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The Structure of the BLR in 3C 390.3

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Abstract. Velocity-dependent flux ratios of the broad Lyα, C IV, Hβ, and Hα lines are used to investigate conditions in the archetypical displaced BLR peak emitter 3C 390.3. Our results suggest that gas producing the the UV emission lines has a lower density than the higher-velocity gas producing broad disk-like profile and is less flattened.

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The profiles of the broad emission lines in the majority of AGNs show a single peak close to the systemic velocity. 3C 390.3 is the archetype of a subclass of AGNs in which the Balmer lines show additional displaced peaks in their high-velocity wings. The high-velocity wings of these line profiles can be interpreted as emission from asymmetric turbulent disks. To attempt to understand the nature of the broad-line emission in 3C 390.3 we have constructed C IV/Lα, Lα/Hβ and Hα/Hβ flux ratios as a function of velocity for 3C 390.3 for "high" and "low" states of the ionizing continuum. We have used the photoionization code CLOUDY (Ferland *et al.* 1998) to attempt to understand the differences in physical conditions in emitting regions (see Nazarova *et al.* 2004, Gaskell *et al.* 2007, and Snedden & Gaskell 2007 for details). We have taken approximate line-emitting region sizes from reverberation mapping by Dietrich *et al.* (1998), O'Brien *et al.* (1998), and Sergeev *et al.* (2002). Comparison of observed ratios with the models suggests that:

1)The increase in the C IV/Lα ratio from the line centre to the wings can be explained by the density increasing from 10^{7-8} cm^{-3} at low velocity to $\sim 10^9$ cm^{-3} in the wings.

2) The increase in Lα/Hβ and Hα/Hβ from the wings to the core can be explained by a decrease in density from 10^{12-13} cm^{-3} for the high velocity gas to 10^{10-12} cm^{-3} towards the line core.

The difference in densities inferred for the high- and low-ionization gas at high velocities suggests that the two regions have somewhat different vertical locations. We have suggested (Nazarova *et al.* 2004) that high-ionization gas had a less flattened distribution than the higher-density, lower-ionization gas in the disk.

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References

Dietrich, M., *et al.* 1998, *ApJS*, 115, 185
Ferland, G. J., *et al.* 1998, *PASP*, 110, 761.
Gaskell, C. M., Klimek, E. S., & Nazarova, L. S. 2007, submitted to *ApJ* (arXiv:0711.1025)
Nazarova, L. S., Bochkarev, N. G., & Gaskell, C. M. 2004, *Astron. Astrophys. Trans.*, 23, 343
O'Brien, P. T., *et al.* 1998, *ApJ*, 509, 163
Sergeev, S. G., Pronik, V. I., Peterson, B. M., Sergeeva, E. A., & Zheng, W. 2002, *ApJ*, 576, 660
Snedden, S. A. & Gaskell, C. M. 2007, *ApJ*, 669, 126