Diffuse Lyman Alpha Emission at High Redshift: a Detection using the Cross-Correlation with QSOs.

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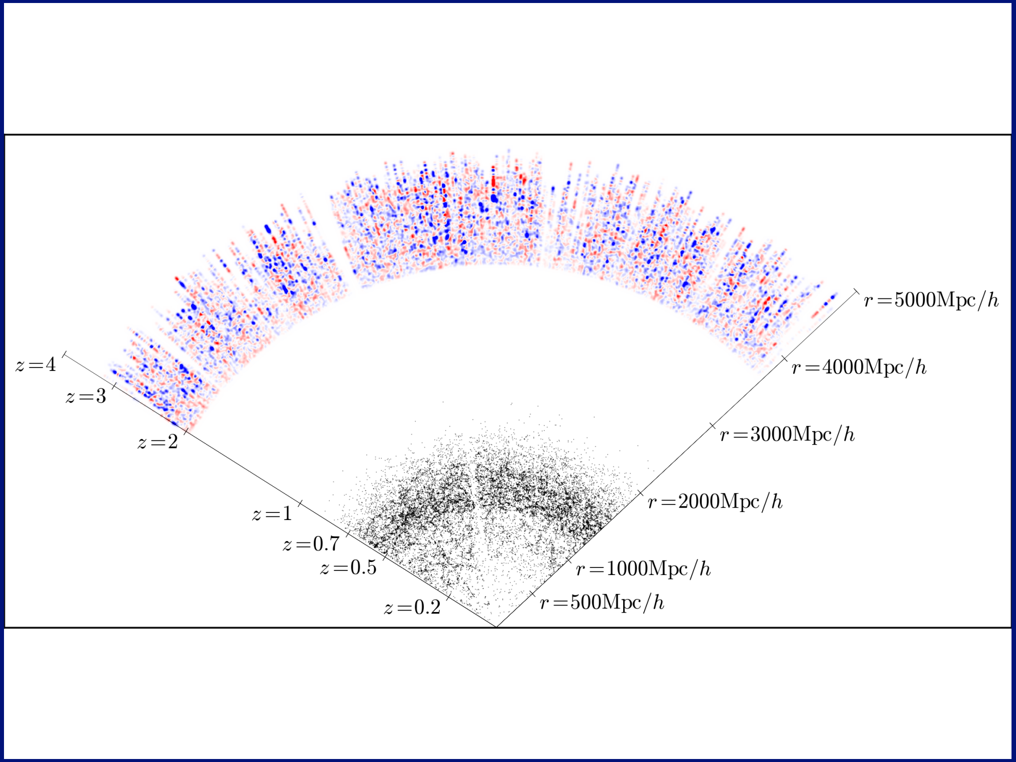
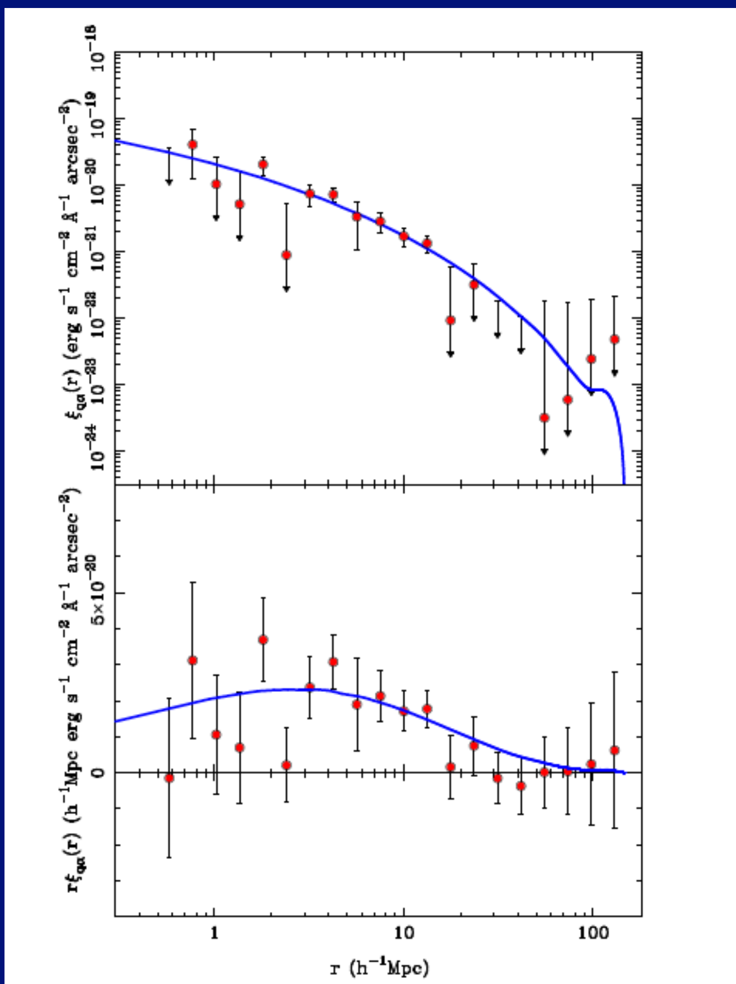
BOSS: spectroscopy of galaxies and quasars



