COSMIC EVOLUTION OF THE LYα LUMINOSITY DENSITY

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in part with data obtained with the GALEX Science Team

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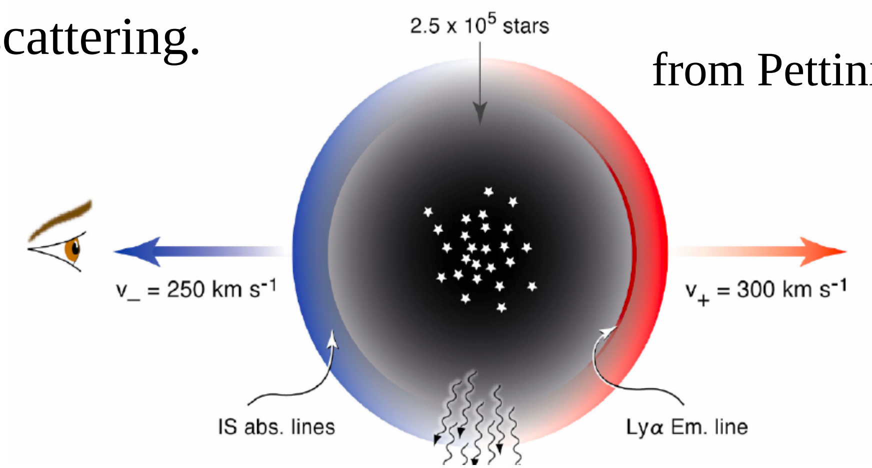
Motivations and introductory remarks

✓ The relation between the Lyα emission from galaxies and their massive stars (or SFR) is not straightforward because of the resonant scattering.

- Lyα escape fraction
- Role of velocity

from Pettini



✓ Lyα luminosity functions are now available over a large redshift range.

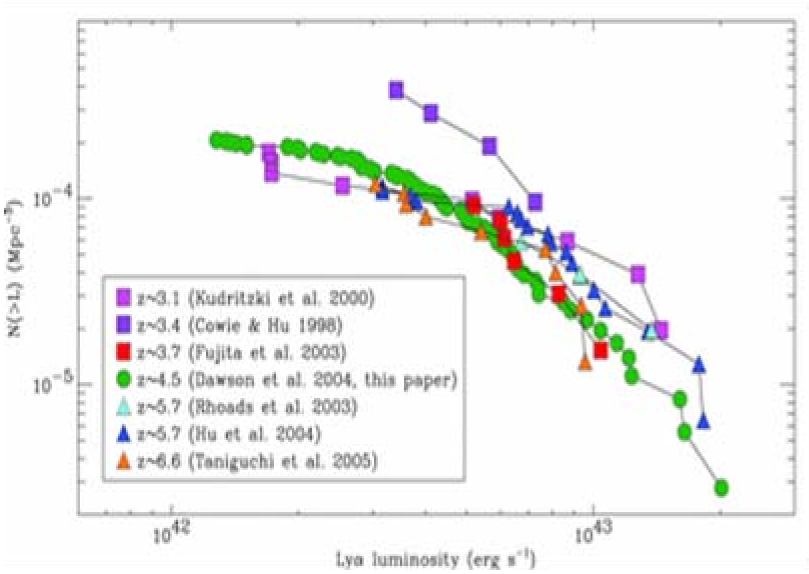
⇒ Can we learn something on the Lyα escape fraction, its cosmic evolution, (or how much Lyα departs from a regular SFR tracer)?

