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OPTICAL OBSERVATIONS OF THE STAR RX J1239.8+5511

The sky was surveyed in the X-ray region of the spectrum by the ROSAT satellite (Voges et al., 1997) and catalogs of the sources included RX J1239.8+5511 = GSC 3844_317 (Jenkner et al., 1990).

The automated 0.5-m. telescope, Cousins R filter and CCD camera of the Climenhaga Observatory of the University of Victoria (Robb and Honkanen, 1992) were used to make photometric observations of RX J1239.8+5511. Using IRAF [1] routines the frames were de-biased and flat fielded, and the magnitudes were found from 6 arc second aperture photometry after using the Gaussian centering option of the PHOT package.

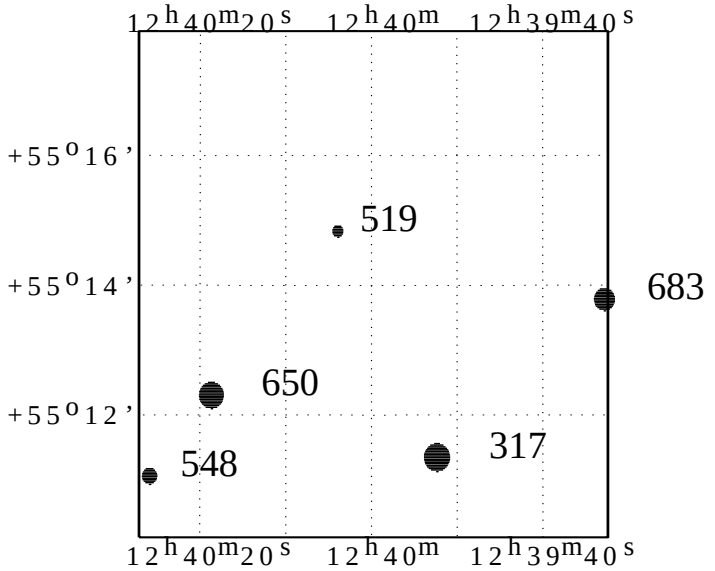

Figure 1. Finder chart of the field labeled with the GSC numbers (Jenkner et al., 1990)

The field of stars is shown in Figure 1, and their designations, coordinates (J2000) and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al., 1990) are given in Table 1. To look for brightness variations during a night the standard deviation of the differential magnitudes for each star during a night were calculated and ranged from $0\overset{m}{.}004$ for a bright star on a good night to $0\overset{m}{.}030$ for the faint stars on poor nights. To measure night to night variations a run mean of the fourteen nightly averages was calculated and is shown in Table 1 as ΔR in the sense the star minus GSC 3844_650. We consider GSC 3844_317 to be the only significantly variable star. Due to the small field of view extinction effects were negligible and no corrections have been made for them. No corrections have been made to transform the R magnitude to a standard system.

[1] IRAF is distributed by National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc., under contract to the National Science Foundation

Table 1. Stars observed in the field of RX J1239.8+5511

GSC No.	RA J2000.	Dec. J2000.	GSC Mag.	Δ R Mag.	V	$(R-I)_C$
3844_317	$12^h39^m52^s$	$+55^o11'21"$	10.9	variable	11.77	0.66
3844_650	$12^h40^m19^s$	$+55^o12'18"$	11.3	-	11.71	0.35
3844_683	$12^h39^m33^s$	$+55^o13'47"$	12.4	$+1.003 \pm .015$	12.92	0.35
3844_519	$12^h40^m04^s$	$+55^o14'50"$	15.3	$+3.701 \pm .058$	-	-
3844_548	$12^h40^m26^s$	$+55^o11'03"$	14.1	$+2.806 \pm .051$	-	-

