OBSERVATIONS OF H_β AND HE II λ 4686 LINES IN THE SPECTRA OF FLARES OF UV CET-TYPE STARS

P.F. Chugainov, P.P. Petrov, A.G. Shcherbakov
Crimean Astrophysical Observatory, USSR

We have carried out 45.4 hours of continuous spectroscopic and photoelectric B-band observations of AD Leo, DT Vir and YZ CMi. The spectroscopic resolution was about 1 A in wavelength and 5-10 min in time. 6 flares were recorded. Light curves and line profiles are to be presented in the Izv.Crim. Astrophys. Obs., Vol.69. In this paper only the main results are discussed.

PREFLARE STRENGTHENING OF H_β LINE

In 2 flares of AD Leo and 2 flares of YZ CMi, i.e. in 67% of our recorded flares, an increase of the central intensity of H_β was observed 10-20 min before the maximum of the star brightness in the B-band. The increase was 10-15% for 3 flares and 50% for one flare in which an increased star brightness was observed 8 min preceding the maximum and a possible negative flare arose 2 min before the maximum. This flare seems to be an unusual one because: 1) in the other 3 flares where the strengthening of H_β occured before the maximum the star brightness did not increase at that time; 2) very extensive photoelectric observations of UV Cet-type stars show that such flares with the increase of brightness 10-20 min before the maximum are very rare. Hence one may conclude that the preflare radiation is characterized by an increase of line emission and a strengthening of the continuum emission which only occurs in rare events. At flare maxima it is the continuum emission that shows the greatest enhancement.

THE H_β LINE PROFILES DURING THE FLARES

The spectra of one flare of AD Leo and one flare of YZ CMi definitely indicate the formation of broad wings of H_β occuring mainly during flare maximum. These flares surpass the other 4 flares in total optical energy. The line wings are traced $\pm$ 15 A for the flare of AD Leo and $\pm$ 10 A for the flare of YZ CMi. The intensities of the violet and red

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wings are not equal at the same distances from the line center. This effect is especially noticeable on the spectrum obtained near the maximum of the flare of AD Leo where it looks like a 'red asymmetry'. The Stark-effect seems to be the most appropriate explanation of the origin of the wings. Assuming an electron temperature of 10000 K and optical depth at line center of 100-1000 we have found the following estimates of the electron density: log n_e=14-15 for the flare of AD Leo and log n_e= 14 for the flare of YZ CMi. The asymmetric profiles imply motions with velocities of the order of 100-1000 km/s.

He II λ 4686 LINE

Special effort was made to search for the presence of this line in the spectra of flare stars in the quiet state. Each star was analysed by 2 or 3 spectra. The averaged spectra showed that the equivalent widths of line emission or absorption do not exceed 0.02 A for AD Leo and DT Vir, and 0.1 A for YZ CMi. But for the case of flares the spectra were not averaged. Thus the upper limit of the equivalent width of the λ 4686 line turned out to be higher than that in the quiet state. It is approximately 0.07 A for flares of AD Leo and 0.2 A for flares of YZ CMi. The λ 4686 line is not revealed in any flare.

The emission in the λ 4686 line can be produced by the cascade recombination of He III ions which appear due to the X-ray flux. Assuming the ratios of X-ray, optical and λ 4686 luminosities being L(x)/L(opt)=1, L(4686)/L(x)=0.0012 we have found that the expected equivalent width of the λ 4686 line during flares is not higher than the threshold of our observations. However, equivalent widths of the λ 4686 line of the order of 1 A and greater were observed in 2 flares of UV Cet by Joy and Humason (1949) and Gershberg and Chugainov (1967). These values cannot be explained by the cascade recombination mechanism if the ratio of optical and X-ray luminosities is nearly the same for all flares of UV Cet-type stars.

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