ABSORPTION SPECTRUM OF THE z=3.78 QSO 2000-330 AT HIGH RESOLUTION

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The forest of absorption lines observed in all high-redshift QSOs at wavelengths shorter than Ly α emission is generally accepted as being due to a population of intergalactic hydrogen clouds. In order to study the physical properties of these clouds and possible changes in the properties with redshift it is first necessary to establish the true continuum level. The difficulty in defining continuum levels in the Ly α forest region is readily acknowledged in the literature but only rarely do published spectra show the adopted continuum.

Our AAT spectrum of the highest-redshift region of the Ly α forest in 2000-330 is shown in Fig. 1 at a resolution of 0.6 Å FWHM (32 km/s). Despite this high resolution and good S/N ratio there are very few regions which can confidently be recognised as genuine continuum. Conventional methods for continuum estimation are based on the local

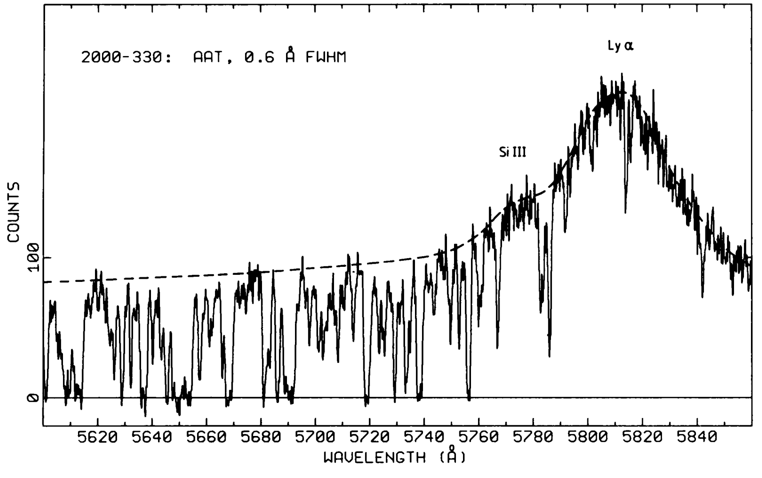

Figure 1. IPCS spectrum of 2000-330 near Ly α emission. The adopted continuum is shown as a dashed line.

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variance in the data and fail completely when confronted with such high line densities (Hunstead et al. 1986). The problem is even more severe below Ly β emission where higher order Lyman lines add to the confusion.

Consequently we adopt a pragmatic approach based on the reasonable assumption that the underlying continuum is a power law with constant exponent; in some spectral regions this necessitates the continuum level being set substantially higher than the data. The level is chosen so that positive excursions are consistent with photon statistics. Our adopted continuum is shown in Fig. 1; the evidence for Si III emission is discussed by Hunstead et al. (1986). A full analysis of all our high-resolution data for 2000-330 will be published elsewhere.

Once the continuum level has been defined, the customary approach for identifying lines belonging to QSO absorption systems involves setting up a line list and then looking for wavelength matches with various redshifted ionic species. This method does not utilise fully the information contained in the spectral data, since it demands that every line subjected to scrutiny be independently assessed as real (>5σ) and then abstracts just one parameter, λ, for correlation purposes. Since most spectra contain blends of lines, an alternative approach which uses the entire line profile can be far more revealing. Superimposed spectrum plots are prepared by rebinning the data (normalised by the local continuum) onto a logarithmic wavelength scale, with origins corresponding to the redshifted species being compared. These spectra are then plotted directly on top of one another, preferably using different colours. Alignments and blending can readily be recognised and additional velocity structure can often be inferred. An example is shown in Fig. 2 for the $z_{abs} = 3.55$ system in 2000-330. The ratio of C IV/Si IV is seen to vary significantly among the components, which span a velocity range of at least 400 km s^{-1}.

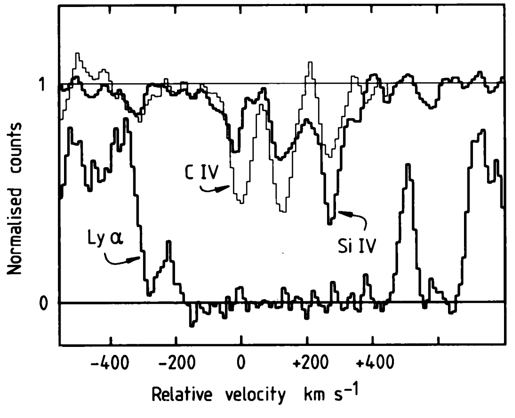

Figure 2. Superimposed spectrum plots of Ly α, C IV 1548 and Si IV 1393 in the z_{abs} = 3.55 system. The velocity origin is at z = 3.5481.

REFERENCE

Hunstead,R.W., Murdoch,H.S., Peterson,B.A., Blades,J.C., Jauncey,D.L., Wright,A.E., Pettini,M. & Savage,A., 1986. Ap. J. (in press)