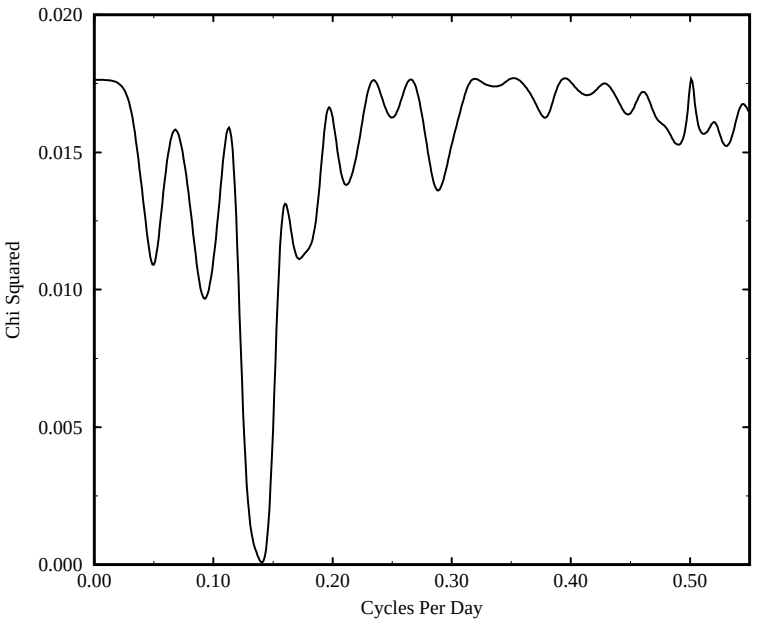

Figure 2. Period search of the nightly means of RX1239.8+5511.

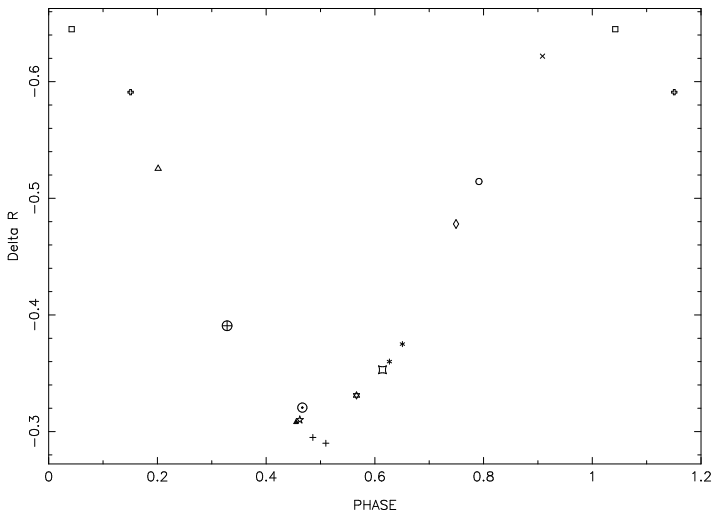

Figure 3. R band light curve of RX J1239.8+5511 for 1997

Brightness variations in RX J1239.8+5511 were barely detectable during a night, but were obvious from night to night. A sine curve was fit to the nightly means and the χ^2 for various periods is shown graphically in Figure 2. The best fit was found for a frequency of 0.1407 cycles per day and semi-amplitude of $0\overset{m}{.}174$. This gives the ephemeris:

$$\text{HJD of Maxima} = 2450583\overset{d}{.}4(3) + 7\overset{d}{.}1(4) \times \text{E}.$$

where the uncertainty in the final digit is given in brackets. A plot of the nightly mean differential (GSC 3844_317−3844_650) R magnitudes phased at this period is shown in Figure 3 with different symbols for each of the different nights.

To help classify the variable star B, V, R and I frames were obtained under photometric conditions (JD 2450608) along with observations of the nearby bright standard stars HR 4660, HR 4716, HR 4931 and HR 5154 (Moffett and Barnes, 1979). The V magnitudes and $(R-I)_C$ colors are listed in Table 1 for the three brightest stars. The random errors for these data are about $0\overset{m}{.}03$. However great caution should be exercised in using these data since they are derived from only a few standard stars and their (R−I) was transformed from the Johnson system to the Cousins system using the equations of Taylor (1986). While certainly not definitive these colors confirm that RX J1239.8+5511 is a late type (approximately K4) star (Cousins 1981). From the admittedly poorly determined (B−V) of $0\overset{m}{.}8 \pm 0\overset{m}{.}1$ RX J1239+5511 is more likely a dwarf and not a giant star. Assuming an absolute magnitude of $7\overset{m}{.}0$ (Allen 1976) we find a distance of approximately 90 parsecs.

From the shape and amplitude of the light curve and the length of the period we would expect that this is a single K4V star with spots and X-rays produced by an active corona. It is possible that this star is a giant with spots or with a close companion either heating one hemisphere or causing a tidal distortion. To eliminate this possibility further photometric observations are useful to look for variations in color or in the height of the maxima. Spectral observations would be helpful to determine the spectral type, to look for Ca H&K emission, to determine $v\,sin(i)$ and to look for radial velocity variations.

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R.M. ROBB
R. GREIMEL
Climenhaga Observatory
Dept. of Physics and Astronomy
University of Victoria
Victoria, BC, CANADA, V8W 3P6
Internet: robb@uvic.ca

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