Lyα LUMINOSITY FUNCTIONS

✓ From z ~ 3 to 5.7

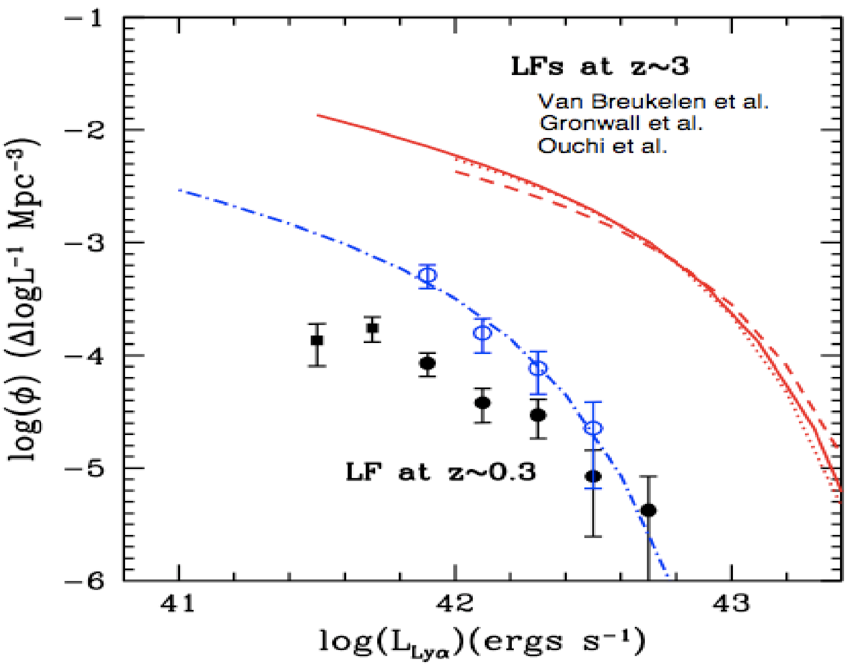
no significant evolution reported

(e.g. Van Breukelen et al. 05, Ajiki et al. 06, Tapken et al. 06, Shimasaku et al. 06, Dawson et al. 07, Ouchi et al. 08)



✓ Extension at low-z (0.2 < z < 0.35) with GALEX spectroscopy (Deharveng et al. 08):

- Grism survey (8 A resolution)
- Over 5.6 sq deg
- Blind search
- Small telescope
- Incompleteness issue (grism)



METHODS AND WARNINGS

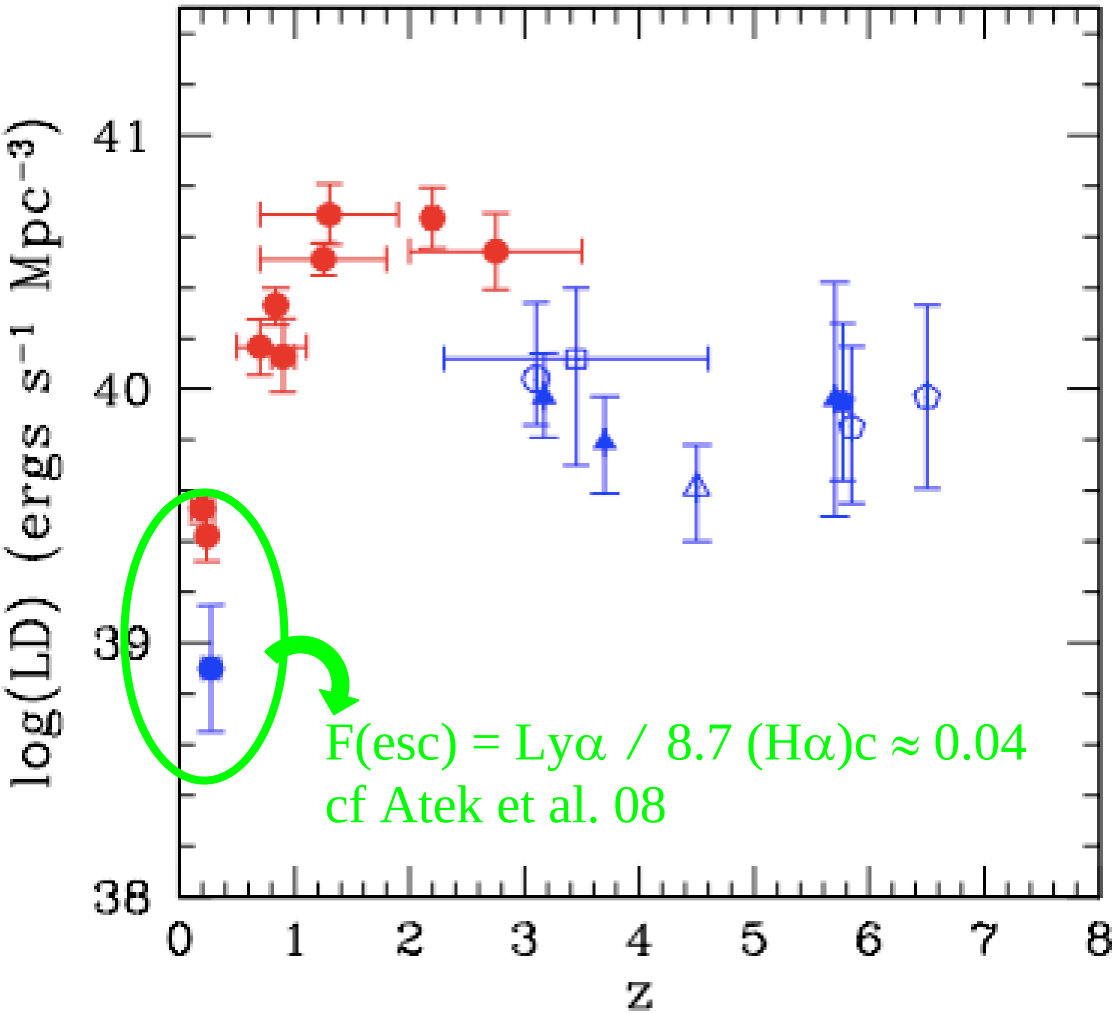
A comparison with UV or Hα is needed to provide a reference for the massive stellar content evolution.

