REVISITING THE GEOMETRY OF THE BLR IN AKN120 :
PRELIMINARY RESULTS FROM UV DATA AND LINE PROFILE ANALYSIS

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ABSTRACT. From continuum and line intensity light-curves in the ultraviolet range, we find that the CIV peak-emission lies at about 2 ± 0.5 light-month from the centre. Line profile variations in the Hα and CIV emission suggest that the BLR is made of two regions with distinct kinematical properties :

. a spherically distributed set of clouds, responsible for the broad HIL emission and responding to ionizing flux variations with a time-lag of 2 light-months at most

. a disc-like structure from which most of the LIL emission arises, with a slow response to ionizing flux changes : hence larger is size.

1. INTRODUCTION

Line and continuum variations can be used to investigate the geometry of the BLR in AGN, through light-travel effects (e.g. Clavel et al, 1987). A suitable object for such an analysis is Akn120.

Following its discovery as a luminous AGN (Arakelian, 1975) Akn120 has promptly been reported to vary both in continuum and line emission (e.g. Peterson et al, 1985 ; Baribaud et al, 1988 and references therein). Hereafter we use for Akn120 a systemic velocity z = 0.0332 (van Groningen, 1984) and a Galactic reddening E(B-V) = 0.12 (Burstein and Heiles, 1982).

2. ESTIMATE OF THE BLR SIZE IN AKN120

Over the past ten years we have collected a large data set for this AGN in the wavelength range 125 to 800nm (spectrophotometry performed at the European Southern Observatory and International Ultraviolet Explorer data bank).

From continuum shape analysis we have estimated the contributions at $\lambda_0$91.2 nm of various components in Akn120 : (i) accretion disc thermal emission producing the so-called big-bump (24000K BB), (ii) power-law (α = 1) and (iii) stellar population. We find that component (i) is the primary contribution to the continuum at λ_0 91.2 nm and this is in agreement with the spectrum hardening we observe over the 146 to 183 nm range when the ultraviolet flux increases. Hence, the $\lambda_0$146 nm continuum light-curve is to be preferred for comparison with BLR emission light-curves when deriving the BLR size in Akn120.

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We have built the $\lambda_0$146nm continuum light-curve as well as that of the CIV line emission, measured over the velocity extent (-16000, +16000 kms^{-1}). Comparison of these curves shows two effects : the variations in the broad line emission are delayed in time and the duration of the line outburst is larger than that of the continuum outburst. These effects both result from the BLR being at a distance R from the ionizing source and can be used to quantify this parameter (Baribaud et al, 1988). Our final estimate for the BLR size in Akn120, from the CIV line emission is R $\leqslant$ 2 $\pm$ 0.5 light-month.

3. LINE PROFILE CHANGES IN THE CIV AND BALMER EMISSION

The structure and kinematical properties of the BLR can be approached through the analysis of *line profile* changes responding to ionizing flux variations.

In order to get rid of the low velocity, non-variable NLR contribution, we have subtracted the spectrum observed in a low state of nuclear activity from that typically found in a high state (scaled to the same NLR [OIII] line flux). The resulting difference-profiles in Hα, Hβ and Hγ are double-peaked. Using least square fitting techniques (Pelat and Alloin, 1980) we find that the Balmer difference profile can be represented by 3 components : a broad one (z = 0.0355 ; FWHM ~ 12000 kms^{-1}), a blue peak (z = 0.0259 ; FWHM ~ 2200 kms^{-1} and a red peak (z = 0.0395 ; FWHM ~ 1890 kms^{-1}). It is interesting to note that the FeII lines also suggest a double-peaked system with redshift values similar to those of the blue and red peaks we observe in the Balmer difference profile (van Groningen, 1984). In contrary, the CIV line profile does not show the double-peaked component but only the broad one. These results point towards a BLR made of two subregions : a disc-like (two-peaked profile) structure responsible for most of the low ionization line (LIL) emission, and a more spherically distributed set of clouds (broad emission) providing the high ionization lines (HIL).

We have monitored the intensity of each of these components in Hα. While the broad line component displays large variations, we find that the blue and red peaks provide an almost constant contribution, except when the nucleus is in an extremely low state. This implies that the disc-like structure is more extended than the 2 light-month BLR size derived from the CIV line variations.

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DISCUSSION

GASKELL The problem with this disk idea is that both sides of the line have to vary together and in two other similar cases (NGC 5548 and 3C 390.3) they certainly don't! There are *enormous* changes in the red/blue ratio with time. This is however just what is expected if we are seeing two quasars in the same nucleus varying independently.

ALLOIN In the case of Akn 120 which I discuss here, the red and blue shoulders change together. As the broad wings pertain to a component which is slightly redshifted, the red shoulder is boosted up when the broad component goes up. But when a proper quantitative analysis of the profile is performed, the red shoulder is found not to have changed noticeably.