The abundance, distribution, and physical nature of highly ionized oxygen OVI, OVII, and OVIII in IllustrisTNG

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Abstract

I will describe our exploration of the abundance, spatial distribution, and physical properties of the OVI, OVII, and OVIII ions of oxygen in circumgalactic and intergalactic media (the CGM, IGM, and WHIM) using the TNG100 and TNG300 large volume cosmological magneto-hydrodynamical simulations. Modeling the ionization states of simulated oxygen, we find good agreement with observations of the low-redshift OVI column density distribution function (CDDF), and present its evolution for all three ions from z=0 to z=4. Producing mock quasar absorption line spectral surveys, we show that the IllustrisTNG simulations are fully consistent with constraints on the OVI content of the CGM from COS-Halos and other low redshift observations, producing columns as high as observed. We measure the total amount of mass and average column densities of each ion from sub-L* to massive clusters, 10ˆ11 < Mhalo/Msun < 10ˆ15, including the predicted radial profiles decomposed into the 1-halo and 2-halo terms. I will relate halo OVI to properties of the central galaxy, where we find a correlation between the (g-r) color of a galaxy and the total amount of OVI in its CGM. In comparison to the COS-Halos finding, this leads to a dichotomy of columns around star-forming versus passive galaxies at fixed stellar (or halo) mass. I will show how this correlation is a direct result of blackhole feedback associated with quenching and represents a causal consequence of galactic-scale baryonic feedback impacting the physical state of the circumgalactic medium. I will conclude by discussing the X-ray properties of TNG halos and then, going further, will show the predictive power of new large-volume simulations like IllustrisTNG for future 'direct imaging' observations of both CGM and IGM hydrogen and metals in emission.

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