. We have optically identified all the emitters in the field. Few of these sources coincide with Lyα, Hα candidates or EROs and could actually be AGNs in the protocluster. Two of them have been spectroscopically confirmed: they are AGNs showing broad emission lines at a redshift similar to that of MRC 1138-262.

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