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New long-period RS CVn variables in the NSVS database

BERNHARD, K. [1,2]

1) A-4030 Linz, Austria, e-mail: klaus.bernhard@liwest.at
2) Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany

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Abstract: 9 new long-period RS CVn variables are presented, which were discovered during a programme of optical identification of ROSAT X-ray sources: GSC 0608-1004, GSC 3335-1727, GSC 4116-0276, GSC 3448-0105, GSC 4388-1284, GSC 3456-2059, GSC 0924-0356, GSC 0969-1638, GSC 3557-0919

During a programme of optical identification of X-ray sources from the ROSAT All-Sky Bright Source Catalogue (1RXS) (Voges et al., 1999) in the ROTSE1 database (http://skydot.lanl.gov/ , Wozniak et al., 2004) 9 new long-period RS CVn variables have been found, which are listed in Table 1.
The criterias for including a star in the list were the X-ray identification, an appropriate B-V colour index and an analysis of the NSVS data with Period 04 (Lenz&Breger, 2005).

The columns contain, 1: running number, 2: RA & Dec (2000) taken from the Tycho-2 catalogue (Høg et al., 2000), 3: the GSC number, 4: Johnson B-V derived from the Tycho-2 catalogue, 5: likely 1RXS identification, 6: range derived from the NSVS data, 7: period (days) and 8: log(fx/fopt) from the 1RXS Correlation to HST_GSC of the ROSAT All-Sky Bright Source Catalogue (1RXS).

Table 1: Positions, identifications and photometric data for the new RS CVn variables

No.	RA (2000)	Dec	GSC	B-V	1RXS	Range	Per.(d)	log(fx/fopt)
1	00 57 07.662	+10 25 56.66	0608-1004	0.704	J005708.1+102554	10.0-10.3	34.81	-2.25
2	04 04 15.408	+49 43 57.11	3335-1727	0.877	J040415.8+494359	10.6-10.9	10.03	-2.57
3	07 30 55.325	+63 43 50.29	4116-0276	1.013	J073055.1+634405	9.6-9.9	85.28	-2.75
4	10 34 39.585	+51 39 20.58	3448-0105	0.852	J103440.7+513924	10.6-10.9	12.11	-2.33
5	11 06 39.028	+70 18 26.05	4388-1284	0.873	J110638.3+701835	10.1-10.4	9.058	-2.48
6	12 23 08.715	+45 27 54.43	3456-2059	1.114	J122308.2+452801	11.1-11.4	11.80	-2.25
7	14 58 00.692	+13 11 48.97	0924-0356	0.868	J145800.3+131158	10.7-11.0	59.66	-2.51
8	16 41 53.083	+11 40 20.97	0969-1638	1.098	J164153.2+114034	9.8-10.1	21.69	-3.01
9	19 43 40.470	+46 40 03.25	3557-0919	0.990	J194340.5+464017	11.1-11.4	25.08	-2.39

Compared to other well-studied high activity RS CVn variable like IM Peg with a ratio of X-ray to optical flux log(fx/fopt)= -2.96, these new variables show a comparable or even higher activity. Therefore these objects seem to be interesting objects for further, more detailed studies.

Lightcurves and comments:

