On the detectability of the Lyman continuum from distant galaxies

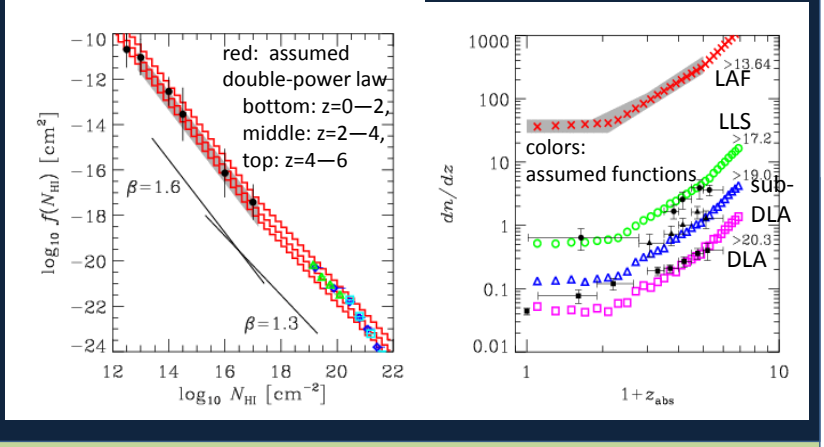
Akio K. INOUE (Osaka Sangyo Univ.) & Ikuru IWATA (NAOJ)

Abstract

We performed a Monte Carlo simulation of the IGM absorption to discuss the detectability of the Lyman continuum from distant galaxies. For an input distribution function of the intergalactic absorbers, we derived an empirical **"unified distribution function" of all types of absorbers .** The obtained transmission is consistent with other studies **except for Madau (1995)**. We expect a good correlation between Lyman α opacity and Lyman continuum opacity. We also expect the **probability to have a transparent (τ<1) line of sight in the source Lyman continuum of 50% for z=3.1 and of 18% for z=3.7**.

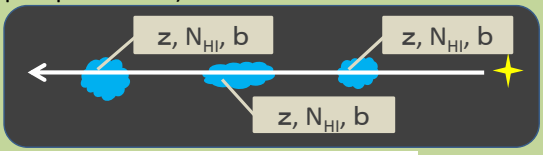
Absorbers' statistics: a "unified distribution function"

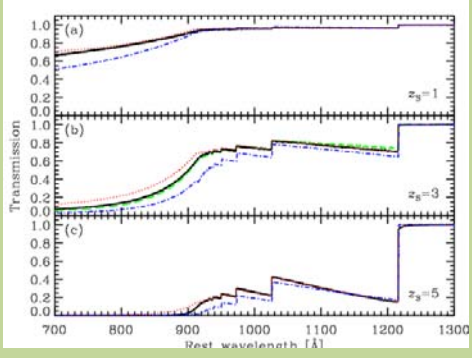
We derive an empirical distribution function of the intergalactic absorbers which reproduces recent observational statistics of the Lyman α forest (LAF), Lyman limit systems (LLSs) and damped Lyman α systems (DLAs) simultaneously. In particular, we assume a common functional form of the number evolution along the redshift for all types of absorbers rather than different functions for each type.



Monte Carlo simulation of IGM absorption

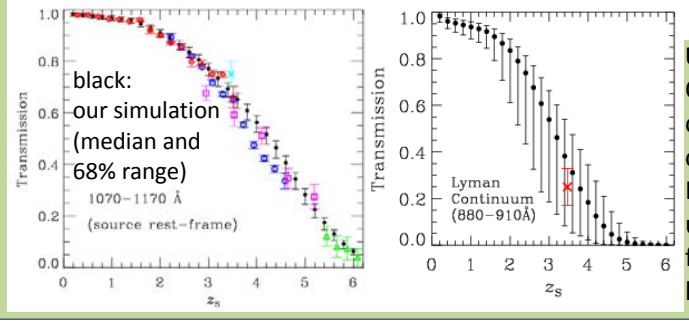
The absorber's properties (redshift, column density, and Doppler parameter) are drawn from the absorbers' statistics.

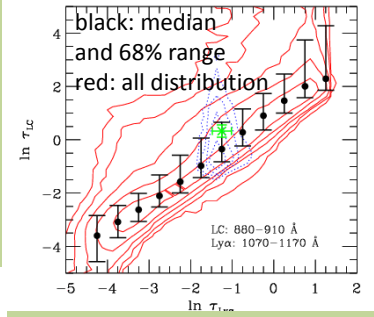




Upper panel; average transmission [black: our simulation, red: Meiksin (2006), green: Bershady et al. (1999), blue: Madau (1995)] Our simulation is consistent with other studies except for **Madau (1995) which seems to underestimate the transmission.**

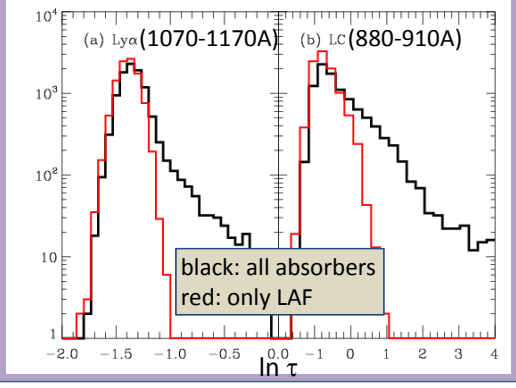
Bottom panels; left: Lyman α transmission, right: Lyman continuum transmission
The Lyman series transmissions in our simulation (black points with 68% range in the distribution) reproduce the observed redshift evolution of the transmissions excellently, and the Lyman continuum transmission also agrees with an observed estimation based on Steidel et al. (2001).





Upper panel: Lyα-LC correlation
Our simulation expects a good correlation between the Lyman continuum opacity and the Lyman α opacity, which may be useful to estimate the former from the latter for an individual line of sight.

Opacity distribution function for z=3



Detectability of the Lyman continuum from z=3-4

We have a chance to have a clean line of sight (τ<1) in the source Lyman continuum:

50% for z=3.1 (NB359)
18% for z=3.7 (NB413)

Narrowband imaging of the Lyman continuum is very interesting because we can trace the photon escaping region directly!