Empirical Estimate of Lyα Escape Fraction in a Statistical Sample of LAEs

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Lyman-alpha emission line has become a fundamental cosmological tool. However, all cosmological quantities and interpretations, based on this line, are prone to severe uncertainties. This is particulary the case for high-redshift Lya-oriented studies.

The determination of the amount of Lyα radiation that escapes from the host starburst is probably the most important step towards the calibration of high-z observations, and cosmological simulations of LAEs.

We here empirically estimate the Lyα escape fraction in a large sample of Lya emitters, which consists of z ~ 0.3 GALEX LAEs and local IUE starbursts. We then study the evolution of *fesc*(Lyα) with the nebular extinction E(B-V).

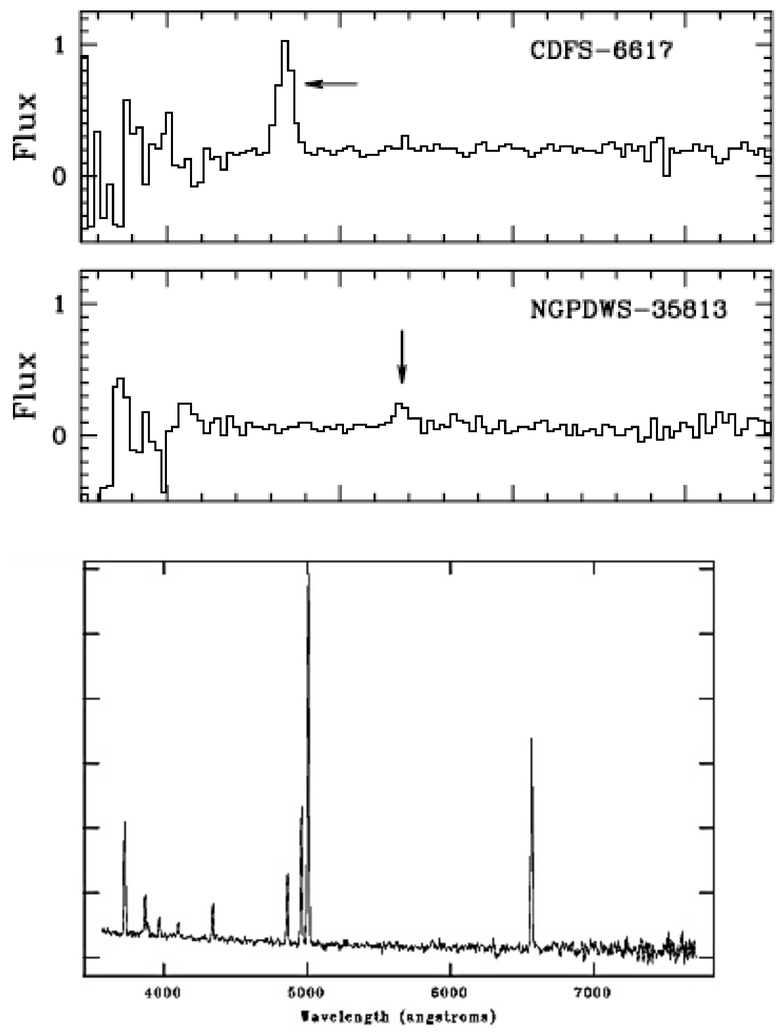

Fig. 1 Examples of GALEX UV (top) and NTT/EFOSC2 optical (bottom) spectra. The potential Lyα feature identified by Deharveng et al. (2008) is marked with an arrow. Optical spectra cover a large wavelength range of 3690 - 9320 Å, including in particular Ha and Hb recombination lines.

Main Results

- fesc(Lyα) is anything but constant: from 0.5% to 100%
- fesc(Lyα) clearly decreases with incresing nebular dust extinction

Few bjects show fesc(Lyα) > fesc(continuum)
→ clumpy or aspherical ISM

- Fitting our data yields an extinction coefficient k(Lyα) closer than expected by models to that of the continuum

Caution: selection and aperture size effects may lead to a significant difference between local starbursts and high-z Lyα-selected galaxies (LAEs)

$$\text{fesc(Ly}\alpha) = f\,(\text{Ly}\alpha) \,/\, [8.7 \times f\,(\text{H}\alpha)cor]$$

