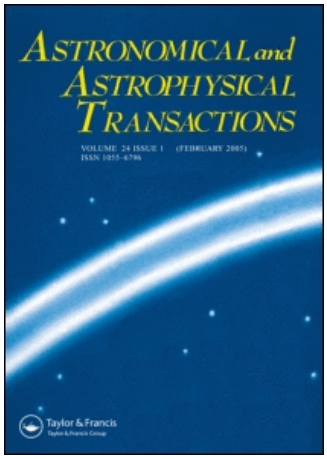

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

Long-term starspot activity of three short-period RS CVn stars: BH Vir, WY Cnc and CG Cyg

A. V. Kozhevnikova [a]; I. YU. Alekseev [b]; P. A. Heckert [c]; V. P. Kozhevnikov [a]
[a] Astronomical Observatory, Ural State University, Ekaterinburg, Russia
[b] Crimean Astrophysical Observatory, Crimea, Ukraine
[c] Department of Chemistry and Physics, Western Carolina University, North Carolina, USA

Online Publication Date: 01 February 2007
To cite this Article: Kozhevnikova, A. V., Alekseev, I. YU., Heckert, P. A. and Kozhevnikov, V. P. (2007) 'Long-term starspot activity of three short-period RS CVn stars: BH Vir, WY Cnc and CG Cyg', Astronomical & Astrophysical Transactions, 26:1, 111 - 112
To link to this article: DOI: 10.1080/10556790701300660
URL: http://dx.doi.org/10.1080/10556790701300660

Astronomical and Astrophysical Transactions
Vol. 26, Nos. 1–3, February–June 2007, 111–112

Long-term starspot activity of three short-period RS CVn stars: BH Vir, WY Cnc and CG Cyg

A. V. KOZHEVNIKOVA*†, I. YU. ALEKSEEV‡, P. A. HECKERT§ and V. P. KOZHEVNIKOV†

†Astronomical Observatory, Ural State University, 51 Lenin Avenue, Ekaterinburg 620083, Russia
‡Crimean Astrophysical Observatory, Nauchnyj 98409, Crimea, Ukraine
§Department of Chemistry and Physics, Western Carolina University, Cullowhee, North Carolina 28723, USA

(Received 26 January 2007)

We present starspot analyses of CG Cyg, BH Vir and WY Cnc on the basis of our new photometric observations as well as published photometric data spanning almost 40 years. The spotted regions were concentrated at low latitudes up to 32°, the spots covered up to 29% of the stellar surface and all three stars show non-axisymmetric spot distributions (active longitude structures separated by approximately half the orbital period). We found that the variations in the brightness and spottedness of CG Cyg are probably cyclic with a period of about 20 years. We detected a large flare on WY Cnc (1.02×10^{35} erg in the *B* band) and analysed the WY Cnc spot activity before and during the flare.

Keywords: RS CVn; Activity; Starspots

Studying starspots on stars other than the Sun as one of the aspects of stellar activity provides an opportunity for us to attain the best understanding of stellar magnetism. Short-period RS CVn stars represent a class of close detached binaries with orbital periods of less than a day and rapidly rotating components of spectral classes G to M that showed different indications of solar-type activity. In this paper we consider long-term activity on the timescale of about 40 years for three stars of this type: CG Cyg ($G9V + K3V$; $P = 0.63$ days), BH Vir ($F8V + G5V$; $P = 0.82$ days) and WY Cnc ($G5V + M2V$; $P = 0.83$ days).

We obtained multicolour photometric observations at three observatories: at Ural State University's Kourovka Observatory with a 70 cm telescope and a three-channel photometer (*BVR*), at Crimean Astrophysical Observatory with a 1.25 m telescope and Piirola photometer (*UBVRI*) and at San Diego State University's Mount Laguna Observatory with a 61 cm telescope (*BVRI*) from July 2003 to February 2006 (total amount is 69 nights, 340 h). A detailed description of the observation technique has been given in [1, 2]. The errors of the observations typically have a magnitude of about 0.01 or less. The light curves show out-eclipse distortion waves caused by starspots with amplitude magnitudes of 0.05 (BH Vir) to 0.13 (CG Cyg).

