The Zeldovich Universe:
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Galaxy and Mass Assembly (GAMA): Selection of the Most Massive Clusters.

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Abstract. We have developed a galaxy cluster finding technique based on the Delaunay Tessellation Field Estimator (DTFE) combined with caustic analysis. Our method allows us to recover clusters of galaxies within the mass range of 10^{12} to 10^{16} $\mathcal{M}_{\odot}$. We have found a total of 113 galaxy clusters in the Galaxy and Mass Assembly survey (GAMA). In the corresponding mass range, the density of clusters found in this work is comparable to the density traced by clusters selected by the thermal Sunyaev Zel'dovich Effect; however, we are able to cover a wider mass range. We present the analysis of the two-point correlation function for our cluster sample.

Keywords. methods: data analysis, surveys, galaxies: clusters: general, cosmology: miscellaneous, cosmology: observations

1. Introduction

The GAMA survey (http://www.gama-survey.org/) is a multi-wavelength spectroscopic survey that covers ~ 360 deg^2, which includes $\sim 400,000$ galaxy redshifts down to a magnitude limit of $r_{AB} = 19.8$ (Driver *et al.* 2011). We chose three stripes within GAMA that cover ~ 144 deg^2 with $\sim 110,000$ galaxy spectra. These three equatorial sky stripes are centred at 9h, 12h and 14.5h (Driver *et al.* 2011).

We have implemented a new cluster finding technique to find overdensities and estimate cluster masses, simultaneously. We find number galaxy overdensities by using an adaptive method based on the Delaunay Tessellation Field Estimator (DTFE, Schaap & van de Weygaert 2000, Platen 2009), mass estimation is done using caustic analysis (e.g., Serra *et al.* 2011, Alpaslan *et al.* 2012). We use this method to detect clusters of galaxies within the mass range of 10^{12} to 10^{16} $\mathcal{M}_{\odot}$, up to $z = 0.3$.

2. Overview and Results

We have found 113 cluster within GAMA. For this sample we have estimated positions, cluster redshifts, velocity dispersions, cluster sizes, and cluster integrated luminosity. Our algorithm has been tested using the GAMA mock catalogs (Robotham *et al.* 2011). The calculation the cluster luminosities have been generated by using the individual cluster-galaxy luminosity functions (LF) corrected for completeness. We have evaluated the cluster selection function by the application of a simple halo occupation distribution (HOD) model. We want to stress that the density of clusters found by mass selection methods (e.g., the Atacama Cosmology Telescope (ACT), Menanteau *et al.* 2013) is

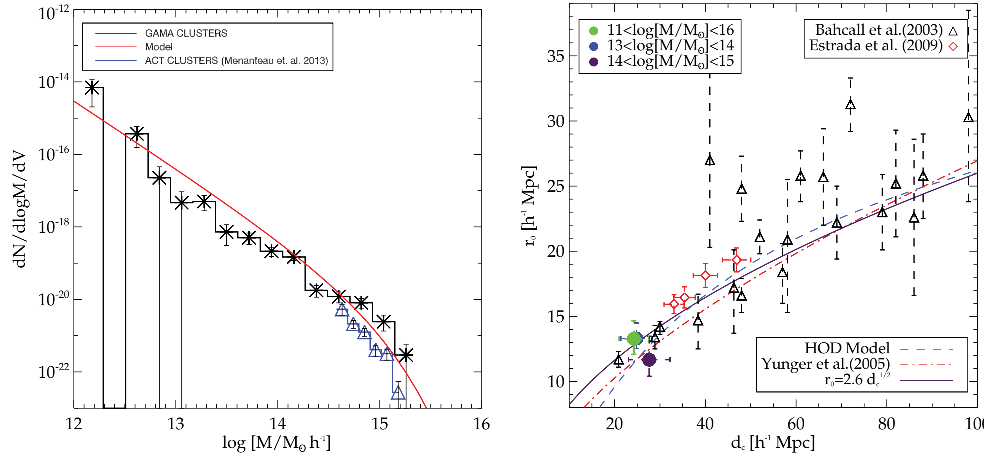

Figure 1. The left panel present the comoving density traced by the cluster found in this study (indicated by filled stars), we have compare our results those of Menanteau *et al.* (2013) generated from a sample of massive clusters selected by the Sunyaev-Zel'dovich effect (open triangles), the continuous dashed line is a simple halo occupation model (HOD). In the right panel we present a compilation of previous results on the characteristic scale for the two-point cluster correlation as a function of cluster separation, the filled big dots represents the results for our sample. We find agreement with previous studies and models

comparable to one found in this work; however, we have covered a larger mass range by more than three orders of magnitude. In addition, we have generated the two-point correlation for clusters of galaxies for our sample. We find broad agreement previous observations and predictions (Estrada *et al.* 2009). We have generated the mass-to-light ratio (M/L) for the clusters and BCGs in our sample, we find that a single power law $\mathcal{L} \propto \mathcal{M}^{\eta}$ can describe . We found $\eta = 0.6 - 1$ for clusters and $\eta_{BGC} = 0.1 - 0.4$ for BCGs. These relations agree with the results of Lin *et al.* (2004) and Lin & Mohr (2004).

The sample found in this study can be used for further studies in galaxy evolution and its relation with environment. We have shown that optical surveys such as GAMA can be used to select cluster by mass. A sample of cluster selected by our method can be used to traced baryon acoustic oscillations using in a survey in which galaxies are selected in the same fashion as GAMA but covering a larger volume.

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