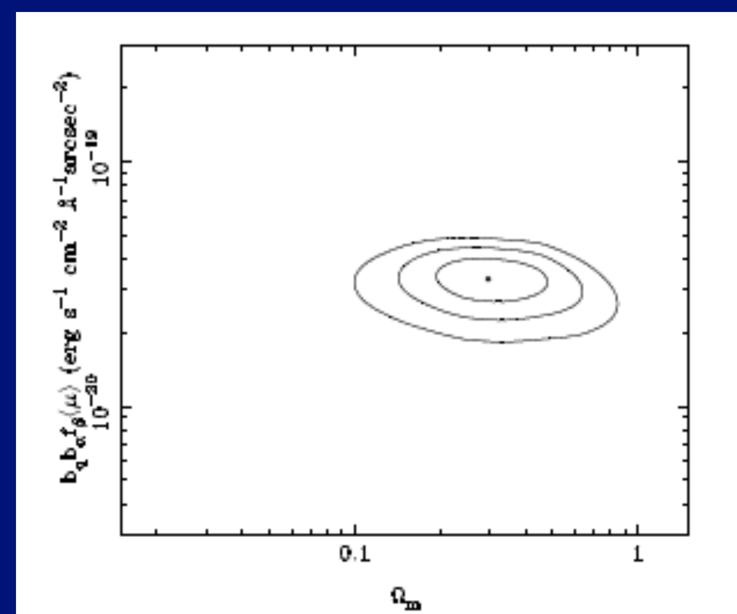
- Most fibers were targeted to massive galaxies at z<0.7, but we can subtract the model galaxy spectrum and use the remaining flux as a tracer of any emission along the line of sight, among that, high-z Lya emission.

Cross-correlation of Lyα emission with quasars (Croft et al. 2015).

