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

Number 5088

Konkoly Observatory
Budapest
24 May 2001

HU ISSN 0374 – 0676

THE DISCOVERY OF BRIGHTNESS VARIATIONS OF GSC 0870-0798

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As part of a continuing search for photometric variations in stars which are known X-ray sources, we observed GSC 0870-0798. This star also known as RXJ114746+125408 was discovered to be a source of X-rays by the ROSAT satellite (Voges et al. 1997). Mason et al. (1995) found the star to be a source of EUV and included it in their catalog as 2RE J114746+125404. Stephenson (1986) classified its spectral type as K4 in his catalog of large proper motion stars in which he listed it as BPM87617. The Tycho catalog (ESA 1997) reported $V_T = 11.014$ and $B_T = 12.194$ for GSC 0870-0798 and $V_T = 8.316$ and $B_T = 8.801$ for the primary comparison star, GSC 0870-0467 = HD 102483, consistent with spectral types of approximately K2 and F7, respectively.

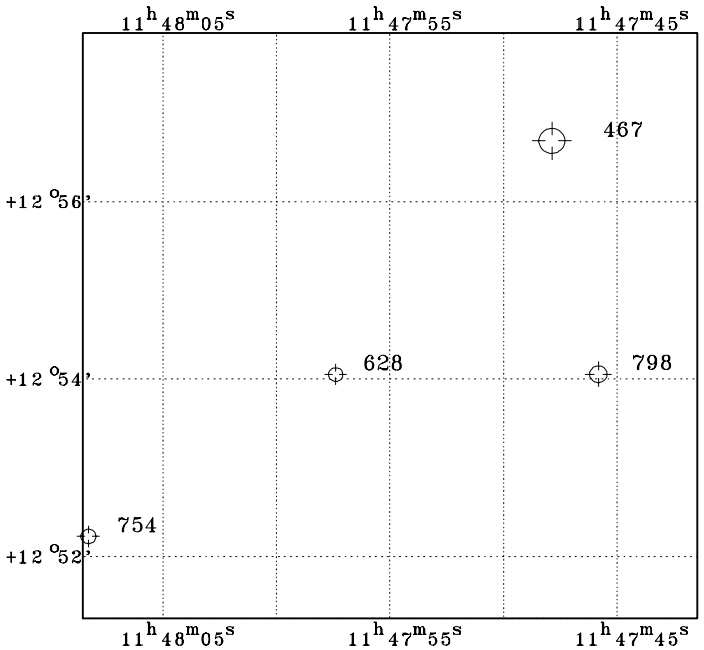

Figure 1. Finder chart labeled with the GSC identification numbers from region 0870

Table 1: Stars observed in the field of GSC 0870-0798

GSC No.	R.A. J2000	Dec. J2000	GSC Mag.	ΔR_c Mag.	Std. Dev. Between	Std. Dev. Within
00870-0798	$11^h47^m45^s$	$+12°54'03''$	10.5	2.183	.033	.004
00870-0467	$11^h47^m47^s$	$+12°56'41''$	8.2	-	-	.006
00870-0628	$11^h47^m57^s$	$+12°54'03''$	11.4	2.939	.005	.006
00870-0754	$11^h48^m08^s$	$+12°52'13''$	11.2	2.848	.003	.007

The field of stars observed with the automated 0.5-m telescope of the Climenhaga Observatory at the University of Victoria is shown in Figure 1. The data were reduced in a fashion similar to that described in Robb and Greimel (1999). Table 1 lists the stars' identification numbers, coordinates (J2000) and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al. 1990). Observations were made using a filter closely matching the Cousins R band (Cousins 1981). The Julian Dates(-2450000) of ten observations are 2009, 2010, 2011, 2014, 2018, 2019, 2020, 2021, 2025, and 2026.

Our differential ΔR_c magnitudes are calculated in the sense of the star minus GSC 00870-0467. Brightness variations during a night were measured by the standard deviation of the differential magnitudes and are listed for the most photometric night in the last column as "Std. Dev. Within". For each star the mean of the nightly means is shown as ΔR_c in Table 1. The standard deviation of the nightly means is a measure of the night to night variations and is called "Std. Dev. Between" in Table 1.

The "Std. Dev. Between" for stars GSC 0870-0754–GSC 0870-0467 is $0^m.003$ so we feel this shows that any night to night variations in either of these stars must be less than a few millimagnitudes. We observed no significant variations in the comparison star GSC 0870-0467 in plots of the individual nights' data and a "Std. Dev. Within" of 0.004 sets an upper limit on hourly variations.