*Corresponding author. Email: kozhevnikova-a@yandex.ru

Astronomical and Astrophysical Transactions
ISSN 1055-6796 print/ISSN 1476-3540 online © 2007 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/10556790701300660

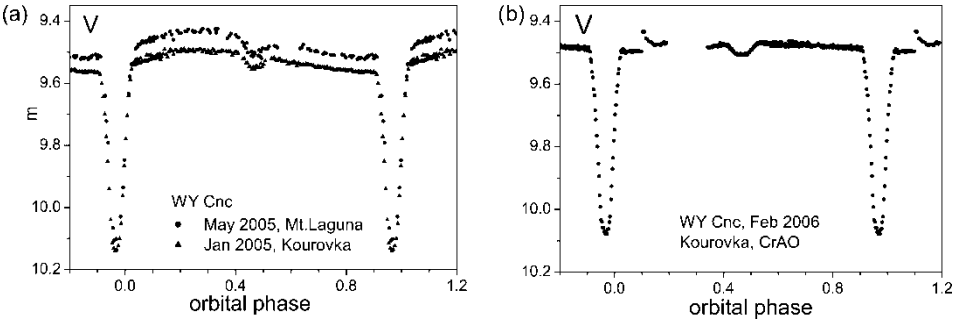

Figure 1. WY Cnc light curves in the V band in 2005–2006.

The large flare on WY Cnc was detected for the first time on 19 February 2006. at 21:50 Universal Time during *BVR* observations at Kourovka Observatory. The flare occurred at orbital phase 0.10 at the side of the primary star facing the secondary component, near the minimum of the distortion wave (close to maximum spottedness). The flare amplitude magnitude was 0.134 in the B band. The flare energies integrated over the flare duration of 64 min were 9.2×10^{34} erg, 5.6×10^{34} erg and 10.2×10^{34} erg in the R, V and B bands respectively [2]. We have analysed preflare WY Cnc activity from a year before the flare. In May 2005, the brightness of WY Cnc increased by a magnitude of 0.07 compared with January 2006 (figure 1(b)), and the spots were located preferentially on the hemisphere facing the secondary component. The flare occurred at the time when the amplitude of the distortion wave was extremely small and the spottedness of both hemispheres of the primary component became almost equal [2]. Compared with other flares on the RS CVn star, we conclude that the flare that we detected is large.

To study the spot activity and to search for long-lived spot structures and activity cycles, we analysed all our light curves and photometric records published elsewhere spanning about 40 years. We use the zonal spottedness model developed by Alekseev and Gershberg [3].

Analysis of spot modelling allows us to make the following conclusions.

(1) In all seasons, spotted regions were concentrated at low and mean latitudes up to 32°. Spots on CG Cyg drift towards the pole with a rate of 0.45° year^{-1}. The spots covered from 4% (WY Cnc) (in years of low activity) to 29% (BH Vir) of the total stellar surface; the temperature differences between the spotted regions and quiet photosphere were 1800 K (WY Cnc), 2100 K (CG Cyg) and 2300 K (BH Vir).
(2) All three stars show non-axisymmetric spot distributions (permanent active longitude structures separated by half the orbital period). Active longitudes on BH Vir are synchronized with the orbital motion and have a preferred orientation with respect to the line of centres in the binary at orbital phases 0.00 and 0.50. In the case of CG Cyg and WY Cnc, the positions of the longitudes migrate slightly with time.
(3) The V-band brightness variations allow us to suppose the existence of a dominant cycle of about 20 years for CG Cyg. WY Cnc does not show evident cycles but it is clearly seen that the brightness of the star increased from 1965 to 1986 and then decayed a little up to 2006. So, if the brightness cycle exists, it should be more than 40 years in length.

References

[1] P.A. Heckert, G.V. Maloney, M.C. Stewart *et al.*, Astron. J. **115** 1145 (1998).
[2] A.V. Kozhevnikova, I.Yu. Alekseev, P.A. Heckert *et al.*, Inf. Bull. Variable Stars No. 5723 (2006).
[3] I.Yu. Alekseev and R.E. Gershberg, Astrophysics **39** 33 (1996).