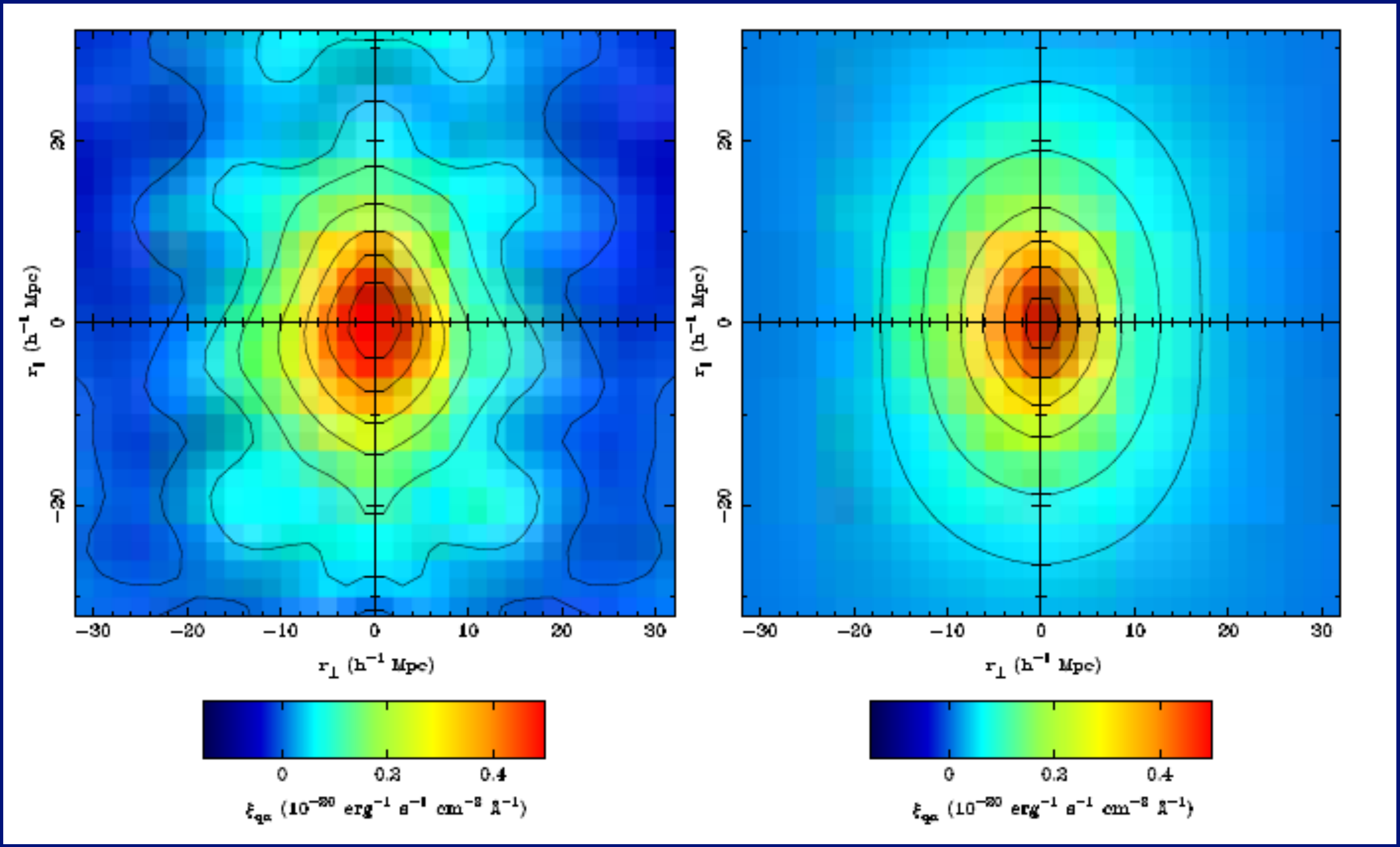
$$b_q b_\alpha f_\beta \langle \mu \rangle = 3.33^{+0.41}_{-0.43} \times 10^{-20}\,\mathrm{erg\,s^{-1}\,cm^{-2}\,Å^{-1}\,arcsec^{-2}}$$



- The cross-correlation is proportional to the mean Lyα emssion, the quasar bias and the bias of Lyα emitters.

