We can estimate upper limits on U by the depths of other ions. The lack of a Lyα high velocity BAL is consistent with a high ionization parameter and the weakness of Lyα in other BALQSOs. As we increase U from –1.5 to –0.5, the fractional abundance ratio between C^{+3} and H^0 increases by a factor of 3. Since the fractional abundance of H^0 goes as U^{-1} (see chapter 3), as we increase U further, eventually, H^0 must dominate, since there are more ion states higher than C^{+3}. However, this does not become significant until $U \gtrsim 1.0$. A much better limit on U can be set by getting far UV observations of very high ionization BALs (see chapter 9). Unfortunately, this QSO has a lyman-limit system at $z_e \sim 2.7$, which may make observing some lines difficult or impossible.

Note that there does appear to be an O VI BAL at $\lambda \sim 950$Å (rest frame), consistent with a high value of U. Unfortunately, we do not have sufficient observation epochs to test for variability. Time variability observations of this line would have (or will) give us important limits on U, and thus on the variability ratio between the ionizing and observed continuum.

We can limit U in another manner. The distance to the ionizing source goes as: $r \propto [L_\nu/(n_e U)]^{-0.5}$ (see chapter 3). The response of the C IV to changes means that $n_e \gtrsim 10^4$, this means that for very high values of U may require that the BALR is too close to the central engine, (see §2.5). However, if we require $r < 1$pc, this is a meaningless limit of $U \lesssim 10^4$. However, a limit of $n_e \gtrsim 10^8$, would require $U \lesssim 1$. We conclude, that either $n_e < 10^8$, or the ionizing flux changed much more than the observed continuum, or both.

13.5 : H 1413+1143

Small changes in the BALs of this object were seen by Turnshek *et al.* (1988). We see decreases in a few different BALs. There appears to be a slight increase in the C IV trough at lower velocity. The sharp transition (in wavelength space) between decreasing and increasing absorption strength is unusual and may be not "fit" with the simpliest photoionization model. This conflict has not been seen in other BALQSOs, and may