SPECTRAL MONITORING OF NGC 5548 IN 1996 – 2004

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We present results of a spectral monitoring program of the Seyfert galaxy NGC 5548 with the 6m and 1m telescopes of SAO (Russia) and with the 2.1m telescope of Guillermo Haro Observatory at Cananea, México. Spectra were obtained with long-slit spectrograph, covering the spectral range ∼(4000–7500) Å with a (4.5–15) Å resolution. We found that:

– Both the flux in the lines and continuum gradually decreased, reaching minimum values during May-June 2002. In the minimum state, the wings of Hβ and Hα became extremely weak, corresponding to a Sy1.8 type, not to a Sy1, as observed previously when the nucleus was brighter.

– When the line profiles were decomposed into variable and constant components, the variable broad component is well correlated with the continuum variation. It consists of a double peaked structure with radial velocities of $\sim \pm 1000$ km/s relative to the narrow component. A constant component, whose presence is independent of the continuum flux variations, shows only narrow emission lines. The mean, rms, and the averaged over years, observed and difference line profiles of Hβ and Hα reveal the same double peaked structure at the same velocities. The relative intensity of these peaks changes with time. During 1996, the red peak was the brightest, while in 1998–2002, the blue peak became the brighter one. Their radial velocities vary in the range ∼500–1200 km/s.

– In 2000–2002 a distinct third peak appeared in the red wing of Hα and Hβ line profiles. The radial velocity of this feature decreased between 2000 and 2002: by the observed profiles, from $\sim +(2500\text{–}2600)$ km/s to $\sim +2000$ km/s and it is clearly seen on the difference profiles.

– The fluxes of various parts of the line profiles are well correlated with each other and also with the continuum flux. The blue and red parts of the line profiles at the same radial velocities vary in an almost identical manner.

– Our results favor the formation of the broad Balmer lines in a turbulent accretion disc with large and moving "optically thick" inhomogeneities, capable of reprocessing the central source continuum.

We made an attempt to investigate the variability of physical parameters in the **BLR** of NGC 5548 using the Boltzmann plot method given by Popović (2003). We applied the method on the broad Balmer lines, and found that variability seen in lines is also present in the electron temperature (**T**). We found that the average **T** for the considered period was $\approx$ 10000K, and that it varies from 6000K (in 2002) till 15000K (in 1998). This variation correlates with the optical continuum flux ($r = 0.85$) and may indicate existence of an accretion disk in the **BLR** of NGC 5548. We found that Partial Local Thermodynamical Equilibrium approximation is valid for at least one part of the BLR of NGC 5548.

The detailed discussion of these results is done in our papers (Shapovalova at al. 2004; Popović et al. 2005).

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References

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