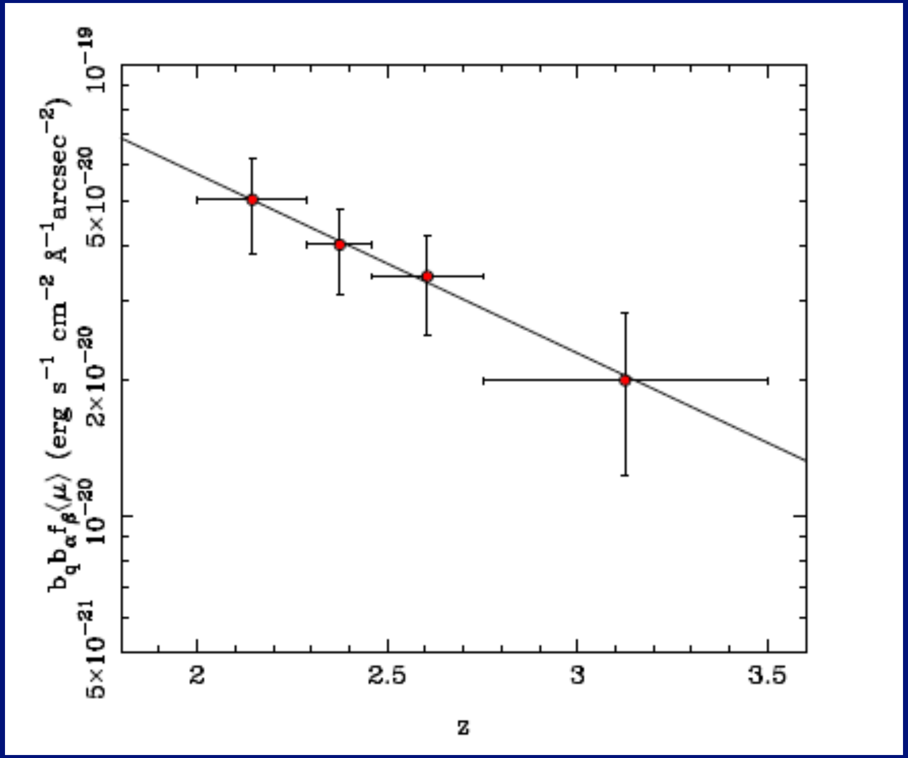


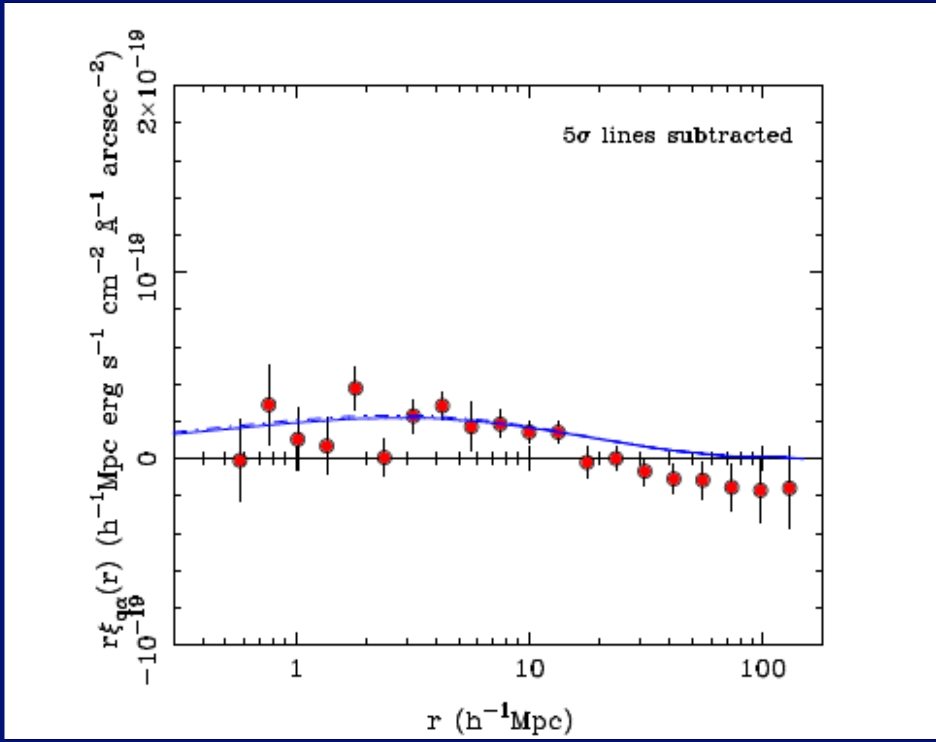
The cross-correlation in redshift space: a radial elongation may originate in radiative transport.



