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# PHOTOMETRIC PECULIARITIES OF CH Cyg DURING ITS RECENT, 1995-97, QUIESCENT PHASE

CH Cyg is a peculiar symbiotic star. A high level of variability in all the observed parameters makes it very difficult to understand. A single-star model had been accepted by some authors until the 1980's, when a regular variation in radial velocities of about 5 700 days was revealed, and the binary nature for CH Cyg was suggested (Yamashita and Maehara 1979). However, explanation of the total hot component luminosity during the 1981-84 maximum in such a wide binary appeared to be a crucial problem. Skopal (1988) tried to solve this problem by assuming an asynchronous rotation of the giant star in the long-period binary to get a larger mass transfer via the $L_1$ point. On the other hand, Mikolajewski and Mikolajewska (1988) suggested a long-term accumulation of the wind material around a rapidly rotating magnetic white dwarf before its final accretion at a high rate. A new track in the investigation of the nature of CH Cyg was set by Hinkle et al. (1993) who suggested a triple-star model in which an unseen G-K dwarf on the long 14.5-year period orbit revolves the inner binary (the symbiotic pair) as the short 756-day period component. Skopal et al. (1996a) supported the triple-star model giving, however, two main modifications of the previous suggestion. They showed that CH Cyg is the system with a very high inclination of both the orbits, and instead of the unseen G-K dwarf, there is another giant star in the system on the long-period orbit. Also multifrequency observations from ultraviolet to the radio/mm-wave region, carried out during the recent 1992-94 active phase, revealed that outbursts can arise from accretion of material from the giant component onto its companion in the symbiotic pair of the triple CH Cyg system (Skopal et al. 1996b). In this contribution we present the recent development in its UBVR light curves.

CH Cyg has been regularly monitored at the Skalnaté Pleso (SP) and Stará Lesná (SL) observatories. The observations have been made in the standard Johnson system using a one-channel photoelectric photometer installed in the Cassegrain focus of the 0.6/7.5 m reflectors. The stars HD 182 691 (V=6.525, B−V=−0.078, U−B=−0.24, V−R=0) and SAO 048 428 ($m_v$=8.0, $m_{pg}$=8.6, spectrum F8) were used as the comparison and the check stars, respectively.

Our new UBVR photometric observations are introduced in Table 1 and plotted in right panels of Figure 1 together with those published previously in the literature. They cover a period of the CH Cyg return to quiescence from its recent, 1992-95, active phase. Here we point two peculiarities which developed during this period: (i) a sudden drop in the U brightness by ∼1.5 mag at about JD 2 450 260 – marked in Figure by a bar, and (ii) about 1 mag deep and ∼200 days broad minimum centered around JD 2 450 310 (1996 August), and pronounced more in V and R.

