A DETAILED STUDY OF THE CIV 1550 LINE PROFILE AND ADJACENT SPECTRAL FEATURES IN NGC 4151 FROM 1978 UP TO 1983

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ABSTRACT. Fitting technics are applied to study the variations of the 1550 line profile and adjacent features in the IUE spectrum of the Seyfert galaxy NGC 4151, from 1978 up to 1983. New important results are found concerning the kinematics and physics of the emission line gas at a few light-days from the continuum source.

1. THE ANALYSIS

Fitting technics are used to study the variations of the CIV 1550 line profile and adjacent features in the spectrum of the Seyfert galaxy NGC 4151 from 1978 up to 1983. The data-base consists of low resolution (900 km/s) high S/N IUE spectra taken at 69 different epochs. The profile of the various features is well represented by a gaussian and for most of them the full-width-at-half-maximum (FWHM) can be held fixed; NIV 1485 (FWHM = 1600 km/s), L1 1516 (1600 km/s), CIV 1550 in emission (FWHM variable from 2400 to 5500 km/s) and in absorption (1300 km/s), L'2 1576 (1600 km/s), L2 1597 (1600 to 3000 km/s) HeII 1640 (1600 km/s) and OIII] 1663 (2500 km/s). No good fit can be achieved without allowing for the presence of two additional ultra-broad (UB) emission components : CIV 1550 (FWHM = 14600 km/s) & HeII 1640 (8600 km/s). The continuum is approximated by a straight line and its intensity at 1450 and 1720 A are free parameters of the model.

2. EVIDENCE FOR A DECELERATED WIND

The most significant result is that emission from the highest velocity material shows extremely rapid variations which mimic closely those of the continuum. Indeed, the variations of intensity of the UB CIV 1550 component lag by only ~5 days behind those of the continuum. This result supports the hypothesis that the high velocity gas is photoionized and

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lies at 5 light-days (1d) from the source of continuum. The absence of such UB emission in the profile of the other UV & optical lines - in particular MgII 2800 - implies that the high velocity clouds are ionized throughout. The gas density must also exceed 7 10^{10} cm^{-3}, as can be inferred from the absence of NIV] 1485 and OIII] 1663 UB emission. An important correlation is also found between the wavelength and the intensity of the UB CIV 1550 component in the sense that this feature has a more pronounced blue-shift when it is weak than when it is strong. This strongly suggests the existence of outflowing motions at 5 1d's from the nucleus. However, the above correlation also requires that the innermost receeding gas is partially hidden to the observer. We note that a tilted accretion disk naturally provides both the necessary obscuration and the tank from where the wind can be continuously replenished. The velocity of the wind decreases outward from ~ 4000 km/s at 5 light-days from the nucleus to ~800 km/s at ~120 light-days where the absorption line gas is located (Bromage et al 1985).

3. A JET-WIND INTERACTION

The intensity of the unidentified L1 1516, L'2 1576 & L2 1597 lines varies on a time scale of a few days. However, their variations are not correlated with those of the continuum. This constrasts strongly with the behaviour of the other lines and suggests an emission mechanism distinct from photoionization. Ulrich et al (1985) have interpreted these features as Doppler shifted CIV 1550 lines resulting from the interaction of a two-sided jet with the broad line gas. The present analysis shows that the variations of L2 correlate well with those of L1 on short time scales. Moreover, any lag, if present, must be shorter than 4 days. This constrains the jet to be almost in the plane of the sky, and therefore strengthens the conclusion reached from independent arguments by Ulrich et al that the jet is inclined at 75° with respect to the line-of-sight. This also requires that the L1 & L2 lines originate within 5 1d's from the origin of the jet. It is therefore likely that they arise from an interaction of the jet with the wind.

REFERENCES

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