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THE COMA CLUSTER FAINT GALAXY POPULATION

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Abstract.
We present preliminary results of new Vimos spectroscopy of faint Coma cluster dwarf galaxies (R≥21). About 1000 spectra where measured along the line of sight. We also present our most recent results regarding spectral characteristics of low surface brightness galaxies, deep galaxy luminosity function, and galaxy orientations in the cluster.

1 Preliminary results of new Vimos spectroscopy of faint Coma cluster dwarf galaxies

We got ∼1000 spectra of faint Coma line of sight galaxies (R∼[21,23]) using the VLT/VIMOS instrument in 2008. Despite the very defavourable Coma declination / VLT latitude, we were able to observe 3 masks at airmasses close to 1.7 and seing of the order of 1.2. The targets were partly selected on the photometric redshift basis and partly randomly in order to increase the number of targets. All data are reduced and we started the analysis of the spectra, measuring first the redshift of the targets. Using 60% of the data, we have a redshift measurement success rate of ∼80%, leading to more than 400 successful measurements (S/N in [3,6] for most of the targets). Among them slightly less than 100 galaxies are part of the Coma cluster. The expected minimum number of galaxies inside the Coma cluster given the target selection was 70, so we are in good agreement with the predictions. This already represents a major breakthrough because spectroscopically, basically nothing was known fainter than R=21. We also confirm the very diffuse shape of the faint Coma cluster galaxies. At least part of them are faint low surface brightness galaxies detected in Adami et al. (2006). Very few of these galaxies have emission lines and the majority of the sample is consistent with post starburst objects. More detailled results will be given in a forthcoming paper.

2 Spectral characteristics of the Coma cluster faint low surface brightness galaxies

As a continuation of our study of faint Low Surface Brightness Galaxies (Adami et al. 2006) in one of the densest nearby ($z = 0.023$) galaxy regions known, the Coma cluster, we used here u* (Megacam), B, V, R, and I (CFH12K) band data in order to put constraints on the Coma cluster faint low surface brightness galaxy spectral characteristics. By comparing the broad band spectral energy distribution with population synthesis models, we infered photometric redshifts (to confirm the Coma cluster membership), ages, dust extinction and photometric types. A large part of our sample is consistent with being in Coma. Assuming that all fLSBs are part of the Coma cluster, the spectral fits agree with our previous interpretation, i.e. galaxies on the extended color magnitude relation are relatively old, the reddest ones exhibiting similar ages, and the bluest ones being

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the youngest. Besides the fact that we confirm the detection of 683 fLSBs in u* compared to our previous BR detections, we show that a majority are part of the Coma cluster. These objects can tentatively be divided into 3 classes: (a) those that have evolved passively after an initial burst of star formation (the fLSB primordial population of the cluster); (b) those that have been removed from massive old galaxies, and (c) those that have been torn away from the outer regions of blue galaxies.

3 Photometric redshifts as a tool to study the Coma cluster galaxy luminosity function

We apply photometric redshift techniques to an investigation of the Coma cluster galaxy luminosity function (GLF) at faint magnitudes, in particular in the u* band where basically no studies are presently available at these magnitudes. Cluster members were selected based on probability distribution function from photometric redshift calculations applied to deep u*, B, V, R, I images covering a region of almost 1 deg^2 (completeness limit R$\sim$24). In the area covered only by the u* image, the GLF was also derived after a statistical background subtraction. Global and local GLFs in the B, V, R, and I bands obtained with photometric redshift selection are consistent with our previous results based on a statistical background subtraction (Adami et al. 2007a and b). The GLF in the u* band shows an increase in the faint end slope towards the outer regions of the cluster: the $u*$ GLF slope varies from $\alpha \sim -1$ in the cluster center to $\alpha \sim -2$ in the cluster periphery. The analysis of the multicolor type spatial distribution reveals that late type galaxies are distributed in clumps in the cluster outskirts, where X-ray substructures are also detected and where the GLF in the u* band is steeper. The concentrations of faint late type galaxies in the cluster outskirts could explain these very steep slopes, assuming a short burst of star formation in these galaxies when entering the cluster.

4 Galaxy orientations in the Coma cluster

Models of large scale structure formation predict the existence of preferential orientations for galaxies in clusters. In this context, we have searched for preferential orientations of very faint galaxies in the Coma cluster (down $I_{Vega}$$\sim$-11.5). By applying a deconvolution method to deep u* and I band images of the Coma cluster, we were able to recover orientations down to very faint magnitudes, close to the faintest dwarf galaxies No preferential orientations are found in more than 95% of the cluster area, and the brighter the galaxies, the fewer preferential orientations we detect. The minor axes of late type galaxies are radially oriented along a northeast - southwest direction and are oriented in a north - south direction in the western X-ray substructures. For early type galaxies, in the western regions showing significant preferential orientations, galaxy major axes tend to be oriented perpendicularly to the north - south direction. In the eastern significant region and close to NGC 4889, galaxy major axes also tend to point toward the two cluster dominant galaxies. In the southern significant regions, galaxy planes tend to be tangential with respect to the clustercentric direction, except close to (α=194.8, δ=27.65) where the orientation is close to -15 deg. Early and late type galaxies do not have the same behaviour regarding orientation. Part of the orientations of the minor axes of late type galaxies and of the major axes of early type galaxies can be explained by the tidal torque model (e.g. Peebles 1969) applied both to cosmological filaments and local merging directions. Another part (close to NGC 4889) can be accounted for by collimated infalls (e.g. Torlina et al. 2007). For early type galaxies, an additional region ($\alpha = 194.8, \delta = 27.65$) shows orientations that probably result from local processes involving induced star formation.

References

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