New HI Reionization Constraints from the High-z Lyman-alpha Forest

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Abstract

How and when the first luminous sources reionized diffuse baryons in the intergalactic medium (IGM) is one of the most fundamental open questions in cosmology. I will show that even after reionization is complete, its thermal vestiges persist in the IGM to much later times. Therefore by measuring the thermal state of the IGM from the statistics of the high-z (z_˜5-6) Lyman-alpha forest, we can place constraints on reionization. I will show results from hydrodynamical simulations that make use of a new method to generate self-consistent inhomogeneous thermal and reionization histories. This new methodology allows us to study in detail the effect of these different histories in the Lyman-alpha forest. I will present the first direct constraints on when HI reionization happened and how much energy per atom was injected into the IGM using the flux power spectrum of high resolution quasar spectra at z> 5. I will discuss the different degeneracies of this measurement and present a forecast for the datasets that will soon be available thanks to the dramatic fivefold increase in the number of z> 6 quasars discovered in recent years from deep wide-field optical/IR surveys.

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