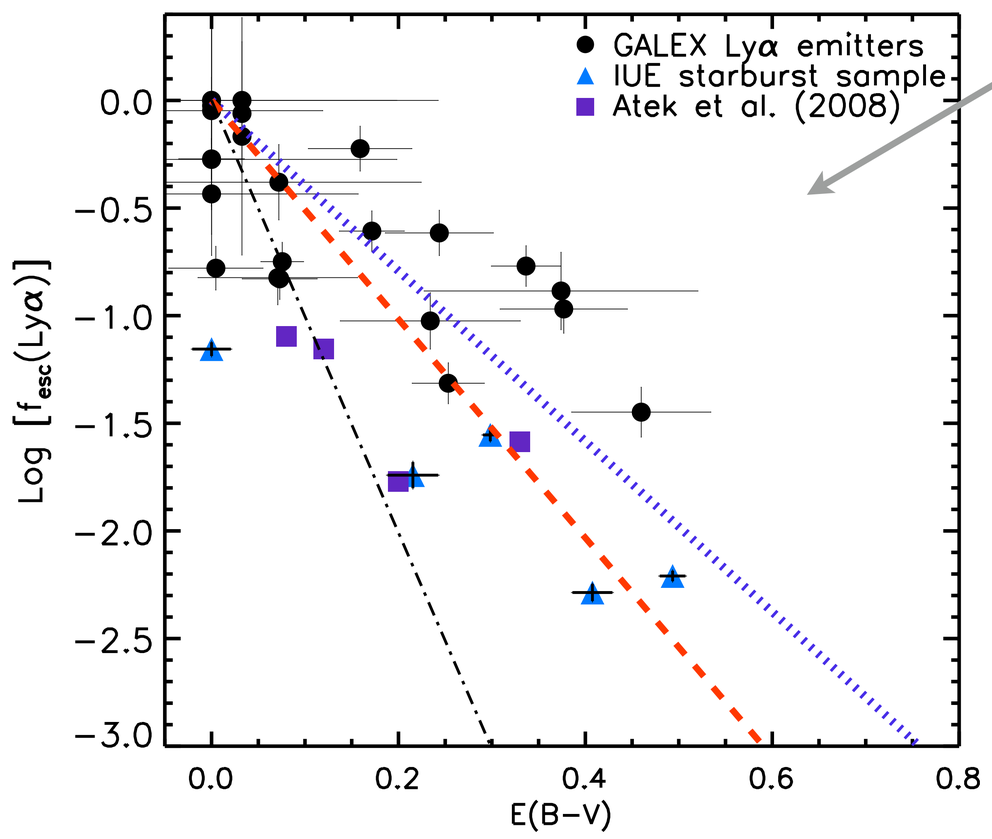

Fig. 2 Lyα escape fraction as a function of dust extinction, observed in both local and z ~ 3 galaxies. The red dashed line is the best fit to all the observations (*GALEX, IUE*, and Atek et al. samples). The dark dot-dashed line represent the best fit determined by Verhamme et al. (2008) from spectral fitting of *z* ~ 3 LBGs. The blue dotted line corresponds to the escape fraction of the continuum attenuated by dust extinction.

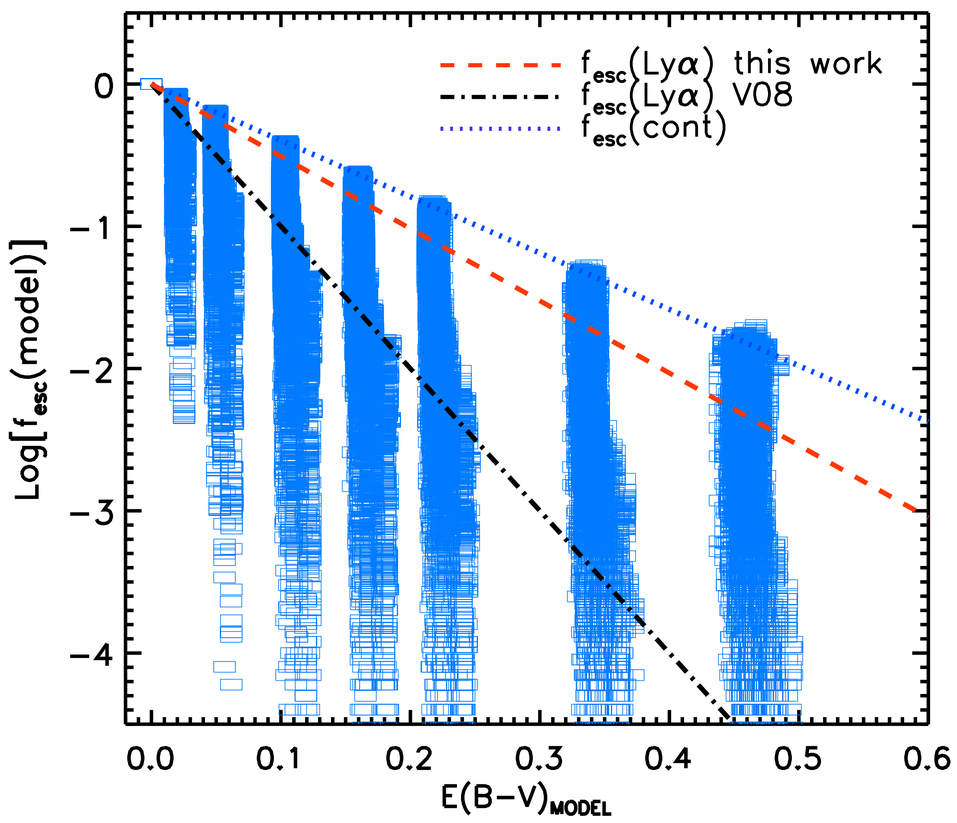

Fig. 3 Predictions for *fesc*(Lyα) using a 3D Lyα radiation transfer code (Verhamme et al. 2006). The dark curve is the best fit for modeled z ~ 3 LBGs (Verhamme et al. 2008) and the blue rectangles (forming columns) are the predicted values of *fesc* (Lyα) versus *E*(*B* – *V*) (Hayes et al. 2009b) using all combinations of the remaining parameters that affect Lyα escape (vexp , *N*(H), *b* ...). The two remaining curves are the same as in Fig. 2.

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