Comparison has to be made in terms of Luminosity Densities.

The faint-end slopes of the Lyα Luminosity Functions are an issue. They are ill-defined and only assumed, with values (-1.6, -1.5); at least comparison of $L^*\Phi^*$

Method not appropriate at re-ionization

COMPARISON OF Lyα AND Hα LUMINOSITY DENSITIES



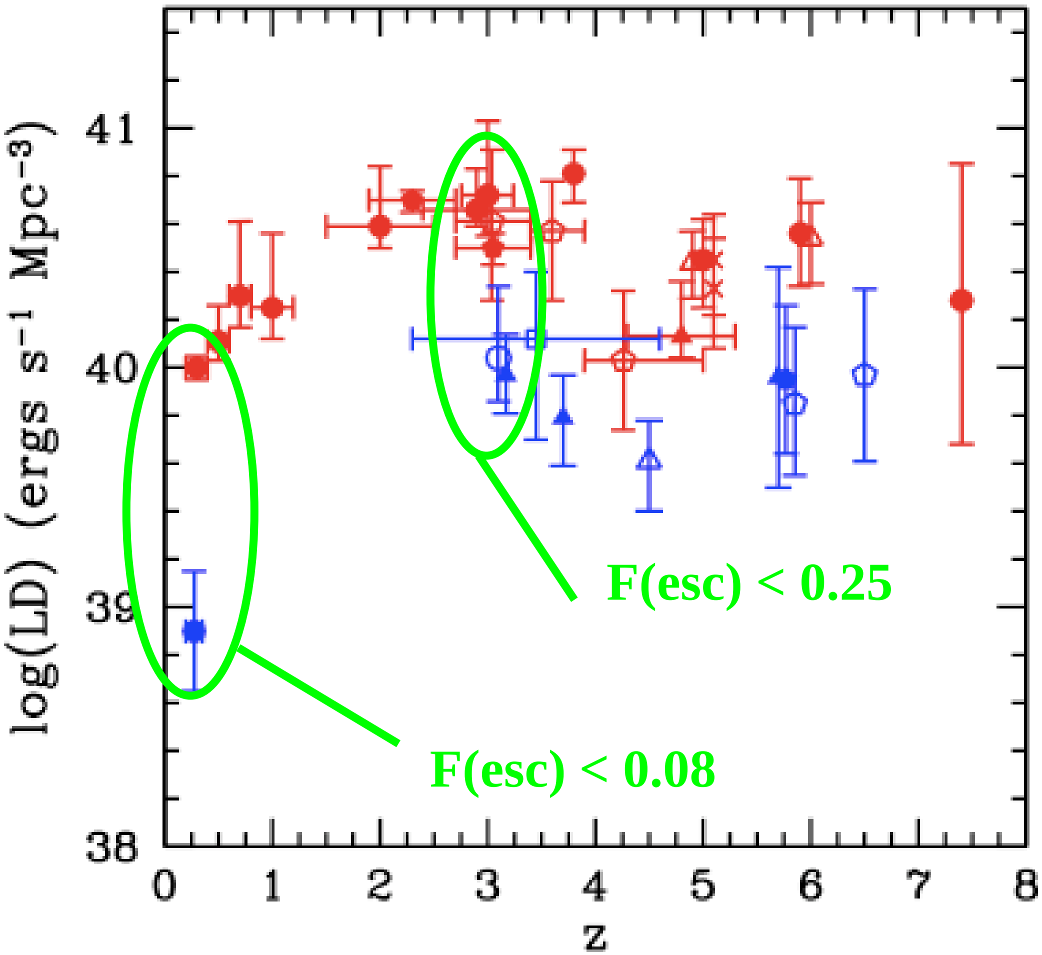
RED: Hα (dust-corrected; inverted from SFR values)

