

# Spectral Changes in the Grygar Variable HBV 475

A. MAMMANO and G. M. RIGHINI (Asiago and Firenze)

Photovisual and spectroscopic observations of HBV 475 in the range  $\lambda\lambda$  3800–11 000 Å, by means of S-20 and S-1 Carnegie Intensifiers and prismatic cameras (dispersion 60 Å/mm at H $\gamma$ ), made in 1969 through 1971, have revealed the simultaneous presence of hot and cold sources of radiation, both variable.

In 1969 when the magnitudes were  $B = 12.45$ ,  $V = 12.05$ ,  $U = 11.40$  the hot source gave origin to a quite strong ultraviolet continuum and to emission lines among which the most intense are due to: HI (H16 to H $\alpha$  and P14 to P7); OI 8446; FeII (mult. 27, 37, 38, 42, 48, 49); [NII] 5755; HeI (4471, 5876, 6678, 7065, 10 830 very strong); [OIII] (5007, 4959, 4363); [NeIII] (3869, 3968); HeII 4686 weak.

The cold source produced an M4-M6 absorption spectrum and, very likely, emission lines of CaII (3933, 8498, 8542, 8662) quite faint, and of [FeII] (mult. 6F, 18F, 21F, 23F).

In 1970 the blue and possibly the visual brightness decreased ( $B = 13.2$ ); the cold component became of later type; the presence of VO bands indicating an M9-M10 spectral type. The excitation of the emission lines increased as it is demonstrated by the disappearance of lines of low I.P. like CaII, the fading of FeII and by the growing of lines of high I.P. like HeI, HeII, NIII, [OIII], [NeIII] which implies an increase of the temperature of the hot source.

In 1971 the B magnitude of the variable and the spectral type of the cold component do not change, while the other component becomes hotter and hotter as can be inferred by the disappearance of permitted FeII lines and by the further strengthening of HeII and the appearance of lines of [FeIII], [FeV] and [FeVI].

The behaviour in the red-visual region is therefore typical of symbiotic variables rather than that of a planetary nebula as suggested by other authors.

By considering the infrared spectrum we realize that the model of two variable stars of very different physical characteristics, imbedded in a thick nebula explains the observations. The density in this nebula should be larger than  $10^7$  el. cm $^{-3}$ , since we do not observe [OII] 7325 and [SIII] 9065–9532, which are clearly seen in novae and in V1016 Cyg.

The full paper will be submitted to „*Memorie Società Astronomica Italiana*“.

## *Discussion to the paper of MAMMANO and RIGHINI*

SAHADE: I feel happy to have two sources of radiation, but I do not feel happy at the identification of the depression at about 3970 as CaII-H absorption.

MAMMANO: The eventual presence of CaII (H) guides us to look at the M star; I agree that the identification is doubtful.

HUTCHINGS: A recent spectrum in the blue taken in Victoria shows that the forbidden line profiles have changed since last year.

GEYER: How do the radial velocities of the absorption and emission features behave?

MAMMANO: The emission lines give an average velocity of  $-27.2 \pm 4.6$  km/sec, but correlation exists between radial velocity and higher ionization potential. The average radial velocity does not correlate significantly. No absorption line velocities have been measured owing to the complex spectrum and small dispersion.