COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4207

Konkoly Observatory
Budapest
14 June 1995

HU ISSN 0374 – 0676

PHOTOMETRY OF SS Cyg IN 1993

SS Cyg is the brightest U Gem type dwarf nova. The average time between outbursts is about 50 days and their amplitudes are nearly 4 mag (Gaudenzi et al., 1990).

The binary nature of SS Cyg and its orbital period have been established spectrosco-!pically. Its photometric behaviour is quite irregular: although SS Cyg has been observed intensively for many decades, there is no general agreement about whether light variations with the orbital period occur in this system or not. Voloshina (1986) found regular magnitude variations with the orbital period, the shape of which was not stable over a long time but varied with the phase of the outburst cycle. This claim was supported by further observations of Bruch (1990) and Voloshina & Lyutyj (1993) but other authors (Honey et al., 1989) did not confirm it.

The photometric observations of SS Cyg in different colours may give important information about its geometric configuration and about the contribution of the different light sources (star components, disc, hot spot) to the total brightness of the system.

We observed SS Cyg mostly in R colour (Cousins system) on 8 nights in Sept/Oct 1993 with the 0.6 m telescope of Mt. Suhora Observatory equipped with a double-beam photometer (Kreiner et al., 1990) and an autoguiding (Krzesinski and Wojcik, 1990). The star HD 206330 (V=5.1 mag) was chosen as a check star. Because of the requirement of the double-beam photometer the distance between the variable and comparison star to be between 10 and 20 arcmin we used the star BD+42°4183 as a comparison. Its colours were B=12.68 and R=12.13 mag. The brightness of the comparison star was constant during our observations. The time of integration was always 10 sec. The observational data were corrected for atmospheric extinction by standard methods and phased according to the spectroscopic ephemeris (Cowley et al., 1980):

$$\mathrm{HJD} = 2444185.6881 + 0.27513 \times \mathrm{E} \qquad (1)$$

(the zero epoch corresponds to the maximum positive velocity of the absorption lines).

Some of our R light curves are presented in Figures 1-4 where Dmag is in sense variable−comparison. Analysis of the light curves allows us to draw the following conclusions:

(1) SS Cyg was in its quiescent state during almost all of our observing run because its mean magnitudes in R and B colours were respectively 11.6 and 12.5 mag.

(2) On Oct 10 the brightness began to increase slowly to 11 mag in R. This enchancement continued on the following night too (unfortunately it was mostly cloudy and there were too few observations). Probably this event is a beginning of an outburst.

(3) During the quiescent state the R light curve consists of spike-like sections. Their rising branches are very steep, nearly vertical, in contrast to the slower declining ones.

