Constraints on HI photoionization rate and escape fraction at z < 0.5 from Ly-alpha forest

Prakash Gaikwad*[1], Raghunathan Srianand[1], and Tirthankar Roy Choudhury[2]

[1]Inter-University Centre for Astronomy and Astrophysics (IUCAA) – Post Bag 4, Ganeshkhind,, S. P. Pune University Campus,, Pune, Maharashtra 411007, India
[2]National Centre for Radio Astrophysics (NCRA) – Pune University Campus, Ganeshkhind, Pune, Maharashtra - 411007, India;, India

Abstract

An accurate characterization of the ultra-violet background (UVB) is necessary for modelling the physical conditions of IGM, ionization corrections to derive metallicities and census of baryons. We constrained the HI photoionization rate in 4 redshift bins at z < 0.5 by comparing SPH simulations with unprecedented quality HST-COS Ly-alpha forest spectra towards 82 QSO sightlines. We present a new semi-numerical method for the evolution of IGM temperature in the post-processing step of Gadget-2. The Ly-alpha forest spectra generated from this simulation are remarkably similar to the observed spectra.
We compare simulated spectra with observations using three statistics: flux PDF, flux power spectrum and column density distribution function. We also compute systematic uncertainties arising from possible degenerate thermal histories of the universe. We obtained the best fit HI photoionization rate and associated error using proper statistical analysis taking into account the appropriate covariance matrix. Using the cosmological radiative transfer code we find that our new constraints on HI photoionization rate can be easily achieved without any contribution to the UVB from galaxies. Our study confirms that there is no crises at low redshift in accounting for the observed Lyman continuum photons using standard known luminous astronomical sources.

*Speaker