No.1: GSC 608-1004 = BD+09 111

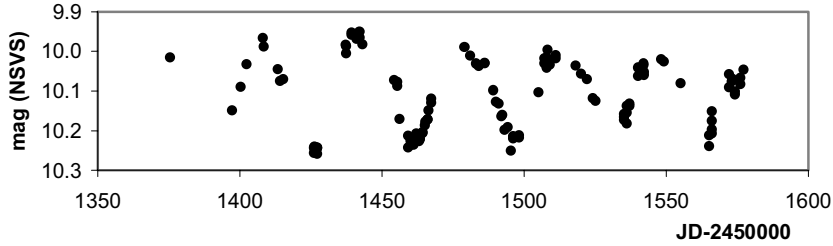

Figure 1: NSVS light curve of GSC 608-1004

No. 2: GSC 3335-1727

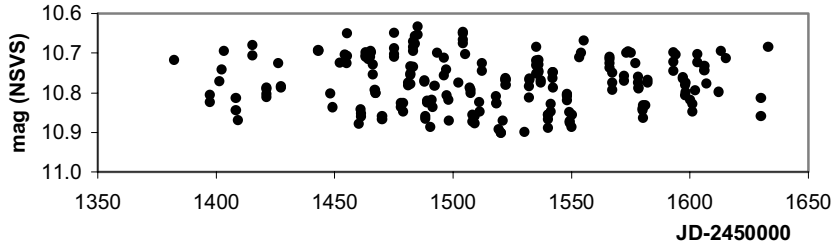

Figure 2: NSVS light curve of GSC 3335-1727

No. 3: GSC 4116-0276

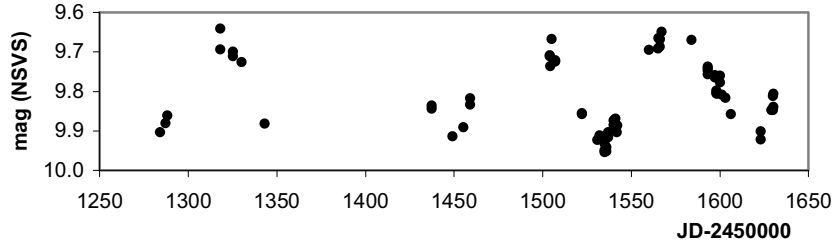

Figure 3: NSVS light curve of GSC 4116-0276

No. 4: GSC 3448-0105

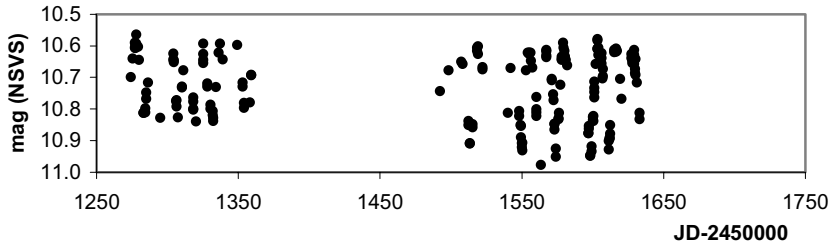

Figure 4: NSVS light curve of GSC 3448-0105

No. 5: GSC 4388-1284

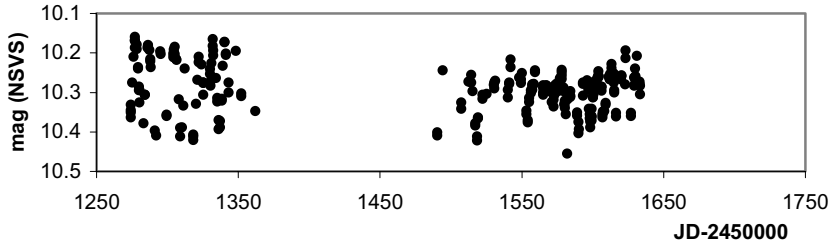

Figure 5: NSVS light curve of GSC 4388-1284

No. 6: GSC 3456-2059

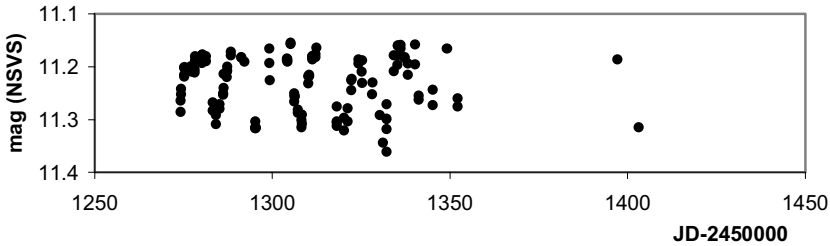

Figure 6: NSVS light curve of GSC 3456-2059

No.7: GSC 0924-0356

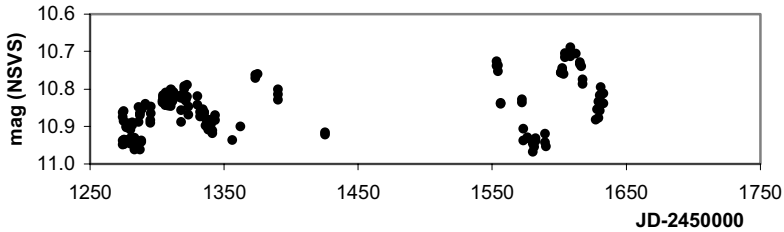

Figure 7: NSVS light curve of GSC 0924-0356

The Hipparcos and Tycho Catalogues, ESA 1997 give a parallax of 141.30+-40.60mas. Therefore the star could be a RS CVn variable, but also a single white darf or a binary star system containing a compact object with an accretion disc.
