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Are strong $z \simeq 0.5$ MgII absorbers the signature of super-winds?

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Abstract. BACKGROUND: In the process of galaxy formation, super-nova driven feedback from low-mass galaxies is the process that most readily account for the galaxy mass-metallicity relation and for the shallower galaxy luminosity function (LF) compared to the halo mass function. Absorption-selected galaxies are prime candidates for the sites of starburst activity as (1) they probe the gaseous halos of galaxies up to $\sim$ 50 kpc (Steidel 1995), and (2) galaxies on the faint end of the LF are likely dominating the statistics. Galaxies selected via their MgII λ2796/2803 doublet absorption against background QSOs are especially well suited as Mg is produced by type II supernova.

GOAL: Our project was to constrain the physical models of the gaseous halos by measuring the dark matter halo-mass (M_h) of the MgII host-galaxies *statistically*, i.e. without identifying spectroscopically the host-galaxy.

METHOD: We have used the cross-correlation $w(r_\theta)$ (over co-moving scales r_θ : 0.05–13h^{-1} Mpc) between our sample of 1800 $z \simeq 0.5$ MgII absorbers with equivalent w width $W_r^{2796} >$ 0.3 Å, and 250,000 Luminous Red Galaxies (LRGs), both selected from SDSS/DR3. The cross-correlation relies on the LRG photometric redshifts, but is not affected from contaminants such as stars or foreground and background galaxies as shown theoretically in Bouché *et al.*2005 and empirically in Bouché *et al.* 2006.

RESULTS: From the cross-correlation analysis, we found (Bouché *et al.* 2006) (i) that the absorber host-halo mean mass is $\langle \log M_{\rm h}(M_\odot) \rangle = 11.94 \pm 0.31({\rm stat})^{+0.24}_{-0.25}$ (sys), i.e. about 1/2 L^*, and (ii) an anti-correlation between halo mass M_h and equivalent width W_r^{2796}.

INTERPRETATION: One SDSS MgII absorber (system) is made of several sub-components or clouds and the stronger the equivalent with of the absorber, the more clouds per system spread over a larger velocity range (Δv). This follows since each sub-component has a velocity width of $\sim$ 5 km s^{-1} (Churchill 1997). As result, the equivalent width W_r^{2796} is a measure of velocity width (Δv) as demonstrated by Ellison 2006. Together with our SDSS results, these relations imply a mass–velocity M_h–Δv anti-correlation. If the clouds in the host-halos were virialized, velocity and mass would have been correlated.

CONCLUSION: Therefore, our M_h–Δv anti-correlation shows that the clouds are not virialized in the gaseous halos of the hosts. This conclusion is best understood in the context of starburst driven outflows where the velocity Δv is related to bulk motion. This opens the possibility to study M82-analogs up to $z \sim 2.0$ using the MgII selection.

Keywords. galaxies: intergalactic medium, galaxies: kinematics and dynamics, galaxies: halos, galaxies: starburst, quasars:absorption lines.

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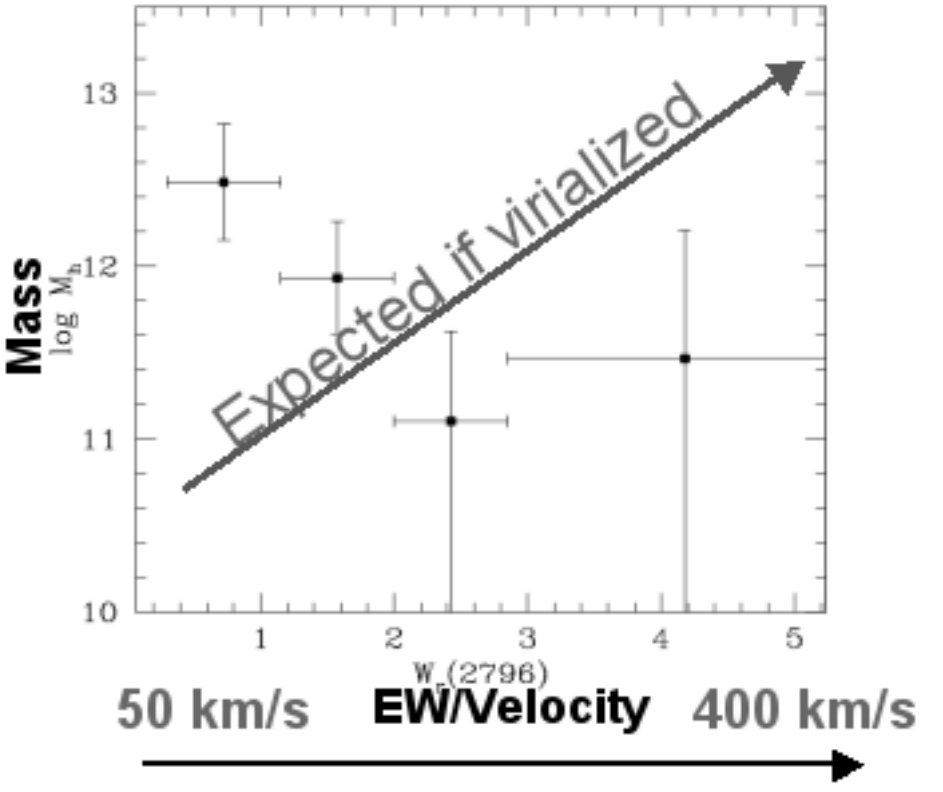

Figure 1. From the cross-correlation between 1800 Mg II-selected galaxies and 250,000 Luminous Red Galaxies (LRGs), we found an anti-correlation between halo mass M_h and equivalent width W_r^{2796}. The equivalent width W_r^{2796} is a measure of velocity width (Δv) as demonstrated by Ellison 2006. Thus, these relations together imply a mass–velocity M_h–Δv anti-correlation. If the clouds in the host-halos were virialized, velocity and mass would have been correlated. Therefore, our M_h–Δv anti-correlation shows that the clouds are not virialized in the gaseous halos of the hosts. This conclusion is best understood in the context of starburst driven outflows where the velocity Δv is related to bulk motion.

1. Online-Material

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