NARROW LINE REGION IN NGC 4151 NUCLEUS

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The well-known correlations of forbidden lines FWHM with the critical density for collisional de-excitation and with the ionization potential mean, that :

i. the noticeable part of forbidden lines emission must arise in a gas of a rather high density $n \sim n_c$

ii. the gas velocity, the density and the degree of ionization they all increase toward the centre of the nucleus.

The gas density varies within the distance as r^{-2} or more slowly, but not less than $r^{-3/2}$ (Fig.1). The critical density for [OIII] lines $n_c \sim 10^6 cm^{-3}$ may be placed at a distance of 1 - 10 parsec from the centre (see Fig.1).

In the continuous gaseous envelope or in the envelope consisting of numerous clouds when $n \sim r^{-2}$ and the filling factor not depending on r, the critical density region (CDR) yeilds the most essential input to forbidden lines emission. That is because the gas emissivity ε is proportional to n^2 when $n < n_c$ (outward part of NLR), and $\varepsilon \sim n$ when $n > n_c$ (inward part of NLR).

Such a scheme is likely to be realized in the centre cloud of the NGC 4151 nucleus. This cloud is responsible for the main central narrow component of [OIII] line profile. As for the wings of [OIII] lines, we must admit, that they are formed in two separate regions in the immediate vicinity of the nucleus. The red wing and a short step on the red part of profile belong to the NE side of the nucleus, while the blue one and the long step on the blue part of contour belong to the region on SW side of the nucleus.

The space separation of clouds responsible for [OIII] wings is nicely seen on the spectra obtained by Ulrich (1973). Later this question was discussed by Pronik (1978), Heckman et al., (1981) and Schulz (1987). They presented pictures demonstrating this effect very prominently. Pelat and Alloin (1982) (PA paper) could not observe the separation of these two regions because of poor spatial resolution (2"8).

The [OIII] line profile observed by Pronik and Balinskaja (1982) at the 6-m telescope with narrow slit (0"4) and good seeing of about 1" but with P.A. $\simeq 120^0$ is quite similar to that published in PA, except for the higher contrast of central maximum. The reproduction of this spectrum with [OIII] line images is shown in Fig. 2. A short red shoulder and a long blue one are well establi-

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shed. The most prominent narrow central part of the line without any doubt belongs to the central cloud of the nucleus (but not to the extending clouds outside the nucleus).

It is very likely, that the gas responsible for the shoulders on [OIII] contour (and for the assymetry of profile, too) has a form of two opposite gas streams or jets releasing from the nucleus, since the angular dimention of shoulders in the spectrum in Fig. 2 is very small ~ 1".5 (P.A.=120°), while in P.A.=40°, as follows from the paper (PA), the high velocity gas flow is observed up to distance of 8" from the nucleus.

The relative intensities of red and blue shoulders and their difference on [OIII] line profile obtained by various authors (Fig. 3) is a fair argument in favour of a multiple structure of NLR in the NGC 4151 nucleus. If it were confirmed, we would be obliged to revise the geometrical model of NLR, the interpretation of observed correlations mentioned hereabove and the nature of narrow line profile assymetry.

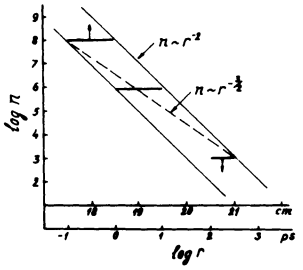

Figure 1. Location of critical density region in AGN

Figure 2. Magnified image of 5007 [OIII] lines obtained at the 6-m telescope (P.A.=120°).

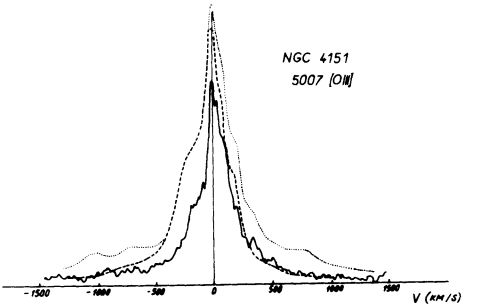

Figure 3. The comparison of 5007 [OIII] line profile obtained by various authors: dotted line - Pelat & Alloin (1982), brcken line - Vrtilek & Carleton (1985), solid line - Schulz (1987).

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