Galaxy Clusters around radio-loud AGN and their evolution across cosmic time

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Abstract

Powerful high redshift radio-loud AGN (RLAGN), are known to preferentially lie in overdense fields and are promising beacons for identifying large-scale structure and galaxy (proto)-clusters. However, due to the relatively small number of confirmed high-z clusters, it is still challenging to draw a clear picture of their formation and evolution.

I will present results of our large Spitzer program, CARLA (Clusters Around Radio-Loud AGN), that has targeted 420 RLAGN at $1.3 < z < 3.2$ for a total of more than 400 hours of Spitzer/IRAC time and that for the first time allows to systematically study the fields of a large sample of powerful RLAGN over a wide redshift range. Studying the density of red color-selected sources shows that ∼200 CARLA fields are rich and compact structures with overdensities established within cells of 0.5 Mpc (Wylezalek et al. 2013). The surface density proves that indeed most of the excess sources are associated with the targeted RLAGN. Two CARLA protoclusters have already been spectroscopically confirmed and more observations with KMOS/MUSE/MOSFIRE and HST are currently being analysed (Wylezalek et al. in prep., Noirot et al. in prep.).

This large (proto-)cluster sample also allows us for the first time at these redshifts, to systematically measure the luminosity function of clusters around RLAGN. Our measurements for m* are consistent with passive evolution models and high formation redshifts ($z_f \sim 3$, Wylezalek et al. 2014). We find a slight trend toward fainter m* for the richest clusters, implying that the most massive clusters in our sample could contain older stellar populations. The results are consistent with cosmic downsizing, as the clusters studied here were all found in the vicinity of RLAGNs – which have proven to be preferentially located in massive dark matter halos in the richest environments at high redshift – and they may therefore be older and more evolved systems than the general protocluster population.