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An Analysis of Broad Emission-Line Profiles from HST Data

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Abstract. We have analyzed the *HST* FOS spectra of all quasars in the Stirpe (1990) high *S/N* line-profile sample and studied line-profile ratios as a function of radial velocity. Some quasars show no sign at all of NLR Lyα. We confirm that Hα is narrower than Lyα (after allowance for NLR contributions). The Lyα/Hα ratios in the cores of the broad lines are all close to or slightly less than case B and values predicted by single-cloud photoionization models. The Lyα/Hα ratio is surprisingly high in the blue wing. With only one exception, the ratios are equal to or greater than the case B value. Intrinsic reddening must be very small in most cases. We also briefly discuss other ratios.

1. Introduction

There are many reasons for believing that the low-ionization BLR lines come from quite different clouds than the high-ionization lines. There are difficulties in explaining all the lines from a single type of cloud: the high-ionization lines are blueshifted relative to the low-ionization lines, the high-ionization lines have broader profiles, and variability studies show that the low- and high-ionization lines come from slightly different radii (see Gaskell 1987). Line variability transfer functions also probably imply that the two regions have different structure (e.g., Horne, Welsh, & Peterson 1991).

We present here a preliminary study of line ratios as a function of velocity for eight quasars with both optical and *HST* FOS spectra. Stirpe (1990) has published high-quality optical spectra of a number of quasars. We have selected those with high *S/N FOS* spectra.

2. Results

The ratio of two lines of different widths vs. velocity will clearly show a curvature that can be approximated with a quadratic. The Lyα/Hα plots have curvature in the sense that confirms that Hα is narrower than Lyα (Zheng 1992; Netzer et al. 1995). Interestingly, in two of the quasars there is no sign of a NLR Lyα contribution (see Fig. 1; note that narrow-line components were removed from Hα but not from Lyα). This can easily be explained by known NLR reddening (Wysota & Gaskell 1988).

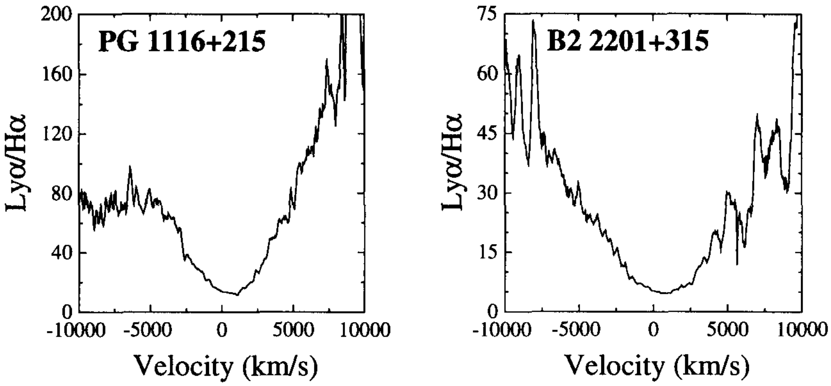

Figure 1. Lyα/Hα profile ratios for PG 1116+215 and B2 2201+315.

With one exception, the Lyα/Hα ratios in the blue wing equal or exceed the case B value of 8.7 (Ferland 1995). The red wing ratio also appears high, although there are contamination problems due to N V. The high Lyα/Hα ratio in the blue wing is surprising. At the very least it implies there is essentially no reddening along the line of sight to these quasars. Since there is probably *some* reddening from our Galaxy, the intrinsic Lyα/Hα ratios might be greater than case B.

On the other hand, in the cores of the broad lines, the values of Lyα/Hα are $\lesssim 8.7$, in agreement with photoionization models (e.g., Ferland 1995).

The ionization-parameter-sensitive and density-sensitive C III]/C IV ratio shows a variety of dependences with velocity. However, the VBLR, ILR, and NLR have the same C III]/C IV ratios in this sample. The Lyα/C IV ratio is fairly constant as a function of velocity, especially when narrow Lyα is absent.

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