from Hopkins 04 (also Reddy et al. 07) + Shioya et al. 08, Villar et al. 08

BLUE: Lyα

from e.g. Deharveng et al. 08, van Breukelen et al. 05, Gronwall et al. 07, Ouchi et al. 08, Dawson et al. 07, Shimasaku et al. 06, Kashikawa et al. 06 (not complete !)

COMPARISON OF Lyα AND UV LUMINOSITY DENSITIES



RED: Lyα inferred from UV via relations with the SFR; not dust corrected.

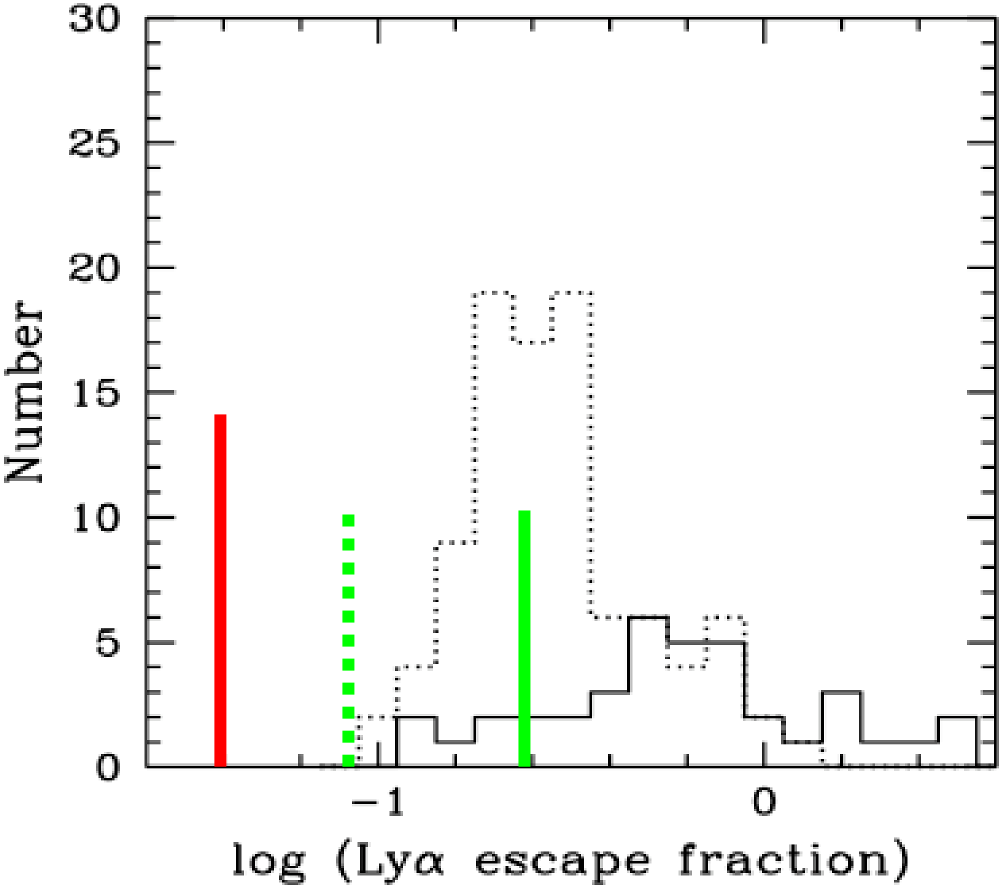
From e.g. Schiminovich et al. 05, Steidel et al. 99, Bouwens et al. 07, 08, Iwata et al. 07, Tresse et al. 07, McLure et al. 08, Reddy et al. 08, Oesch et al. 08 (not complete !)

