Contributed Talk

Splinter Computation

Constraining Feedback Prescriptions with Lyα Absorption

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Understanding the physics of the intergalactic and circumgalactic media (IGM and CGM) is fundamental to study galaxy formation in a cosmological context. Galactic winds, supernovae and AGN feedback alter the physical state of the CGM, although the details of these processes are still poorly understood. Lyman-α (Lyα) absorption represents a powerful tool to probe the physics of both CGM and IGM. For the first time, we compare the predictions of the state-of-the-art Nyx and Illustris hydrodynamic cosmological simulations with observations of Lyα absorption around foreground galaxies at different transverse separations from background quasars (between $\sim 25\,$kpc and $\sim 17\,$Mpc). For the first time, we show that the exquisitely precise BOSS measurements of the mean Lyα absorption in the range of transverse distance from galaxies $(1,\, 17)\,$Mpc are capable of discriminating between the predictions of the simulations considered. As such, they can set tight constraints on the physics implemented in cosmological simulations. Furthermore, Nyx and Illustris predict a different Lyα absorption for transverse distances $< 1\,$Mpc but larger than the virial radius, which we argue are due to the different feedback prescriptions in the two simulations, although they are consistent with the error bars of the observations in this regime. We thus call for future observations to increase the precision of measurements out to $\sim 1\,$Mpc in the CGM, as that would allow setting tighter constraints on simulations. Nyx and Illustris underpredict the mean Lyα absorption within the virial radius. Through the implementation of a a novel semi-analytic technique to alter the temperature of the CGM in post-processing, we discuss how this discrepancy could be mitigated in order to improve feedback prescriptions in future simulations. To summarize, the main conclusion of our work is that, considering the constraining power given by current and near-future observations, the comparison

of Lyα absorption data both in the CGM and IGM with predictions of simulations should become a standard test to constrain feedback prescriptions.