A New Statistical Method for Measuring the Temperature-Density Relation in the IGM using the b-N Distribution

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Abstract

We present a new method for measuring the parameters of the temperature-density relation of the intergalactic medium based on Voigt profile fitting. The traditional method is based on quantifying the position of a thermal state dependent cutoff in the distribution of hydrogen absorption line-width and column-density (b-N distribution). In order to go beyond the limitations of cutoff fitting, we present a new statistical method based on Kernel density estimation for modeling the full b-N distribution. To test this method, we use a custom built model emulator to explore the sensitivity of the shape of the b-N distribution to the temperature-density relation of the IGM using simulated spectra from collisionless simulations at z=2. Preliminary tests show that this method allows us to measure the parameters of the temperature-density relation with a typical precision of 0.05 in gamma and 0.04 in logT0 using mock data with a pathlength of 300 Mpc/h.

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