A COMMON HIGH-COLUMN DENSITY LY-α LINE IN THE SPECTRA OF Q 1429–008 A & B

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Abstract. We observed a common high-column density Ly-α absorption line in the spectra of both Q 1429–008 A & B, but with different equivalent widths.

1. Common high-column density Ly-α absorption at $z = 1.662$

Q 1429–008 is a probable gravitational lens candidate (Hewett et al. 1989). The two quasar images, A & B, are separated by 5.14″, have the same redshift (2.076), and have R-band magnitudes of $m_{\rm R} = 17.7$ and 20.8. No lensing galaxy is observed.

We obtained 2 Å resolution spectra of the Ly-α forest for A & B with the CTIO 4m telescope, and additional high-resolution ($R \approx 33000$) spectra for A with UCLES on the AAT.

We observed a common high-column density Ly-α absorption line at $z = 1.662$ in the spectra of both Q 1429–008 A & B, but with different rest-frame

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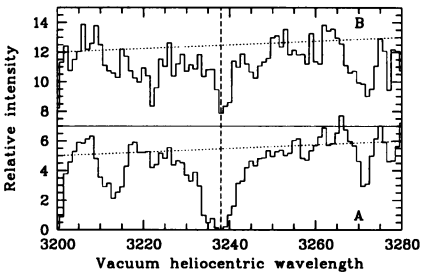

Figure 1. The high $N_{\rm HI}$ Ly-α absorption line in A (lower panel) and in B (upper panel). The continua used to measure the equivalent widths are drawn as dotted lines.

equivalent widths $W_{\rm rest}$. We obtain $W_{\rm rest} = 10.6$ Å for the line in the A spectrum, which corresponds to $N_{\rm HI} = 3 \times 10^{20}$ cm^{-2}. The measurement of $W_{\rm rest}$ for the corresponding line in the B spectrum critically depends on the definition of the continuum, a delicate operation for low S/N spectra such as the one of the B component. A preliminary estimate of the continuum leads to $W_{\rm rest} = 2.5 \pm 1$ Å so that $N_{\rm HI} \simeq 10^{19}$ cm^{-2}.

We also observe a C IV doublet at $z = 1.42$ (i.e. on top of the Ly-α emission line), with a velocity difference of 580 km s^{-1} between the lines in A and in B. This suggests the presence of a cluster of galaxies, which could be the main lensing agent. If we assume that this velocity difference is a good approximation of the one-dimensional velocity dispersion of a Singular Isothermal Sphere cluster, then we only need an additional L_* elliptical galaxy to account for the separation of the two images (5.14″). Therefore, we propose that the lens redshift is 1.42.

In this model, the linear separation between the two lines-of-sight at the redshift of the $z = 1.662$ system is 23 h_{50}^{-1} kpc ($H_0 = 50\ h_{50}$ km s^{-1} Mpc^{-1}, $q_0 = 1/2, \Lambda = 0$). Similar column densities are seen for the $z = 1.6616$ Ly-α absorption line seen in the A and B components of HE 1104-1805 (Smette et al. 1995, Smette et al. in these proceedings), but the linear separation is less well determined in this system. These values are compatible with the current view of damped Ly-α systems as the progenitors of present-day spiral galaxy disks with diameters of $\sim$ 40-60 h_{50}^{-1} kpc, embedded in the $\sim$ 160 h_{50}^{-1} kpc diameter halos that give rise to the Lyman limit systems.

References

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