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

Number 5513

Konkoly Observatory
Budapest
23 March 2004

HU ISSN 0374 – 0676

ERUPTION IN THE SYMBIOTIC NOVA V1329 CYGNI

PRIBULLA, T.[1]; CHOCHOL, D.[1]; PARIMUCHA, Š.[2]; VAŇKO, M.[1]

[1] Astronomical Institute of the Slovak Academy of Sciences, 059 60 Tatranská Lomnica, Slovakia; e-mail: (pribulla,chochol,vanko)@ta3.sk

[2] Faculty of Theoretical Physics and Astrophysics, University of P.J. Šafárik, Moyzesova 16, 040 01 Košice, Slovakia; e-mail: parimuch@ta3.sk

The symbiotic nova V1329 Cyg (HBV 475), discovered by Kohoutek (1969), reached the brightness maximum m_{pg} = 11.5 mag (caused by the thermo-nuclear runaway) in October 1966. The pre-outburst brightness varied around m_{pg} = 15 mag with occasional 2.5 mag decreases, which repeated with the period of 950-959 days and were explained as the eclipses of a hot component by a red giant (Stienon et al., 1974; Grygar et al., 1979). The post-outburst UBV photometry shows a linear decrease combined with a wave-like orbital brightness variation. Schild & Schmidt (1997) improved the orbital period to 956.5 days and found from polarimetry the orbital inclination of the system to be 86±2 degrees. Fekel et al. (2001) determined reliable spectroscopic orbit of the cool giant in the system. The Gaussian deconvolution of the optical and UV emission lines (Ikeda & Tamura, 2000; Pribulla et al., 2003) allowed to determine also the orbital parameters of the hot component and find minimum masses of the white dwarf and red giant in the system to be $m_1 = 0.71\pm0.09$ M$_\odot$ and $m_2 = 2.02\pm0.41$ M$_\odot$, respectively.

New photometric observations of V1329 Cyg were obtained using the single-channel photometer installed in the Cassegrain focus of the 0.6 m telescope in the G2 pavilion of the Stará Lesná Observatory. BD+35°4294 ($V = 10.16$, $B-V = 1.07$) and BD+35°4290 ($V = 10.34$, $B-V = 1.07$, $U-B = 0.88$) were used as the comparison and check star, respectively (Hric et al., 1991). Since March 2003, V1329 Cyg has also been observed using a new 0.5 m telescope in the G1 pavilion of the Stará Lesná Observatory. The telescope is equipped with the SBIG ST-10 MXE camera mounted in Newton focus (see also Pribulla & Chochol, 2003). The observations were obtained in $UBV(RI)_c$ filters. The CCD frames were reduced in the usual way (bias and dark subtraction, flat-field correction) in MIDAS reduction package using procedures written by the first author. The brightness of the variable was determined by the aperture photometry with respect to BD+35°4294. Since the variable-comparison angular distance is about 6ʹ.5, the extinction correction has not been applied. Since the transformation of the instrumental data to the international photometric system is quite unreliable for the emission-line objects, the $BVRI$ magnitudes were left in the instrumental system (close to Johnson-Cousins system). The U observations were shifted by –0.34 mag to be in agreement with the new photoelectric data of Arkhipova & Ikonnikova (2004). Our observations are given in Table 1.

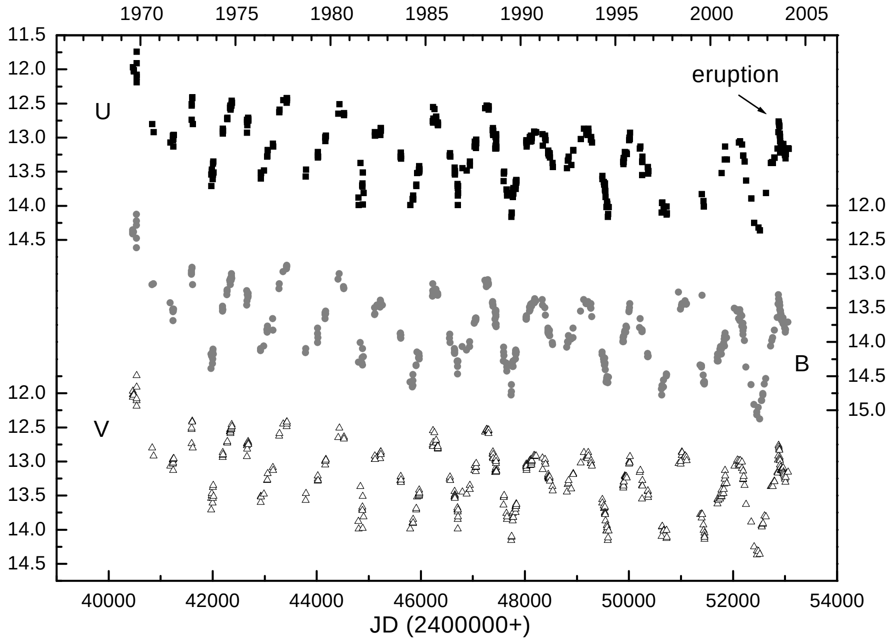

Figure 1. Historical UBV light curve of V1329 since 1969

In Fig. 1 we present the historical UBV light curve of V1329 Cyg using our new observations and data taken from Chochol et al. (1999), Skopal et al. (2002; 2004) and Arkhipova & Ikonnikova (2004).

