Origins, distribution and kinematics of circumgalactic O VI around z _˜ 0 L* galaxies in cosmological zoom-in simulations

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Abstract

We present results on the origins, distribution and kinematics of O VI absorbers around star-forming L* galaxies at z _˜ 0 from detailed comparisons between the high-resolution zoom-in simulations "Eris" and "Venus" and the COS-Halos data. Synthetic spectra are generated in post-processing, taking into account radiation from the UV background and local star formation. At z _˜ 0, the O VI column density is between 10ˆ14 to 10ˆ15 cmˆ-2 up to 300 kpc, consistent with the COS-halo data. This column density appears to remain unchanged from z = 3 to z = 0 in the range of 10-100 kpc. The mass distribution of the circumgalactic OVI peaks at the virial radii for all redshifts. Majority of the gas traced by O VI is warm-hot corona gas with temperature 10ˆ5 K < T < 10ˆ6 K, and density around 10ˆ-5 - 10ˆ-4 cmˆ-3, and they are mainly collisionally ionised. But photoionisation also has a non-negligible impact on O VI abundance beyond 100 kpc. We track gas particles with high O VI abundances at z = 0 back to z = 3 to identify its origins, and find that it is predominately from cooling of hot (T > _˜ 10ˆ6) corona gas. However, unlike the classical interpretation of hot mode shock accretion, the corona gas is mainly heated by energy injected from supernova feedback. At all redshift, majority of the gas traced by O VI is outflowing, although the fraction of inflowing component increases with time. We also explore the correlation between O VI absorbers and the low ionisation absorbers (e.g. H I, C II, Si III and Mg II). Although the simulations reproduce well the observed column density distribution of H I, they underpredict the column densities of low metallic ions, indicating the need of alternative non-thermal feedback, or a better resolution for the CGM in cosmological simulations.

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