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SPECTROSCOPIC STUDY OF C IVλ1549 AND ITS RELATION WITH OPTICAL PARAMETERS IN ACTIVE GALACTIC NUCLEI

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We explore the relation between optical and UV parameters for all known types of broad line emitting AGN using our 4D Eigenvector 1 parameter space, in an attempt of a spectroscopic unification scheme. Black hole masses computed from FWHM(C IVλ1549$_{BC}$) indicate that the C IVλ1549 width is a poor virial estimator.

Our 4DE1 parameter space (Sulentic et al. 2007, hereafter S07) involves: (1) full width half maximum of broad $H\beta$ (FWHM $H\beta_{BC}$), (2) equivalent width ratio of optical Fe II and broad $H\beta$: $R_{\rm Fe\,II}$ = W(Fe IIλ4570)/W($H\beta_{BC}$), (3) the soft X-ray photon index ($\Gamma_{\rm soft}$) and a measure of (4) C IVλ1549 broad line profile velocity displacement at half maximum ($c(1/2)$). We divide sources into two AGN populations using a division at FWHM $H\beta_{BC}$=4000 km s^{-1} with sources having lines narrower and broader than this value designated Population A and B respectively (Sulentic et al. 2000, hereafter S00). We use HST archival spectra for 130 sources with S/N high enough to permit reliable C IVλ1549 broad component measures (S07).

$c(1/2)$ was chosen from among possible C IVλ1549 profile measures (FWHM, $c(1/2)$ and EW) because: (1) it is not obviously luminosity dependent, (2) it showed the largest intrinsic dispersion and (3) it showed possible correlations with the other 4DE1 parameters. Line broadening may be due to both rotational and non-rotational velocity components especially if a disk + wind model is applicable to our sources. $c(1/2)$ on the contrary, is most likely related to the amplitude of any non-virial motions in the BLR. It is this parameter that adds a new element that can be argued to be physically orthogonal to previously defined E1 parameters: FWHM($H\beta_{BC}$) estimates the virial broadening in the LIL-emitting part of the BLR; $R_{\rm Fe\,II}$ measures the ionization conditions, while $\Gamma_{\rm soft}$ provides a measurement of the continuum shape.

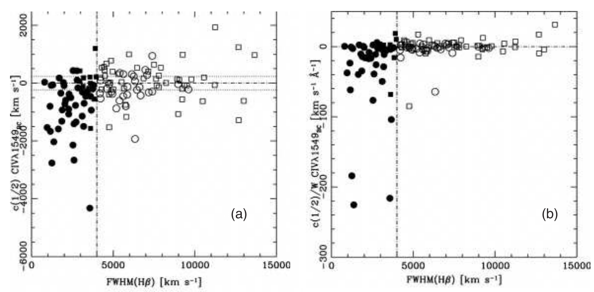

Fig. 1. (a) $c(1/2)$ of C IVλ1549$_{BC}$ vs. FWHM(Hβ_{BC}) (in km s^{-1}). (b) $c(1/2)$ normalized by EW C IVλ1549$_{BC}$ in order to emphasize the difference between Pop A and B sources which are denoted with filled and open symbols respectively; RL sources are represented by squares and RQ by circles. The vertical line in both panels marks the Pop A-B boundary. Dotted lines in (a) indicate $\pm 2\sigma$ confidence intervals.

In our 4DE1 we find that Radio Loud (RL) sources show broader Hβ_{BC} and C IVλ1549$_{BC}$ profiles than Radio Quiet (RQ) AGN, while RQ sources show stronger $R_{\rm Fe\,II}$, a $\Gamma_{\rm soft}$ and $c(1/2)$ than RL sample. 4DE1 also shows a restricted occupation as a strong concentration of RL sources in a small region of the $c(1/2)$ vs. $R_{\rm Fe\,II}$ and $\Gamma_{\rm soft}$ planes. RL sources are rarely found with 4DE1 parameter values: FWHM(Hβ_{BC}) km s^{-1}, $R_{\rm Fe\,II}$, Γ_{soft} and $c(1/2)$ km s^{-1}. Figure 1 illustrates one of the correlations of the 4DE1 between $c(1/2)$ and FWHM$H\beta$. The complete correlations can be found in S07. The expanded C IVλ1549 sample confirms this results which likely indicates a fundamental difference in BLR structure, kinematics and/or physics between RL and RQ populations.

On the other hand, we made estimations of M_{BH} using FWHM of $H\beta$ and C IVλ1549 (S07). The result of the comparison of the masses using both lines, is an over estimation of M_{BH} when we use the C IV profile, which is noted mostly on Pop A.

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