SOME NOTES ON SS CYGNI

L. V. MIRZOYAN
Byurakan Astrophysical Observatory, Armenia, U.S.S.R.

ABSTRACT. The results of photoelectric and spectral observations of SS Cyg are briefly discussed. Some features of the spectral variations observed during a large outburst of SS Cyg can probably be explained using a model of a double star which is surrounded by an absorbing gaseous shell. It is noted that the existing data are not numerous enough for the explanation of the SS Cyg variability, in particular, its short-term variations.

SS Cyg is a spectroscopic binary star with a 0.276 period. The components of this system are dwarf stars (M = 5.5 for both stars), with dG5 and sdBe spectra; they probably show eruptive activity (Joy, 1956). In the spectrum of the B-component strong emission lines are observed. The dG5 spectrum is observed only in the minimum of SS Cyg.

There are various investigations of SS Cyg, but up to now the cause of its variability, in particular, its rapid variability has not been determined. In addition, there are many other observations which have not been explained.

1. As all other U Gem-type stars, SS Cyg shows cyclic outbursts. The mean time between these outbursts is equal to about 50 days. The amplitude of cyclic outbursts is 4-5. They have various forms of light curves. The duration of these outbursts usually does not exceed 5-10% of the cycles (Bretz et al., 1974).

Besides these cyclic outbursts, small (amplitude about 0.5), nearly continuous and completely irregular variations of the star brightness - small 'outbursts' - are observed. They occur very rapidly (of the order of a minute and less). In maximum brightness of SS Cyg, these small 'outbursts' are superimposed on the cyclic outbursts (Chalonge et al., 1968).

Finally, parallel with these two light variation types, SS Cyg...
undergoes sometimes 'middle outbursts' of about one hour duration and with about 1° irregular light variations (Gorbatskij, 1970). Thus, all light variations of SS Cyg can be formally divided into three groups, according to their magnitude and duration:

1. Large cyclic outbursts;
2. Middle 'outbursts';
3. Rapid 'outbursts'.

It must be noted that the duration of the outbursts of the two last groups is considerably shorter than the orbital period of SS Cyg.

2. Light variations of SS Cyg are accompanied by variations of its spectrum. Unfortunately, nothing is known up to now about the variations of SS Cyg's spectrum during rapid and middle outbursts.

Large variations of the star spectrum are observed during periods of large cyclic outbursts. In this period the star spectrum is strongly transformed. The emission lines of HI, HeI and CaII, which are the most characteristic lines at minimum, disappear and then turn into absorption lines with increasing brightness of the star. However, as Hinderer (1949) has shown for the first time, a pure absorption spectrum without noticeable signs of emission is observed only during the periods of increasing brightness of a large outburst.

Pronounced variations take also place in the continuous spectrum of SS Cyg during large outbursts. According to Mirzoyan and Kalloghlian (1965), the energy distribution in the photographic region corresponded at minimum to the spectrophotometric temperature 4000-5000°C (spectral type G); in the region 2.4 < 1/λ < 2.8 the intensity of the continuum emission increased rapidly towards short wave lengths. According to Chalonge et al. (1968) the energy distribution in the photographic region corresponded at maximum to the spectrophotometric temperature -13000°C K (spectral type B8).

Chalonge et al. (1968) have observed the changes of the SS Cyg spectrum during one large outburst (from minimum to maximum) in a spectral region which included the Balmer discontinuity. In this period, radical variations were noticed in the SS Cyg spectrum, both in the line and the continuum intensity.

Near minimum the emission lines were prominent. The strong emission lines of hydrogen (up to H10) and the moderate intensity lines of He I (λ5876 and λ4686) and He II (λ4026 as well as Ca II λ 3934) were observed. With increasing star brightness these emission lines transformed into absorption lines and almost disappeared in maximum light.

The variations in the continuum corresponded to an increase of the spectrophotometric temperature from -5000°C K to -13000°C K in the spectral region before the Balmer discontinuity and from -7500°C K to -15000°C K beyond it. It is important to note that the energy distribution both at minimum and maximum can be represented by a black body distribution for the investigated spectral region (λλ 3150-6200). The spectrophotometric temperature is higher in the