H_β PROFILE VARIATIONS IN THE SPECTRUM OF SEYFERT GALAXY NGC 5548 NUCLEUS

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ABSTRACT. The spectra of NGC 5548 galaxy nucleus obtained at the Crimean Astrophysical observatory on 2.6-m Shain telescope from April till August 1985 showed strong variations of H_β line profile. The profile being almost symmetrical in April became more and more asymmetrical in June-August, the flux in blue wing increased twofold in respect to the red one. Such variations of line profile were accompanied by continuum decrease.

We suppose, that the observed variations might be explained by the appearance of the absorbing matter located on the line of sight between the nucleus and the gas responsible for the intensity increase in the blue wing of H_β line. This gas might have been ejected close to the line of sight direction.

1. A large number of the existing models of central regions of active galaxies (AG), in particular Seyfert galaxies, are still inadequate to explain the observed variety of their spectral and photometrical characteristics. This is especially valid in case of rapid spectral and photometrical variations.

As far as NGC 5548 galaxy nucleus is concerned, according to spectral observations carried out by de Bruyn (1980) and at the Crimea 2.6-m telescope (during ten years), the intensities of H_β line and continuum may considerably vary with time. Hereinafter we discuss the spectrum variations in the galaxy nucleus for several months in 1985. It is undoubtedly interesting, since they reveal the geometry and kinematics of gas and dust in the central region of the galaxy.

2. The characteristics of a spectrograph with the image tube in Nesmith focus of 2.6-m telescope and the spectrograms obtained using this installation have been described earlier (Chuvaev, 1985). Let us remind that the galaxy nucleus was observed with a slit width 1".8, dispersion $\sim$ 100 Å/mm and spectral resolution 6 - 7 Å. The H_α and H_β regions were taken at different time in two posi-

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tions of diffraction grating. The spectrograms were reduced on the microphotometr G3 connected with microcomputer "Iskra 1256", that allowed a satisfactory accuracy of the photometrical analysis of spectrograms with rather strong emission lines. The accuracy of the results compiled in the Table is about ± 10%.

TABLE: Hβ profile variations in the spectrum of Seyfert galaxy NGC 5548 nucleus

Dates	J.D. 2446+	W (H_β)	n(H_β)	W (H_α)	n(H_α)	W (N_1+N_2)	K
26/27.4.85	160	95	2	345	1	85	1.00
12/13.5.85	198	135	2	470	1	110	1.10
17/18.6.85	234	125	2	450	1	95	1.55
16/17.7.85	263	165	2	660	1	120	2.30
18/19.7.85	265	145	1	530	1	105	2.00
10/11.8.85	288	180	1	630	1	140	1.95
11/12.8.85	289	165	2	585	1	125	2.15
8/9. 4.86	527	130	2	460	1	90	1.15

Note : 12/13.5.85 - bad guidance
16/17.7.85 - nonstable seeing

Due to bad weather at the beginning of 1985, we could observe the galaxy only for 5 months. The Table shows the dates of observations, the number of obtained spectra n(H_β) and n(H_α), equivalent widths W of H_α, H_β and (N_1+N_2) lines. N_1 and N_2 are actually [OIII]λλ 4959 and 5007. "K" stands for the asymmetry of H_β line. It was determined as a ratio of the area limited by the profile and continuum from the blue side of wavelength λ_o, corresponding to a narrow peak in H_β line versus the same area redward λ_o. In order to simplify the picture (see Figure), we show the profiles obtained only for 3 dates out of 8 presented in the Table. They correspond to the beginning, middle and end of 1985 observations. The normalization was made by summing up H_β areas above the continuum. The last line of the Table shows the data for April 1986 observations of galaxy nucleus. The characteristics of the spectrum became almost the same as in April-May 1985.

Absolutely analogous variations observed in H_α line can be estimated as direct and independent evidence for the reality of H_β line profile and its equivalent width variations.

3. A thorough consideration of Figure and the data compiled in Table allows the following conclusions :

a) Being symmetrical in the end of April, the H_β line profile became more and more asymmetrical with time. The intensity in the blue wing of broad component of the line markedly increased, whereas in red it decreased.

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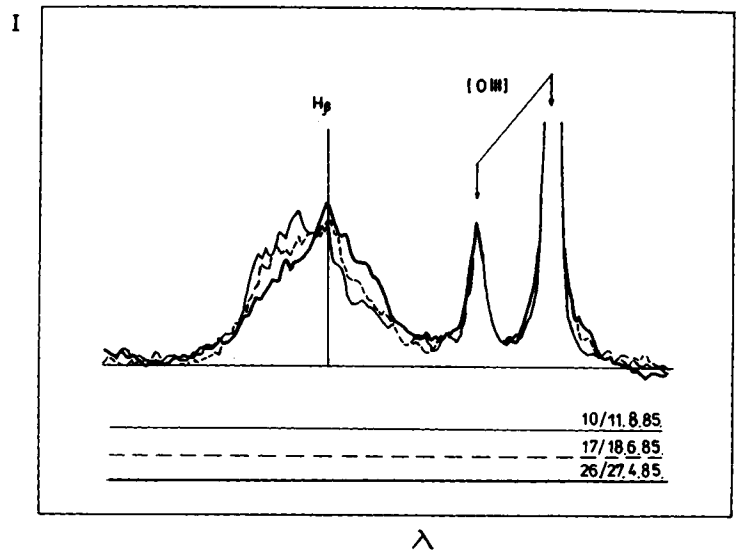

H β emission line profiles obtained for three dates indicated in bottom right-hand corner are shown in the Figure. The lines parallel to λ axis show the level of continuum and zero point of the intensity scales for these dates.

b) Assuming the flux radiation in N_1 and N_2 lines being constant during a year we can state, that the intensity of the continuum decreased. Really, the value of $W(N_1+N_2)$ in August was 1.5 times higher than that in April. Such difference is far beyond possible errors of reduction accuracy.

c) According to Table the values of $W(H_\beta)$ and $W(H_\alpha)$ were varying synchronously.

d) The following facts are noteworthy, too. In spite of the appearance of the excess emission in the blue wing of H β line, the boundary of the wing within the data reduction accuracy remained the same. Simultaneously the intensity of H β peak was nearly constant.

4. Recently a number of important works pointing out the existence of absorption in regions of narrow and broad emission lines and continuum of SG nuclei have been carried out. For instance, Lawrence and Elvis (1982) evidenced that the absorbing matter can be located in the vicinity of the central source. It can either coexist with the region of broad emission lines, or exceed it in size.

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Turning back to NGC 5548 galaxy nucleus observations in 1985 we are inclined to suggest that they might be interpreted as a result of gas ejection with simultaneous or consequent appearance on the line of sight of some absorbing matter (clouds or filaments). Such an assumption readily explained the observed weakening of continuum and red wing of H_β line.

If our assumption is correct and the phenomenon really exists the effectively absorbing matter should be located between the central source and, at least, the ejected gas. (Let us note, that recently Veron et al. (1985) has obtained similar results about the location of absorbing clouds in NGC 4151 nucleus while studying its UV spectra). The direction of gas outflow was close to the axis of rotation of the galaxy, i.e. to the line of sight, since it is observed on the plane of the sky; the axial ratio b/a being 0.83. The dispersion of gas velocities in the jet is markedly lower than that of clouds or gas forming the summarized H_β profile. This assumption is in accord with the fact that the blue wing's boundary of the broad component of the line was constant during the whole period of observations.

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