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ON THE TWO-COMPONENT STRUCTURE OF SPECTRUM-FORMING LAYER OF METALS IN CEPHEID T Vul

Based upon the system of equivalent widths for determining the local temperature in physical variable stars (Fenina et al., 1990) an investigation of the classical cepheid T Vul ($P=4^{d}.4315578$) was carried out from the equivalent widths published in the work by Rautela et al. (1981). In their work some physical and chemical parameters of stars were determined in different phases of light variations by the method of differential "curves-of-growth" with respect to the Sun. The authors account their choice of the comparison star for the closeness of T Vul spectral class (F7 Ib -G3 Ib) to the solar one. However the equivalent widths of absorption lines of metals, in particular neutral iron, when compared to the stationary stars of the same spectral classes using similar dispersion, are not always consistent with their spectral interval. In a number of cases the equivalent widths of FeI absorption lines are inconsistent with temperature parameters determined by the authors (Rautela et al., 1981). Besides the temperature parameters and the spectral classes interval of T Vul given in their work are inconsistent with each other. Therefore the alternative analysis was made of equivalent widths of absorption lines in T Vul by the absolute method of "curves-of-growth" with the account of local temperature and new data on atomic parameters of chemical elements. The excitation temperature was determined by the method of successive approximations from the local temperature determination. In the first approximation the temperature is estimated from each of the lines from the work by Fenina et al. (1990).

In constructing "the curves-of-growth" with the individual value Θ_{ex} for each line it is divided into two components (Fig. 1) from which one can estimate two dominant mean values Θ_{ex} as the second approximation. Within the range of these values, as a rule, there is the value Θ_{ex}, parameter Θ_{ex} determined by Rautela et al., (1983). Two phases of the main light variation $\phi = 0.04$ and 0.72 are exceptions. The division of the curve of

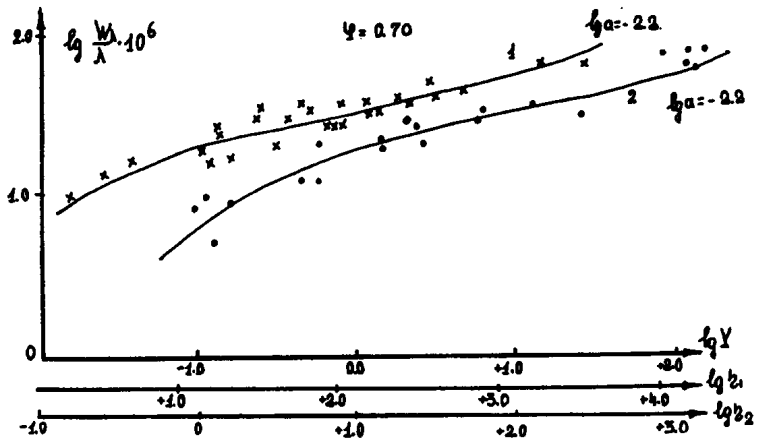

Figure 1

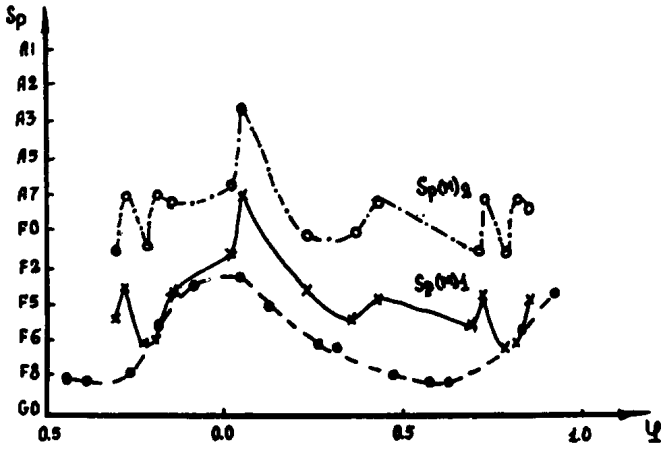

Figure 2

growth into components permits to approximate each of them by the theoretical "curve-of-growth" unambiguously within the range of ± 50K. Thus it is supposed that the spectra of the cepheid T Vul are mixed, that is there are absorption lines present in them which are formed in the regions with different temperature and other physical conditions. A possible distortion of a continuous spectrum level caused by this seems to be small. The mixed spectrum consists of absorption lines only of those stellar atmospheric regions for which the exposition chosen proved to be the optimal one. In Fig-

Table I. Spectral characteristics of spectrum-forming level of metal absorption lines in T Vul.

φ	0.02	0.04	0.23	0.36	0.42	0.70	0.72	0.78	0.81	0.85
$\theta_{ex}1$	0.917	0.841	0.953	0.968	0.936	0.968	0.936	1.000	0.989	0.946
$\theta_{ex}2$	0.847	0.763	0.884	0.890	0.847	0.900	0.855	0.910	0.855	0.865
SpI	F1.2	A6.4	F4.0	F5.4	F4.0	F5.5	F3.5	F6.4	F6.0	F4.1
Sp2	A6.6	A2.6	F0.1	F0.0	A7.5	F1.0	A7.0	F1.0	A7.0	A8.0

ure 1 the two-component "curve-of-growth" is shown for one of the phases of the main variation of T Vul constructed in coordinates:

$$\lg W_\lambda / \lambda\, 10^6, \qquad \lg f g\lambda - \theta_{ex}\varepsilon$$

On the horizontal axis three scales are represented: one experimental scale $Y = \lg f g\lambda - \theta_{ex}\varepsilon$ and two theoretical scales η_1 and $\eta_2 = Nk/V_t$ (Wrubel, 1949). If the components of "the curve-of-growth" are superimposed from the parameter η_1, η_2, we can be easily convinced in their full coincidence. This confirms the difference in temperatures in forming lines situated in different curves-of-growth and testifies to the quantitative coincidence of the number of iron atoms FeI. Due to this the "curves-of-growth" constructed in the work by Rautela et al. (1981), from the parameter are unambiguous and give the mean value of temperature.

For all the phases of T Vul light variation the two-component "curves-of-growth" are given in the work by Fenina et al. (1989). In Table I the spectral characteristics of the formation level of metal absorption lines in T Vul are represented according to this latter work.

In Figure 2 a complicated character of the variation in the spectral classes is shown depending upon phase ϕ which is due to the layered structure of a spectrum -forming level. Crosses and blank circles correspond to the components of the curve-of-growth $Sp(M_1)$ and $Sp(M_2)$ whereas the dots denote the spectral classes corresponding to the temperatures from work by Rautela et al. (1983) for comparison purposes.

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