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LYα EMITTERS AS TRACERS OF PROTO-CLUSTERS OF GALAXIES AT HIGH-Z: RLQSOS AND RQQSOS ENVIRONMENT

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The great capability and flexible nature of the OSIRIS-GTC tunable filters make them the most efficient tool to study systematically the environment of RLQSOs and RQQSOs in the range $2 < z < 4$. In this work we present our first results on simulations performed in order to define our optimal observational strategy.

The basic idea of this project (see Benítez et al. 2005) is to detect Lyα emitters within 5 Mpc ($\sim$ 12.5 arc min) around our target QSOs, possibly the sites of proto-cluster formation, above a line-flux threshold corresponding to faint emitters, i.e., 1×10^{-17} erg cm^{-2} s^{-1} at $z = 4.5$ (e.g. Dawson et al. 2004). The basic idea is to observe at least 3 RQQ and 2 RLQ in three redshift windows (2.35, 3.05, 4.25), in order to study possible environmental dependencies and their evolution. Control fields $\sim$20-30 Mpc away from each target will also be observed in order to quantify the significance of possible overdensities around our target QSOs. Simulations show that filter widths of $\sim$ 350 km s^{-1} are sufficiently large to be consistent with typical galactic masses while sufficiently small to recover also the dynamics of the proto-clusters. The expected integration time, per spatial pointing and wavelength tuning in order to reach $S/N = 3$ at the detection threshold, is $150 < t_{\rm integ} < 750$ s, depending on the z-window. The minimal number of pointings and λ-tunings necessary for the aims of our project are estimated using detailed simulations, which show that our initial project objectives can be carried out within $\sim$15-20 hours of OSIRIS guaranteed time.

In order to test whether our observations of Lyα emitters in the proto-cluster environment will be able to recover the dynamical properties of the proto-cluster, we have simulated the detection procedure on various ΛCDM clusters and at the different redshift windows. Our original set-up assumes that (a) proto-clusters are either dynamically active (non-relaxed) with two sub-cluster components merging, or dynamically quiescent, forming by slowly accreting material along the filament within which they are embedded and (b) that the QSO (target redshift) is situated at the center of the overall proto-cluster potential well. We have found that for an expected range of proto-cluster velocity dispersions (plus possible bulk motions) and in order to recover the dynamical properties of the simulated proto-clusters it is necessary to perform two tunable filter observations, shifted with respect to each other by 2000 km s^{-1}, and with a λ-tuning that yields a 600-700 km s^{-1} width, corresponding to a 300 km s^{-1} uncertainty in the radial velocity of each emitter.

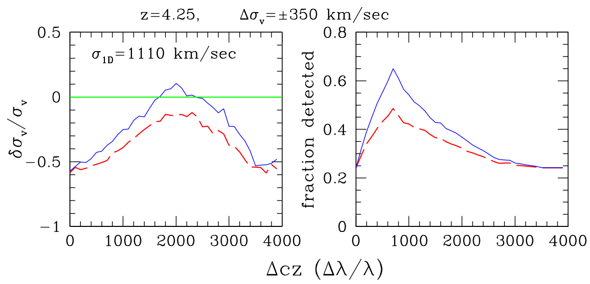

Fig. 1. Results from applying our observation strategy on a simulated ΛCDM cluster (see text).

In Figure 1 (left panel) we present for one case, the fraction of the recovered cluster velocity dispersion (of σ_{1D}=1110 km s^{-1}) as a function of the wavelength shift of the tunable filter, which arises from the spatial variation of the filter wavelength sensitivity. Of course we have assumed that the Lyα emitters are tracing the cluster potential well. The broken line corresponds to one tunable filter observation while the continuous line to the double observation, described above. The right panel shows the corresponding fraction of the Lyα emitters that will be detected by these observations.

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