Table 1. New photometric observations of CH Cyg

| JD −2 440 000 | U | B | V | R | Date | Obs |
|---|---|---|---|---|---|---|
| 10070.291 | 10.314 | 10.314 | 8.710 | 6.734 | 18/12/95 | SP |
| 10080.188 | 10.553 | 10.357 | 8.637 | | 28/12/95 | SL |
| 10096.191 | 10.953 | 10.319 | 8.483 | | 13/01/96 | SL |
| 10099.190 | 10.553 | 10.232 | 8.458 | | 16/01/96 | SL |
| 10115.633 | 10.465 | 10.117 | 8.504 | 6.558 | 01/02/96 | SP |
| 10139.613 | 10.572 | 10.349 | 8.841 | 6.849 | 25/02/96 | SP |
| 10150.607 | 10.510 | 10.336 | 8.869 | 6.869 | 07/03/96 | SP |
| 10160.502 | 10.649 | 10.467 | 8.987 | 6.937 | 17/03/96 | SP |
| 10161.531 | 10.414 | 10.397 | 8.966 | 6.948 | 18/03/96 | SP |
| 10193.539 | 10.538 | 10.389 | 8.885 | 6.960 | 19/04/96 | SP |
| 10197.487 | 10.898 | 10.508 | 8.959 | 7.008 | 23/04/96 | SP |
| 10234.411 | 11.285 | 11.121 | 9.660 | 7.536 | 30/05/96 | SP |
| 10240.469 | 11.174 | 11.130 | 9.752 | 7.611 | 5/06/96 | SP |
| 10248.470 | 11.478 | 11.358 | 9.921 | 7.749 | 13/06/96 | SP |
| 10269.371 | | 11.725 | 10.063 | 7.859 | 4/07/96 | SP |
| 10274.478 | 11.425 | 11.473 | 10.070 | 7.847 | 9/07/96 | SP |
| 10278.492 | | | 10.183 | 7.829 | 13/07/96 | SP |
| 10286.448 | 11.116 | 11.306 | 9.948 | 7.756 | 21/07/96 | SP |
| 10292.373 | 11.159 | 11.329 | 9.939 | 7.746 | 27/07/96 | SP |
| 10296.455 | 10.858 | 11.173 | 9.888 | 7.726 | 31/07/96 | SP |
| 10305.477 | 10.869 | 11.213 | 9.953 | 7.793 | 09/08/96 | SP |
| 10364.462 | 11.393 | 11.394 | 9.882 | 7.649 | 07/10/96 | SP |
| 10365.373 | 11.365 | 11.377 | 9.883 | 7.656 | 08/10/96 | SP |
| 10371.231 | 11.600 | 11.624 | 9.947 | | 14/10/96 | SL |
| 10383.208 | 11.476 | 11.522 | 9.929 | 7.651 | 26/10/96 | SP |
| 10384.207 | 11.680 | 11.628 | 9.956 | | 27/10/96 | SL |
| 10397.256 | 11.339 | 11.428 | 9.908 | | 09/11/96 | SL |
| 10411.193 | 10.803 | 11.004 | 9.642 | 7.457 | 23/11/96 | SP |
| 10421.247 | 10.931 | 10.963 | 9.452 | 7.313 | 03/12/96 | SP |
| 10421.290 | 10.968 | | 9.453 | 7.294 | 03/12/96 | SP |
| 10422.209 | 11.162 | 11.157 | 9.492 | | 04/12/96 | SL |
| 10425.192 | 11.232 | 11.191 | 9.471 | | 07/12/96 | SL |
| 10428.263 | 11.069 | 10.957 | 9.375 | 7.230 | 10/12/96 | SP |
| 10445.261 | 11.044 | 10.864 | 9.292 | 7.127 | 27/12/96 | SP |
| 10456.217 | 11.292 | 11.029 | 9.384 | 7.177 | 07/01/97 | SP |
| 10467.676 | 10.779 | 10.811 | 9.310 | 7.162 | 18/01/97 | SP |
| 10482.555 | 10.737 | 10.721 | 9.203 | 7.034 | 02/02/97 | SP |
| 10509.467 | 10.759 | 10.733 | 9.209 | 7.006 | 01/03/97 | SP |
| 10519.551 | 10.895 | 10.852 | 9.282 | 7.068 | 11/03/97 | SP |

The first event is probably caused by cessation of the mass accretion onto the active star in the system, indicating thus the end of the recent, 1992-95, active phase. After this, between approximately JD 2 449 900 and JD 2 450 100, the color indices did not differ from those of a typical late-type giant, which supports the above mentioned idea. A rival interpretation – a dust condensation in the circumstellar envelope of CH Cyg – should be tested by the infrared/radio observations, which, however, are not available at present time.

