Interactions between galaxies and the IGM at z~3: the VLT VIMOS LBG Survey

R.M. Bielby (IAP), N. Crighton (Durham), L. Infante (Cattolica) ,T. Shanks (Durham), P. Tummuangpak (Durham) and others

Introduction: Observations of the z~3 Lyman-break galaxy(LBG) population represent an important tool in the study of galaxy evolution. Based on the Adelberger et al. (2003, 2005) observations, the lack of Lyα absorption near LBGs is still an unsettled issue, since it is still unclear whether galactic winds have effects on the galaxy surroundings. These results from Adelberger et al motivate us to make a further study of the correlation between QSO absorption line systems and LBGs at high redshift.

Observational Data

We have measured VLT VIMOS redshifts for ~1100 LBGs in the fields of 6 bright QSOs Q0042-2627, Q0043-26, SDSS J0124+0044, HE0940-1050, PKS2126-158

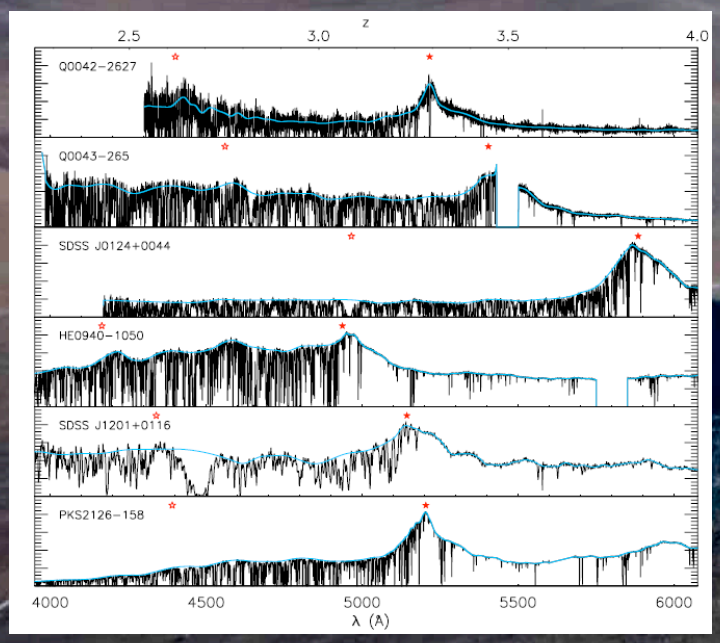


Figure 1. QSO spectra from VLT UVES, Keck HIRES and SDSS. Wavelengths of the intrinsic QSO Lyα are shown by the filled stars and intrinsic Lyβ are shown by the open stars.

Evidence of outflows

Velocity differences between Lyα emission and ISM absorption lines in the LBG spectra confirms the evidence from Adelberger et al of outflow due to star formation.

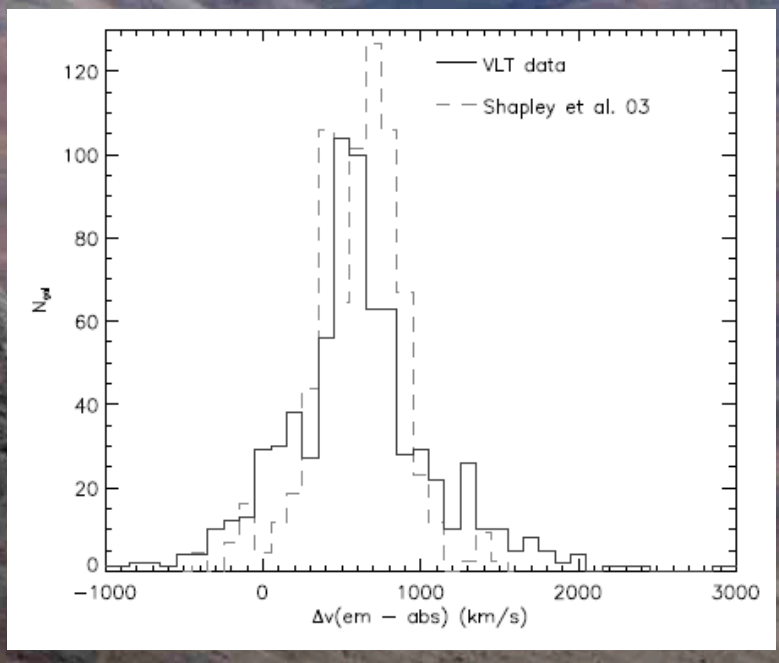
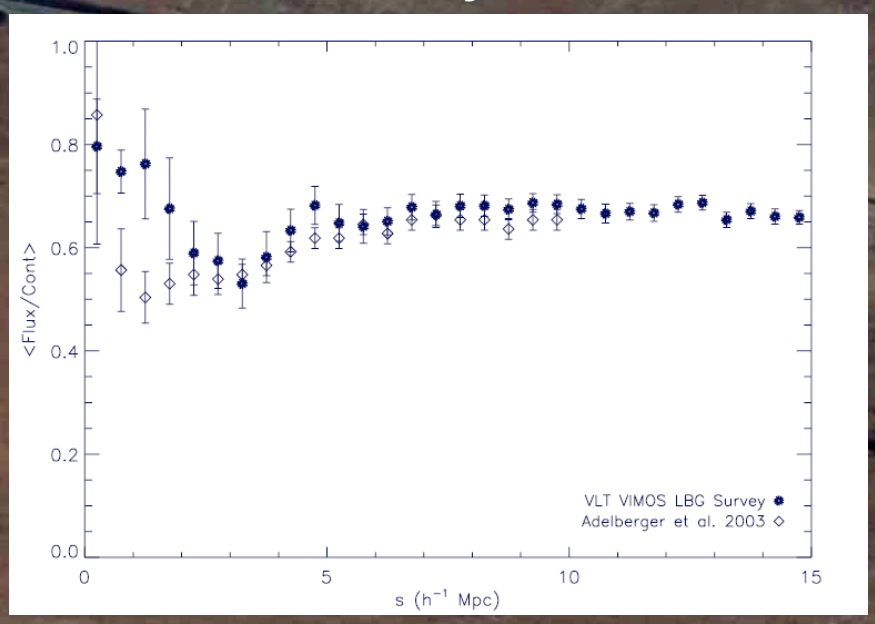