From z ~ 0.2 to z ~ 3, Lyα LD increases faster than UV LD

Lyα escape fraction evaluated as measured Lyα / UV-inferred Lyα (upper limit)

Lyα AND UV COMPARED ON INDIVIDUAL OBJECTS

Histogram of SFR (Lyα) / SFR (UV)
(equivalent to F(esc) ; UV no dust-corrected)

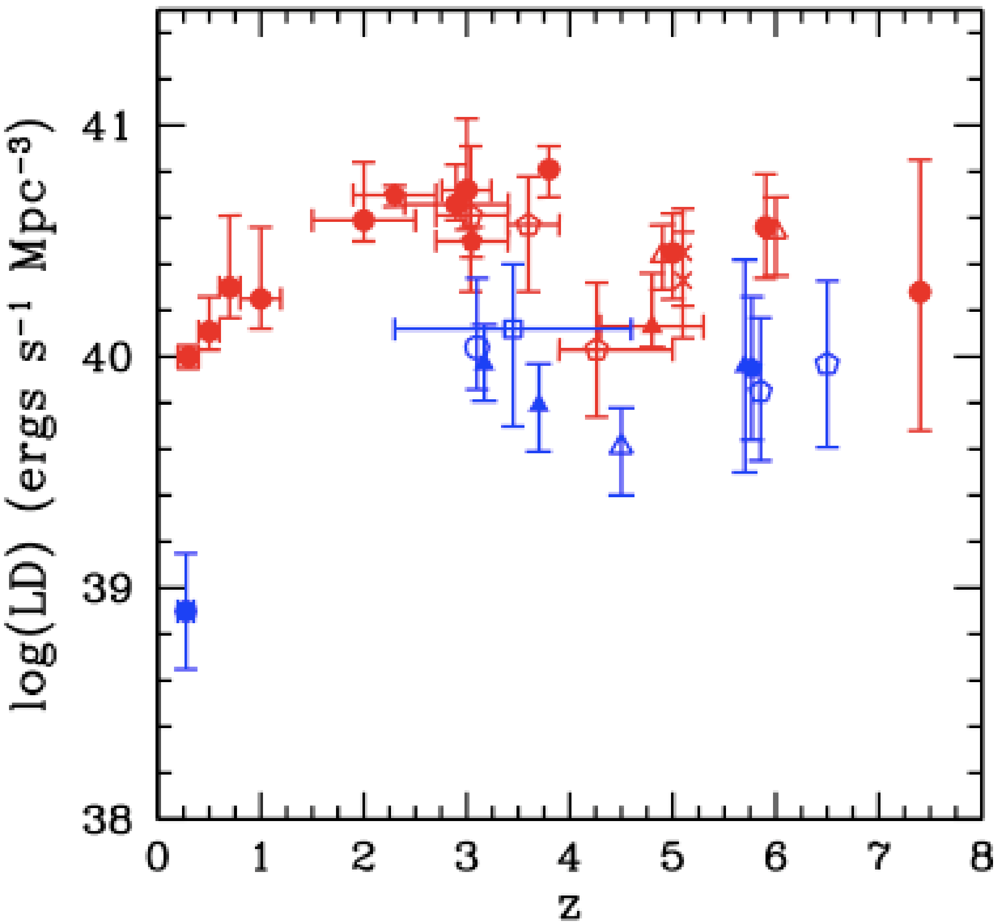


Solid line: sample at z ~ 3.1 (Gronwall et al. 07)