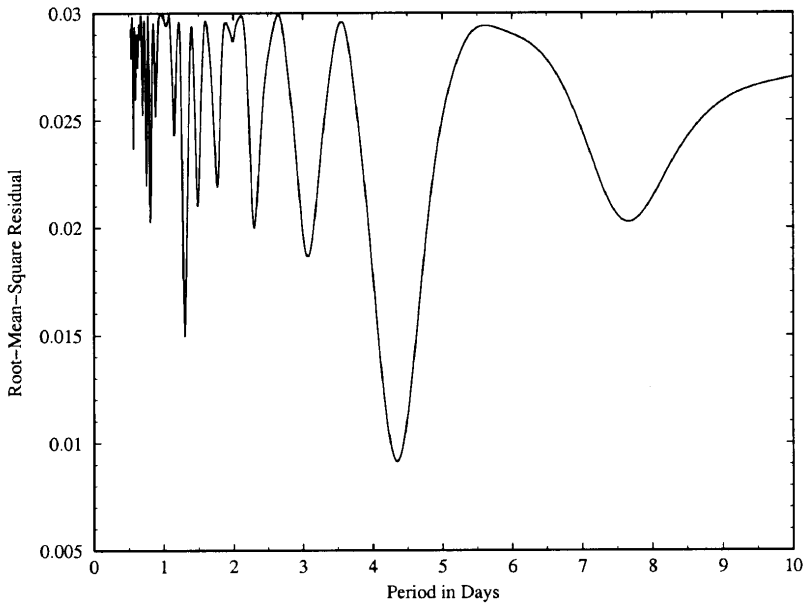

Figure 2. Periodogram for GSC 0870-0798 in 2001

Only the star GSC 0870-0798 had obvious variations and thus it is a new variable star. The chi-squared of a fit of the data to sine curves as a function of period is shown in Figure 2. Thus we find the ephemeris:

$$\text{HJD of Maximum Brightness} = 2452009\overset{\text{d}}{.}7(9) + 4\overset{\text{d}}{.}45(20) \times E$$

where the uncertainties in the final digit are given in brackets and the root-mean-square error of the fit is $0\overset{\text{m}}{.}01$. The 1413 differential R_c filtered magnitudes phased at this period are plotted in Figure 3 with different symbols for each of the nights. The small variations seen during some of the nights are probably real, but more data will be necessary to elucidate their nature.

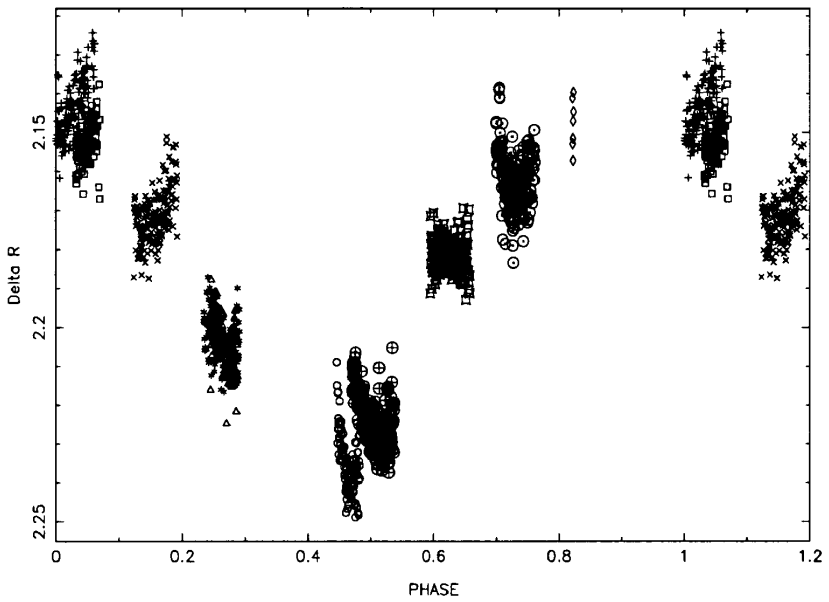

Figure 3. R_c filtered light curve of GSC 0870-0798 for winter 2001

GSC 0870-0798 is an EUV and X-ray source and a K4 spectral type dwarf star with a small amplitude photometric variation similar to typical BY Dra stars. Photometric observations should be continued to monitor for flares, changes in the spot distribution and period changes. Spectroscopic observations will be valuable to determine a precise spectral class for the star, to check for emission in the hydrogen and Ca H & K lines and to measure radial velocities to check for duplicity.

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