Figure 2. Distribution of velocity offsets between ISM absorption lines and the Lyα emission line in individual galaxies from our LBG survey (solid histogram). We measure a mean velocity offset between Lyα emission and the ISM lines of $\Delta V = 570 \pm 310$ kms^{-1} . The dashed histogram shows the result of Shapley et al. (2003).

Lyman α transmissivity - LBG correlation



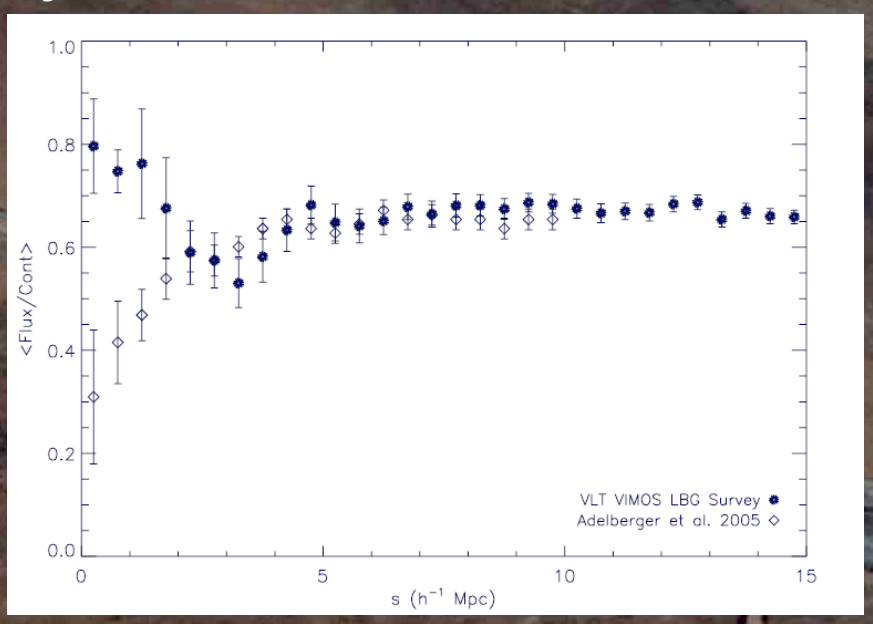


Figure 3. Our cross-correlation of LBG positions with the transmissivity in the Lyα forest from high resolution QSO spectra has produced some interesting results. The data appear to show a fall in the transmissivity in the Lyα forest at scales of ~ 5 h^{-1} Mpc away from LBGs. This is in agreement with previous results from Adelberger et al. (2003, 2005) and indicates an increase in gas densities at these scales. At smaller scales, our result shows better agreement with the Adelberger et al. (2003) result which showed a peak in the transmissivity at scales of $s < 2h^{-1}$ Mpc, potentially signifying the presence of low density holes in the IGM close to LBGs, perhaps due to star-formation feedback.

Conclusions: There is evidence of outflow due to star formation from the velocity offsets between Lyα emission and ISM absorption lines in the LBGs. We also detect the effect of feedback from these outflows on the Lyα forest, more in agreement with the result of Adelberger et al (2003) rather than Adelberger et al (2005).