Chapter 9 : Spectra - Observing Strategy

9.1 : The Most Visible Lines and Selection Effects on Redshift

Empirically, C IV $\lambda\lambda$1548,1550 is the most visible of all broad absorption lines in ground-based observations. Other transitions redward of C IV include Al III $\lambda\lambda$1854,1862 and Mg II $\lambda\lambda$2796,2803. However, these lines are usually much weaker and not generally detected in low S/N survey spectra. As a result, most BALQSOs are discovered via their C IV BAL, which means $z_e \gtrsim 1.3$ for ground-based detection.

Since most BALs come from highly ionized systems, $\log(U) \gtrsim -2$, the N V $\lambda\lambda$1238,1242 and O VI $\lambda\lambda$1031,1037 BALs tend to be as strong as the C IV BAL. However, confusion with the Lyman-α (H I λ1216) emission line, and the Lyman-α forest lines, along with the general depression of the continuum blueward of Lyman-α emission due to the density of the Lyman-α forest lines at $z_e \sim 2$, means these lines are not as easily seen in survey spectra. Also, whenever O VI and N V are visible, C IV is also visible and generally at a more sensitive region of the detector (at least for $z_e \lesssim 3.5$). The Lyman-α BAL should also be strong due to the abundance of hydrogen, but is almost always significantly weaker than N V and C IV.

These factors bias our list of objects to $z_e \gtrsim 1.3$. We are further biased towards somewhat higher redshifts due to the decreasing signal-to-noise of the survey spectra closer to the atmospheric cutoff in the UV. Finally, considering the rapid decrease in the number density (per square degree of sky to a fixed apparent magnitude limit) of optically selected QSOs with $z_e \gtrsim 2$ in most surveys (*cf.* Schmidt *et al.* 1991) and the lack of redshift dependence on the fraction of BALQSOs in optically selected samples (Foltz *et al.* 1990), means that our objects cluster around redshifts of 1.6 to 2.5.

9.2 : Isoelectronic Sequences: Which Lines to Expect

Note that of the six primary metal lines of interest, all originate from *alkali*-like ions (ions with a single valence electron). C IV, N V, and O VI represent ions with equivalent 3