Reanalysis of the simulated Lymanα Forest

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Our aim is to investigate how Lyα clouds originating from different regions (filamentary structures and underdense regions) contribute to the forest and how they do evolve along a line of sight between $z = 0$ and $z = 5$. Thus it is necessary to compare the computed spectra and observational data analysing both by identical methods of Voigt profile fitting.

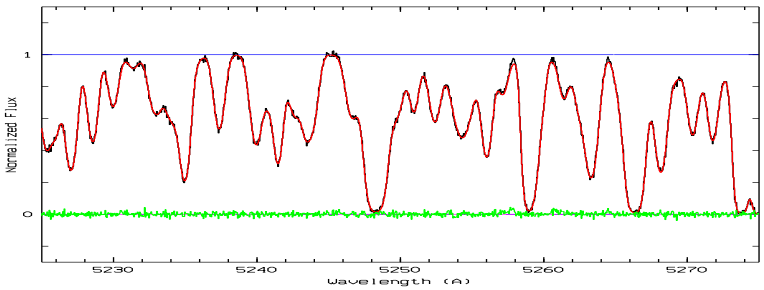

Figure 1: Typical MIDAS fit to a computed spectrum, difference is given at zero-level

The well established MIDAS package FITLYMAN by Adriano Fontana and Pascal Ballester has been improved and developed to a fully automated fitting procedure. For a given spectrum, the procedure searches for individual absorption features and thus separates single fittable line systems. Then it determines the expected minimum number of absorption lines for each single system by calculating the number of visible minima in the system and starts fitting these lines with the most probable parameters for column density $N_{\rm HI}$ and Doppler parameter b according to given redshift z. It then increases the number of lines by adding a further line at the largest difference between the fit and the data and fits the line system again. This continues until a sufficient χ^2 is reached. This procedure has been applied to computed spectra (see Fig. 1) from our simulation of the Lyα forest (Mücket et al. [3], Riediger et al. [5]).

In Fig. 2 we compare the column density distributions for three different treatments of our simulation data at redshift $z = 3.0$ with observational data. The solid line takes only those clouds into account which are found in the

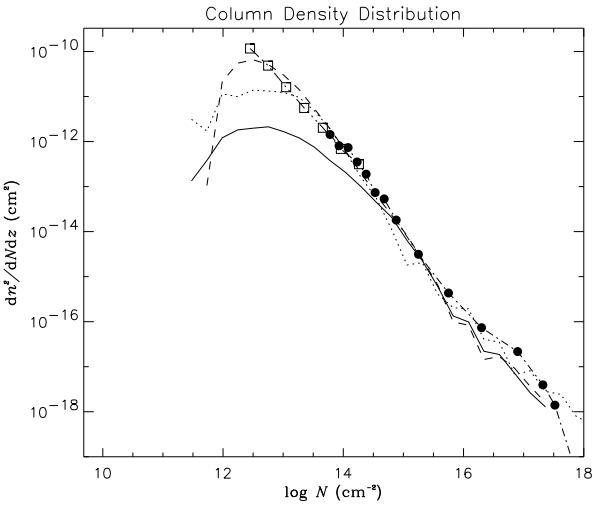

Figure 2: Observed and simulated column density distributions

filamentary component (cf. Mücket et al. [3]). The dashed line includes also the clouds in underdense regions which dominate the population of Lyα clouds for column densities $\log N_{\rm HI} < 14.5$. These two curves are computed directly from 50 line-of-sights obtained from simulated data (cf. Mücket, this volume). The dotted line shows the distribution when fitting the lines from a sample of 10 computed spectra from the same simulation. It can be seen that the distribution fits the observation well for $\log N_{\rm HI} > 13.3$ but at low column density due to blendings a strong drop can be noticed.
For comparison observations are given from Hu et al. [2] (dashed-dot-dot-dotted line with squares) and Petitjean et al. [4] (dash-dotted line with filled circles). Note that the dotted line obtained from the reanalysis by line fitting reproduces the deficiency at $\log N_{\rm HI} > 14.5$ quite well.

References

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