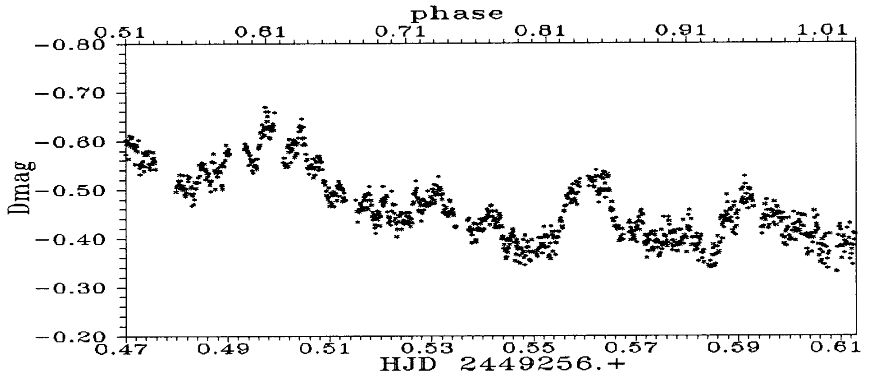

Figure 1. R light curve on Sept 26

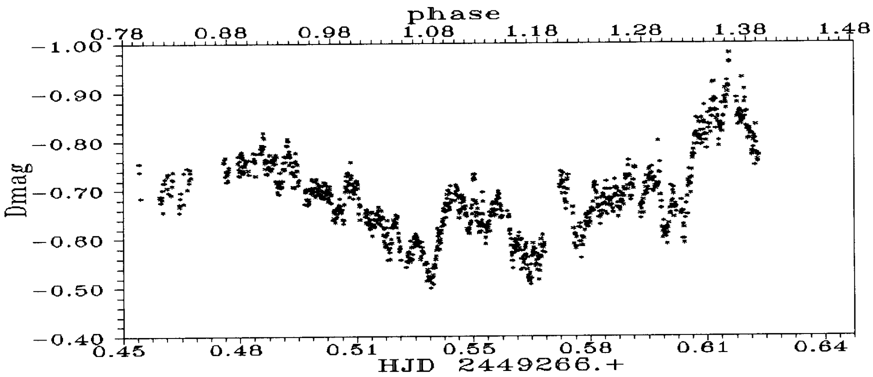

Figure 2. R light curve on Oct 5.

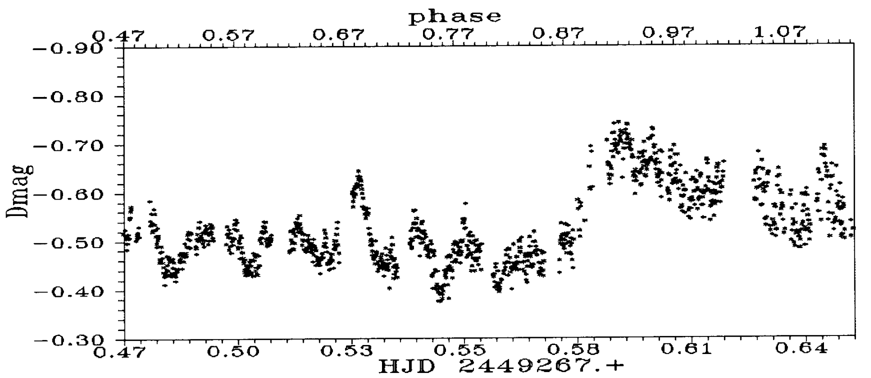

Figure 3. R light curve on Oct 6.

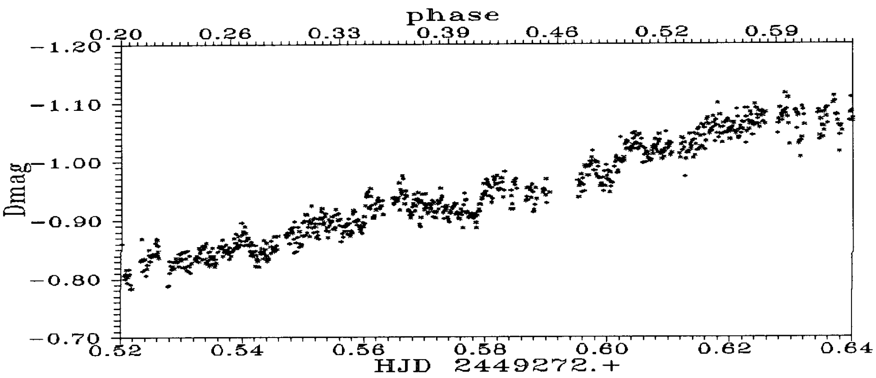

Figure 4. R light curve on Oct 11.