Dotted line: sample at 0.2 < z < 0.35 (GALEX)

Comparison with the global values based on the LDs

Lyα AND UV LDs COMPARED AT Z > 3

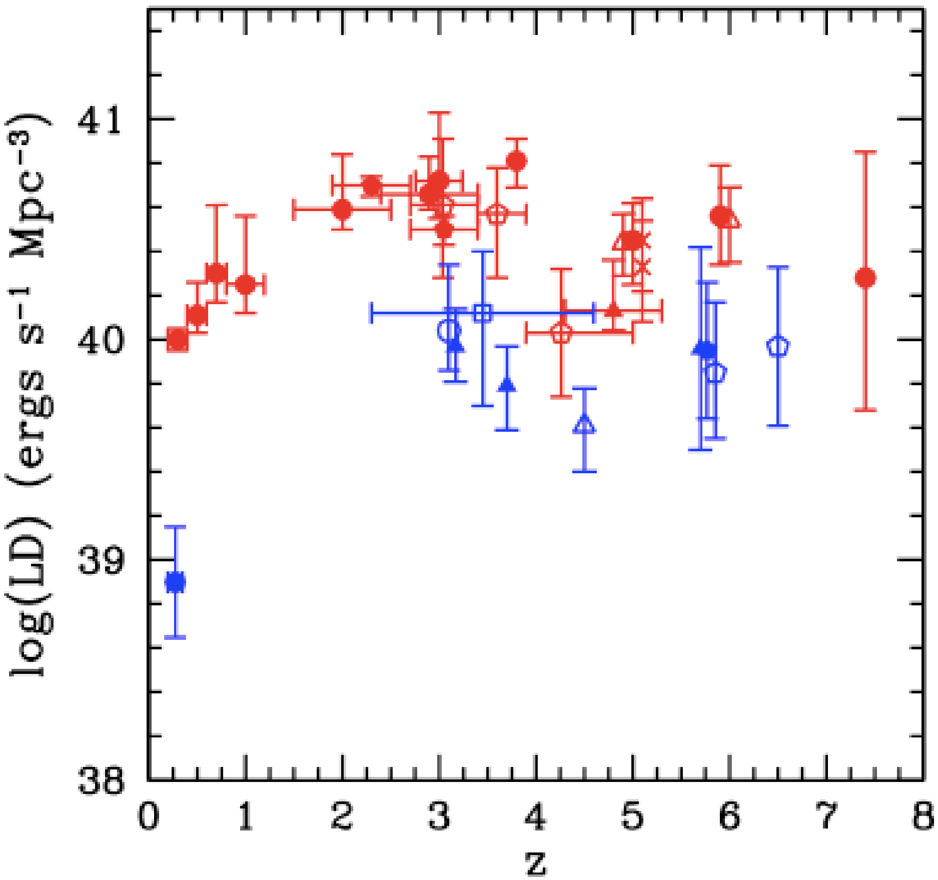


If the UV (Lyα UV-inferred) LD (RED) declines (dissenting voice Bremer et al.),

the Lyα escape fraction is likely to increase further at z > 3

Similar to higher incidence of Lyα emission at high redshifts (e.g. Reddy et al., Ouchi et al.)

FACTORS AFFECTING OUR INTERPRETATION / CAVEATS



- ✓ Uncertainties, selection effects, mixing of surveys
- ✓ Dust: an increase of UV dust attenuation from low to high z ?
- ✓ IMF
- ✓ LF faint-end slope: a steepening from z=3 to 0.3 would make the Lyα LD higher at low-z and evolution in step with the UV; the same for a flattening at z >3. Trend opposite to what is observed for the UV LF (Ryan et al. 07)

CONCLUSIONS

An increase of the Lyα escape fraction is possible from redshift ~ 0.2 to 3, and marginal beyond z ~ 3.

Needs confirmation with the observation of fainter Lyα emitters.

Consistent with the expectation of decreasing dust attenuation and/or increasing outflows at high-z.

Relation with the cosmic evolution of the LyC escape fraction (Inoue et al. 06)