Abstract
We are interested in analysing the environmental effects of the large scale structure (LSS) over the clusters, galaxies and gas. For galaxies, we employ a sample of filaments that are located inside of superclusters of galaxies. We implemented different strategies to probe the bona-fide structure of the filaments. For the gas, we measure the thermal pressure of a sample of clusters using Sunyaev–Zel’dovich effect.

Filament skeleton determination
To confirm the structure of the filaments, we apply different pattern recognition techniques. This analysis employs the spectroscopic redshift and galaxy positions from the SDSS DR8 [1] catalog.

To trace the filament skeleton, we applied a version of the hierarchical clustering which re-group the galaxies by considering their spatial position.

Density estimation
To identify high density regions (filaments, clusters and groups), we applied a Kernel Density Estimator (KDE) and Voronoi Tessellation (VT) [6].

KDE is a non-parametric estimator for a density function probability. It estimates the density considering each observation as a component of the density function. VT works partitioning the space in optimal cells.

Galaxy properties
We produce the color mass diagrams to compare the galaxy population of the cluster, filament and field environments. We employed the stellar mass number provided by MPA-JHU group [3,4].

Figure 2. 2-D density estimation for the structures in the super cluster MSCC310. The VT method provides a density value at each galaxy position. The KDE method detects contiguous high density regions. The filament skeleton trace high density regions.

Gas of galaxy clusters
We compute the thermal pressure profile of a sample of 31 clusters.
We used a combination of Planck and ACT maps (angular resolution of 1.4 arcmin). The ACT map is provided in two stripes, equatorial and southern. We extract the emission profiles and apply a deconvolution-deprojection to obtain the pressure profiles.

Figure 5. Left, Planck+ACT image of a galaxy cluster. Right, the red points correspond to the staked emission profile of individual emission profiles in gray.

Results
We confirmed the bona-fide structure of filaments. Then we study the environmental effects of such filaments over the galaxy properties. Our analysis show that the galaxies in filaments have a red sequence, suggesting more massive and evolved galaxies. We also observed a correlation between the galaxy mass and the distance to the filament. On the other hand, we reconstruct the emission profile and calculate the thermal pressure profile for a sample of clusters with low S/N.

Perspectives
We will use the red sequence to characterize the evolution of galaxies in the different environments. For the gas, we will analyze the thermal pressure in the cluster outskirts, where the gas is not virialized. Furthermore, we will extend this analysis to more samples of cluster and galaxies in order to obtain a representative and statistically results.

References

Figure 1. Example of a filament skeleton inside of the super cluster MSCC310 [2]. The color ellipsoids represent groups of galaxies. The blue lines are the connections between groups with distance lower than 10 Mpc. On the right, result for a super cluster volume, two separate large structures can be observed. Left zoom over the superstructure.

Figure 3. Color mass diagrams for the structures of the filament MSCC310. The clusters (a), filaments (b) show a red sequence suggesting a most evolved galaxy population the field.

Figure 4. Relation between galaxy mass and local density and their distance to the nearest structure determined by the filament skeleton.

Figure 5. Left, Planck+ACT image of a galaxy cluster. Right, the red points correspond to the staked emission profile of individual emission profiles in gray.