

The Evolution of Metals in the Intergalactic Medium

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Theory: Yes

Abstract

We propose to study the impact of metal and energy deposition from galactic winds on the diffuse IGM at $z < 2$, by comparing cosmological hydrodynamic simulations with UV quasar absorption line data from the STIS archives. Metal enrichment provides a unique probe into the cumulative star formation history of the cosmos, and the ubiquitous presence of metals in the intergalactic medium should yield important constraints on models of galaxy formation and feedback. We have incorporated galactic winds into hydrodynamic simulations in order to properly model the complex interactions of infalling and outflowing gas within a full hierarchical structure formation scenario, employing parameterizations based on locally-observed correlations of outflows with galaxy properties. Our preliminary comparisons with $z > 2$ IGM and galaxy observations are surprisingly promising. To fully test our model and understand the metal history of the universe, we propose to extend our comparisons to $z = 0$, thereby probing the bulk of the Universe's age. STIS echelle spectra uniquely provide the resolution and data quality needed to constrain metal absorption in the diffuse IGM, and we have identified over 30 archived quasar spectra suitable for this purpose. We will engage in careful comparisons of these versus simulated spectra, for which we already have the tools in-hand, in order to test and tune our feedback models. A self-consistent model of galactic feedback would open up new avenues for understanding such puzzles as the missing metals problem, the existence of highly enriched objects at early times, the presence of metals in quiescent and diffuse intergalactic gas, and the source and epoch of intracluster gas enrichment.

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Number of investigators: 2