Redshift evolution

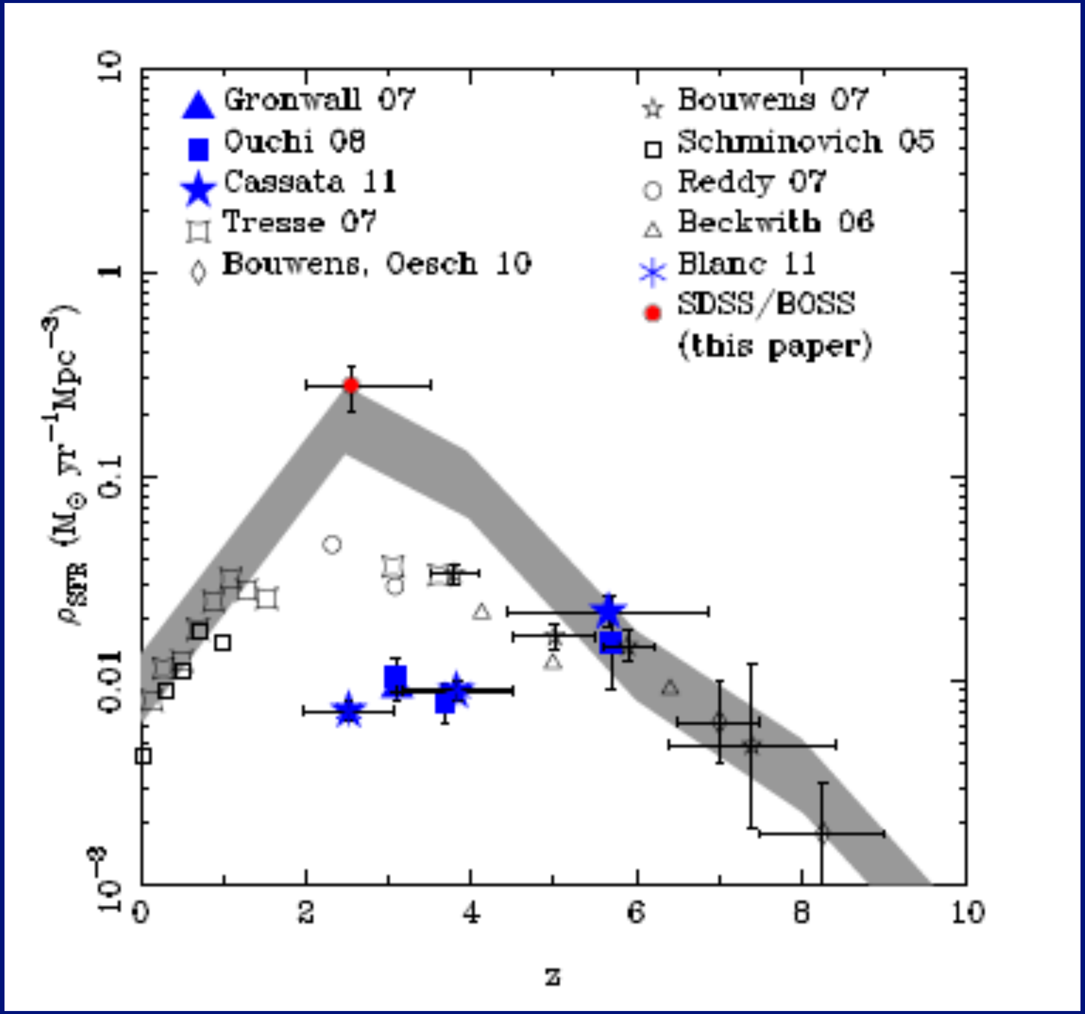
No contribution from any highly luminous Lyα galaxies.





A surprisingly high implied star formation rate density:

$$b_q b_\alpha f_\beta \mu_\alpha = (3.3 \pm 0.4) \times 10^{-20} \text{erg/s/cm}^2 / \text{A} / \text{arcsec}^2$$



Implication: for b_α=3 and the observed quasar bias b_q=3.6, the inferred Lyα emission is nearly all the observed star formation rate density after correcting for dust absorption!

This is surprising: it implies that even though most UV continuum photons are absorbed by dust, most Lyα photons escape from large gaseous halos of low Lyα surface brightness surrounding galaxies.

The only other possible source of this Lyα emission is cooling radiation from gas in halos, but still short by a factor ~ 10 to account for this measurement.

Conclusions

- We have measured the cross-correlation of Lyα brightness and quasars. The result is an 8-σ detection at z=2.5, interpreted as the clustering of star-forming galaxies around quasars. The surprising implication is that most Lyα escape out to gaseous halos of low surface brightness around galaxies, from where they are emitted into the intergalactic medium.