SPECTRAL VARIABILITY OF NGC 4151 IN 1972-1991

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After a minimum in the spring of 1984, when the broad permitted lines were found to become much weaker, the spectrum of NGC 4151 became much more like a Sy 2 (Lyutyi et al.,1984; Chuvaev and Oknyanskij, 1989; Penston and Perez, 1984). Recently, this object returned to the high state after about 8 yr in the semiquiescent phase (Oknyanskij et al., 1991).

The purpose of the present work was to investigate the variability of different emission components in the spectrum of NGC 4151 over a long series of coordinated spectral (2.6-m telescope) and photometrical (60-cm telescope) observations which were made with the same equipment during several hundreds nights in last two decades. Additionally, we use in our investigations other published (or obtained from private communications) spectral, IR (see details of near IR data reduction in Oknyanskij, 1993), UV (IUE archive) and X-ray data . Using all these data we drew combined light curves and then investigated them with the Fourier and cross-correlation analysis.

The main results are the following:

1. To obtain clear power spectra, we applied the CLEAN algorithm to optical continuum light curves in two time intervals: 1968-1977 and 1978-1988. We revealed that the semiregular component $1/66^d$ was present only during the first interval.

2. Cross-correlation functions for the lines H_β, H_α vs. F(U) during "low" and "active" states are very different. For the "low" state we surely found time delays between the optical continuum and the line variations about 12 ± 5 days for H_β and H_α. For "active" state the values of time delays are about the same but can't be estimated so exactly in view of the broader profile of peaks in the cross-correlation functions.

3. Measurable time delay between the UV, X-ray (2-10 keV) and optical continuum light curves is abdent, but near IR flux F(K) variations appear to lag those in optical F(U) by 18 ± 6 days.

4. From the modeling we concluded that the IR emission region can be better modeled as a thin disk viewed nearly edge-on than as a thick spherical shell.

References

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