

Study of Photometric and Spectral Variability of Planetary Nebulae during 1968-1996

E.B. Kostyakova

Sternberg Astronomical Institute, Moscow, Russia

The photometric and spectral study of 7 selected planetary nebulae has been carried out since 1968. (See: Mem.Soc.Roy.Sci.Liege, 6^e ser., 1973, 5, 473). During nearly 30 years of photoelectric observations, 5 planetaries (NGC 6572, IC 4997, Hu2-1, NGC 6891 and NGC 6543) have undergone noticeable variations of integral UVB-brightness in the range $0.1 \div 0.6$ mag. The nebulae NGC 6720 and IC 3568 showed no changes of integral brightness exceeding 0.1 mag. The most remarkable behaviour was found for the nebula IC 4997: a steady decrease of the integral brightness in 1968–85, amounted on the whole to $0.4 \div 0.6$ mag., an unexpected stop of this decrease in 1985–86, and almost monotonous brightening in 1987–96.

A parallel systematic spectral study of the same objects has been carried out since 1972 by means of 50-cm Maksutov telescope with objective prism. The absolute energy fluxes in the brightest nebular emissions and in the continua of the central stars were measured in the photographic region of spectra.

For the nebula IC 4997 the analysis of the spectra showed that during our observations the energy fluxes in hydrogen and nebular lines became somewhat weaker, but the ratio N_2/H_β remained almost constant. At the same time, the flux in λ 4363 [OIII] became about 2 times stronger, but the flux in λ 3727 [OII] – about 2 times weaker. That can testify to grows of ionization degree in the nebula. The known ratio: $R = F(\lambda 4363 \text{ [OIII]})/F(H_\gamma)$, indicating the excitation degree of the nebular spectrum, showed a strong rise from 1972 till about 1992, and then a slow decrease during last 4 years. This ratio reached its maximum value in 1992 ($\log R = +0.28$). The HeI, λ 4471 flux and the flux in the central star continuum ($\lambda_{ef} \simeq 3970 \text{ \AA}$) showed also some increase in 1972–92. The analysis of photometric and spectral behaviour of the nebula IC 4997 leads to the conclusion that during the observation period the radiation field of its central star had undergone noticeable changes, caused by some temporary outbursts (or flares) of the ultraviolet radiation and grows of the central star temperature due to possible instability of the star.

Our results of the UBV-observations of 7 planetaries were published in 3 catalogues:

REFERENCES

- Publ.of Sternberg Astron.Inst., 1991, 62, 143
- Sov.Astron.J.Lett., 1990, 16, 12, 1085
- Sov.Astron.J.Lett., 1994, 20, 2, 122

The catalogue of the spectral characteristics of planetaries IC 4997 and NGC 6572 will be published in Sov.Astron.J.Letters. The spectra of other variable nebulae are still in work.