All V observations were used to determine the ephemeris for the minima times of the orbital wave-like brightness variations. The linear decrease was removed and residuals were fitted by the 4th order trigonometric polynomial. This resulted in the following ephemeris:

$$JD_{min} = 2\,448\,676(3) + 956.0(8) \times E. \quad (1)$$

The phase light curve indicates that the maxima of the wave-like variations occur in the orbital phase 0.5.

After August 3, 2003 a rise to the maximum caused by the eruption was recorded (Fig. 2). The maximum of the eruption occurred at JD 2452876 simultaneously in all passbands. The approximate amplitudes of the brightness increases were 0.41 mag in U, 0.33 mag in B and 0.41 mag in V. The decrease to the pre-eruption brightness lasted about three months. It is no doubts that the hot component (white dwarf surrounded by the accretion disk) is responsible for the eruption.

According to the ephemeris (1) the eruption started at the orbital phase 0.37, 123 days before the expected maximum of brightness, when the hot component was in front of the cool one. Using the radial velocities of the cool component (Fekel et al., 2001) and the 956-day orbital period, we found that the time of the spectroscopic conjunction occurred 20 days after the expected maximum of brightness. Very interesting behaviour can be seen in the I passband where a small increase of brightness (corresponding to the maxima in $UBVR$) is followed by a dip lasting approximately 30 days. This could be possibly interpreted as an eclipse of the cool giant by the ejected material or by the formation of the dust in this material. The reliable analysis and interpretation of the phenomenon require the spectroscopic data taken during the eruption.

As can be seen from Fig. 1, other eruptions were not detected in photoelectric data since 1969. Although the brightness of V1329 Cyg slowly decreases since the principal maximum in 1966, the system still deserves attention both from the amateur and professional astronomers.

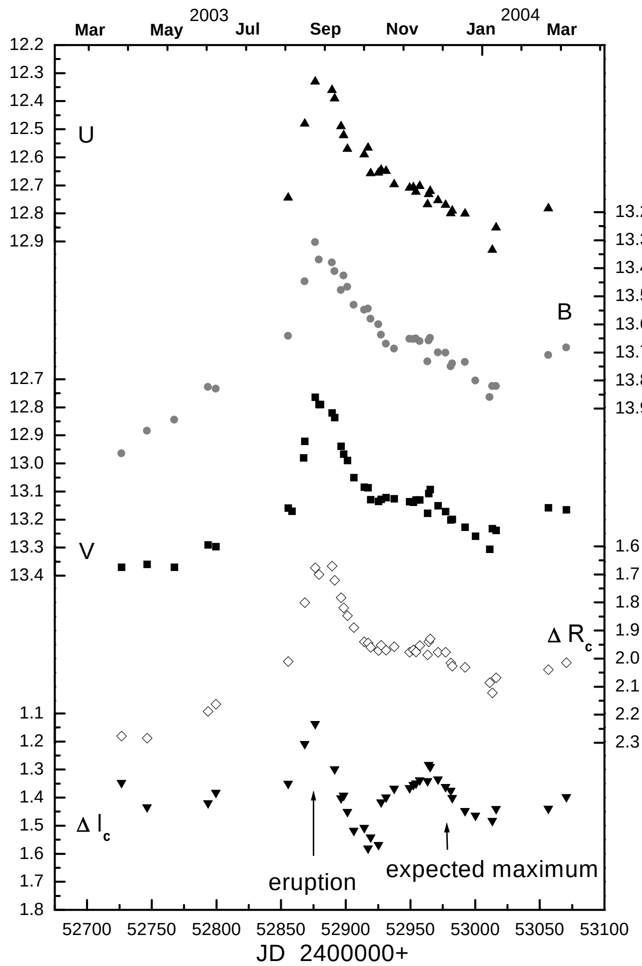

Figure 2. Recent $UBV(RI)_c$ CCD light curve of V1329 Cyg. The eruption and expected maximum of the orbital wave-like variation are denoted by arrows.

Acknowledgements. This work was supported by Science and Technology Assistance Agency under the contract No. APVT-20-014402 and Slovak Academy of Sciences VEGA grant 4014.

References:

Arkhipova, V.P., Ikonnikova, N.P., 2004, *Astronomy Letters*, **30**, 117

Chochol, D., Andronov, I.L., Arkhipova, V.P., Chinarova, L.L., Mattei, J., Shugarov, S.Yu., 1999, *Contrib. Astron. Obs. Skalnaté Pleso*, **29**, 31

Fekel, F.C., Hinkle, K.H., Joyce, R.R., Skrutskie, M.F., 2001, *AJ*, **121**, 2219

Grygar, J., Hric, L., Chochol, D., Mammano, A., 1979, *Bull. Astron. Inst. Czechosl.*, **30**, 308

Hric, L., Skopal, A., Urban, Z., Dapergolas, A., Hanzl, D., Isles, J. E., Niarchos, P., Papousek, J., Pigulski, A., Velic, Z., 1991, *Contrib. Astron. Obs. Skalnate Pleso*, **21**, 303.