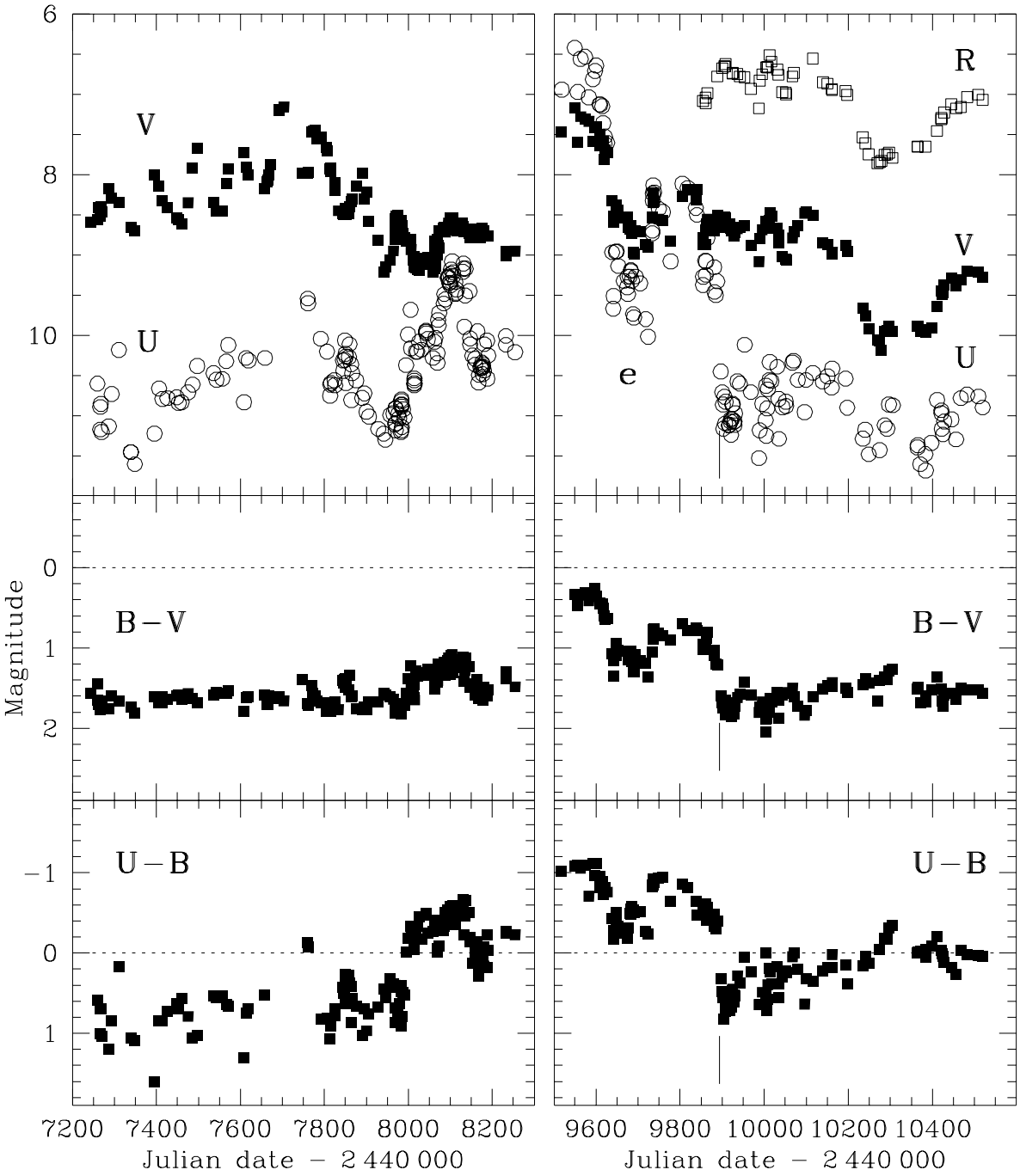


Figure 1. Right: recent UBVR photometry of CH Cyg covering its return to quiescence. The end of the active phase is marked by a bar. The eclipse in the symbiotic pair of the triple-star system is marked by **e**. Left: a part of the light curve during the previous, 1987-91, quiescent phase. It displays variations in V similar to those recently observed

The second phenomenon – the deep minimum – is characterized by a change in the U−B index to ≤0. Prior to this minimum, the M giant's ∼100-day pulsations were seen well in the V, R light curves. A similar behaviour was recorded during the previous, 1987-91, quiescent phase (see left panels of Figure 1), during which a series of ∼100-day pulses of the giant star was also ended by a more pronounced minimum in the V band around JD 2 448 030 (1990 May). Here we note that only the giant star in the symbiotic pair of the triple CH Cyg system is responsible for the observed ∼100-day variations (Skopal, in preparation). In addition, spectroscopic observations made during these two minima, in 1990 and 1996, show a similar change in the cool continuum – a significant smoothing of the TiO bands (cf. Figure 6 of Bode et al. 1991 and Figure 3 of Mikolajewski et al. 1996). According to these observations and a detailed discussion on the 1990 minimum by Taranova and Yudin (1992), we can generally see the nature of the deep minimum in the giant's intrinsic variability rather than in a new dust creation. However, multifrequency observations are strongly needed to understand better the real nature of such the minima in the light curve of CH Cyg.

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