Further observations in 2007 were made using a 20-cm Schmidt-Cassegrain telescope and a Starlight XPress SX CCD camera with BVR filters in Linz, Austria. The comparison stars used were GSC 0924-1129 and GSC 0924-0983, which were found to be constant within <0.03 mag. Observations were performed on 28 nights between May and September 2007 (Figure 8).

We could not find short period variations during long runs in single nights, and BVR observations did not show a significant change of B-R between maximum and minimum. A binary star system containing a compact object and an accretion disc is therefore unlikely. A single white dwarf seems to be very unlikely because the X-rays emitted from the objects are too hard (Dr. Konrad Dennerl, private communication). Thus GSC 0924-0356 is also very likely a RS CVn variable.

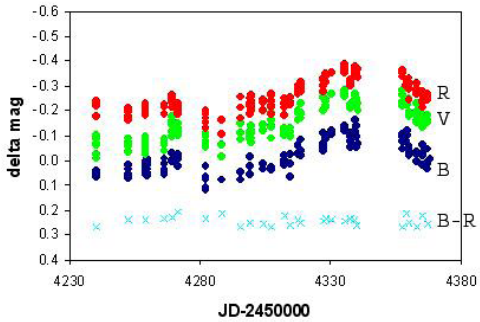

Figure 8: BVR observations of GSC 0924-0356 in 2007

No. 8: GSC 0969-1638 = BD+11 3024

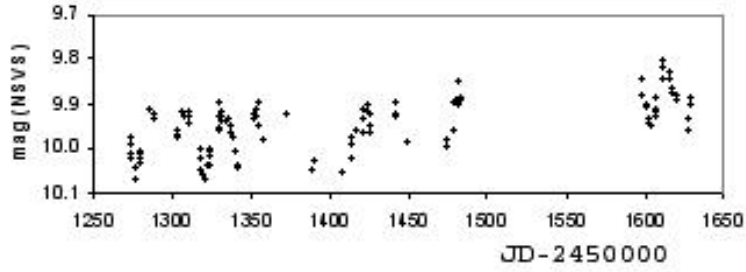

Figure 9: NSVS light curve of GSC 0969-1638

No. 9: GSC 3557-0919

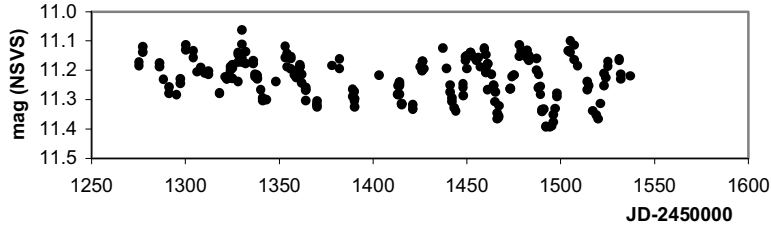

Figure 10: NSVS light curve of GSC 3557-0919

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