Ikeda, Y., Tamura, S., 2000, *Publ. Astron. Soc. Japan*, **52**, 589
Kohoutek, L., 1969, *Inform. Bull. Var. Stars*, No. 384
Pribulla, T., Chochol, D., 2003, *Baltic Astronomy*, **12**, 555
Pribulla, T., Chochol, D., Parimucha, Š, 2003, in R.L.M. Corradi, J. Mikolajewska & T.J. Mahoney (eds.): *Symbiotic stars probing stellar evolution, ASP Conference Ser.*, **Vol. 303**, in press
Schild, H., Schmid, H.M., 1997, *A&A*, **324**, 606
Skopal, A., Vaňko, M., Pribulla, T., Wolf, M., Semkov, E., Jones, A., 2002, *Contrib. Astron. Obs. Skalnaté Pleso*, **32**, 62
Skopal, A., Pribulla, T., Vaňko, M., Velič, Z., Semkov, E., Wolf, M. Jones, A., 2004, Contrib. Astron. Obs. Skalnaté Pleso, **34**, 1
Stienon, F.M., Chartrand, M.R., Shao, C.Y., 1974, *AJ*, **79**, 47

Table 1: $UBV(RI)_c$ instrumental magnitudes of V1329 Cyg derived with respect to BD+35°4294 obtained at the G1 and G2 pavilions of the Stará Lesná Observatory. Unsure observations are denoted by ":" in the last column. The phase were computed according to ephemeris (1)

2 400 000+	Phase	U	B	V	ΔR_c	ΔI_c	Obs.
52352.622	0.846		14.63	13.89			G2
52408.509	0.904	14.16	14.92	14.25			G2
52487.381	0.987		14.96	14.32			G2:
52518.412	0.019	14.13	15.13	14.36			G2
52634.237	0.141	14.17	14.54	13.81			G2
52726.600	0.237		14.06	13.37	2.276	1.347	G1
52746.500	0.258		13.98	13.36	2.283	1.434	G1
52767.500	0.280		13.94	13.37			G1
52793.510	0.307		13.824	13.290	2.188	1.420	G1
52799.544	0.313		13.83	13.297	2.162	1.382	G1
52855.402	0.372	12.744	13.642	13.159	2.011	1.350	G1
52868.328	0.385	12.48	13.447	12.921	1.801	1.209	G1
52876.338	0.394	12.33	13.308	12.764	1.677	1.137	G1
52879.308	0.397		13.37	12.79	1.70		G1
52889.409	0.407	12.36	13.38	12.82	1.67		G1:
52891.362	0.410	12.39	13.411	12.836	1.721	1.299	G1
52896.356	0.415	12.49	13.478	12.939	1.783	1.402	G1
52898.305	0.417	12.522	13.426	12.967	1.819	1.393	G1
52901.341	0.420	12.57	13.467	12.989	1.847	1.451	G1
52906.278	0.425		13.531	13.050	1.889	1.518	G1
52914.272	0.433	12.59	13.548	13.085	1.940	1.507	G1
52917.291	0.437	12.566	13.544	13.087	1.944	1.581	G1:
52919.358	0.439	12.657	13.580	13.129	1.960	1.542	G1
52925.400	0.445	12.655	13.600	13.135	1.971	1.568	G1
52927.285	0.447	12.645	13.637	13.128	1.953	1.416	G1
52931.274	0.451	12.649	13.669	13.122	1.970	1.399	G1
52937.383	0.458	12.696	13.687	13.126	1.958	1.368	G1
52949.247	0.470	12.709	13.652	13.136	1.977	1.366	G1
52952.250	0.473	12.707	13.653	13.138	1.969	1.354	G1
52954.251	0.475	12.723	13.651	13.130	1.976	1.349	G1
52957.208	0.478	12.703	13.660	13.130	1.954	1.338	G1
52963.296	0.485	12.768	13.732	13.178	1.987	1.341	G1
52964.271	0.486	12.731	13.658	13.107	1.940	1.283	G1
52965.229	0.487	12.720	13.649	13.093	1.93	1.29	G1
52971.290	0.493	12.753	13.700	13.151	1.977	1.335	G1
52977.255	0.499	12.770	13.701	13.172	1.977	1.362	G1
52981.268	0.504	12.800	13.75	13.201	2.016	1.375	G1
52982.343	0.505	12.790	13.74	13.199	2.027	1.401	G1
52992.174	0.515	12.801	13.735	13.227	2.031	1.447	G1
53000.239	0.523		13.801	13.259		1.464	G1
53011.260	0.535		13.86	13.306	2.086		G1:
53013.272	0.537	12.930	13.82	13.232	2.122	1.483	G1
53016.229	0.540	12.850	13.82	13.239	2.068	1.440	G1
53056.681	0.582	12.782	13.710	13.158	2.039	1.439	G1
53070.671	0.597		13.683	13.165	2.015	1.398	G1