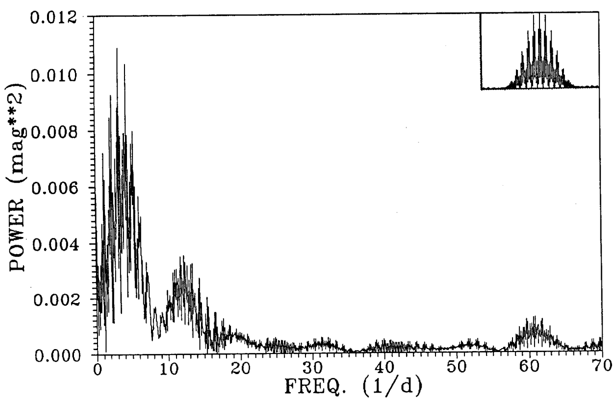

Figure 5. Fourier power spectrum of SS Cyg.

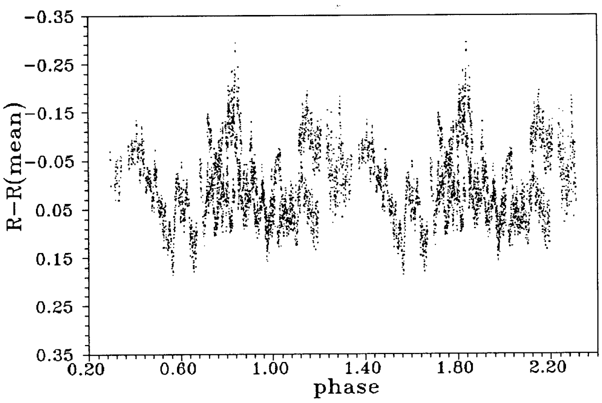

Figure 6. Folded light curve of SS Cyg.

The duration of each spike is about 20 minutes and the height is 0.13-0.15 mag. But there are also higher spikes with an amplitude of 0.2-0.3 mag (Oct 6 and 8), and they are nearly symmetric. These shapes of our light curves are quite different from the regular two-wave curves of Voloshina & Lyutyj (1993) but they are similar to those of Bruch (1990). The reason may be the observations are carried out in different phases of the outburst cycle. We suspect this fact could be due to the higher time-resolution of our observations compared to those of Voloshina & Lyutyj (1993).

(4) The increase of brightness at the beginning of the outburst is almost linear (Figure 4). Then there are smaller spikes with heights 0.05-0.07 mag.

The light curves of SS Cyg obviously exhibit strong variability on different time scales. In order to investigate periodic components of variability, all light curves (their total duration is 25 hours) were subjected to a common Fourier transform. In order to remove the long term trend the nightly means were first subtracted from each light curve. The resulting power spectrum is shown in Figure 5. It is similar to that of Bruch (1990). The highest maximum with an amplitude 0.1 is at frequency f=3.36 that corresponds to the photometric period 0.2972 days. This value differs from the spectroscopic period by 9 %. The folded light curve with our period value confirms this light variability (see Figure 6). It has two-wave shape and is similar to that of Bruch (1990). That is why we suppose the photometric period determined by us is related to the orbital one and our photometric data support the orbital nature of the long-term light variations of SS Cyg.

Acknowledgements. The authors are grateful to the Krakow Pedagogical University for the telescope time.

Dragomir V. MARCHEV
Diana P. KJURKCHIEVA
Shoumen University
9700 Shoumen
Bulgaria

References:

Bruch, A., 1990, *Acta Astron.*, **40**, 369
Cowley, A., Crampton, D., Hutchings, J., 1980, *Ap.J.*, **241**, 269
Gaudenzi, S. et al., 1990, *Acta Astr.*, **40**, 105
Honey, W.B. et al., 1989, *MNRAS*, **236**, 727
Kreiner, J. et al., 1993, IAU Coll. No 136 - Poster Papers on Stellar Photometry, ed. I. Elliott and C. Butler, Dublin Institute for Advanced Studies, p.80
Krzesinski, J. and Wojcik K., 1993, *Astr. and Astrophys.*, **280**, 338
Voloshina, I.B., 1986, *Pisma Astr. Zh.*, **12**, 219
Voloshina, I., Lyutyj, V., 1993, *Astron. Zh.*, **70**, 61