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

Number 4949

Konkoly Observatory
Budapest
5 September 2000

HU ISSN 0374 – 0676

HD 77191: ANOTHER VARIABLE SOLAR TWIN

LEBZELTER, T.

Institut für Astronomie, A-1180 Vienna, Tuerkenschanzstr. 17, Austria, email: lebzelter@astro.univie.ac.at

The University of Vienna runs two automatic photometric telescopes (APT) in the Southern Arizona desert named Wolfgang and Amadeus. A description of the telescopes and the used photometers is given by Strassmeier et al. (1997). Beside other programs the telescopes are used for monitoring the light change of long period AGB variables (Lebzelter 1999, Kerschbaum et al. 2000). The discovery of a new photometric variable G star reported here has been made in the course of a short time monitoring of a group of AGB stars for determining their current brightness. Typically one datapoint is obtained per night. The new variable has been used as a comparison star within this program.

HD 77191 has been observed together with the program star RT Cnc (M5III) and the second comparison star HD 76678 (G5). Observations have been done with Wolfgang using Johnson B and V filter. HD 77191 has been identified as variable by comparison of the light change of RT Cnc relative to both comparison stars.

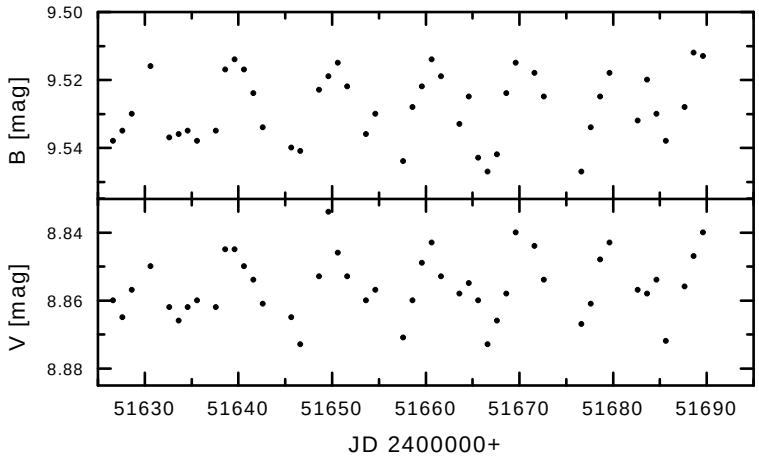

Figure 1. Light change of HD 77191

Figure 1 shows the light change of HD 77191 in both filters. Data have been derived relative to the second comparison star HD 76678 ($V = 8\overset{\mathrm{m}}{.}39$, $B - V = 0\overset{\mathrm{m}}{.}83$ from Tycho Catalogue, Perryman et al. 1998). Each datapoint is the mean of ten measurements. The mean scatter of these measurements is $0\overset{\mathrm{m}}{.}004$ in B and $0\overset{\mathrm{m}}{.}003$ in V, respectively, therefore

clearly smaller than the amplitude of the variations observed. Figure 2 presents the results of a Fourier analysis of the data using Period98 (Sperl 1998). From the strongest peak (0.099988 c/d) we derive a period of 10.0 ± 0.2 days. Figure 3 gives the visual brightness versus phase.

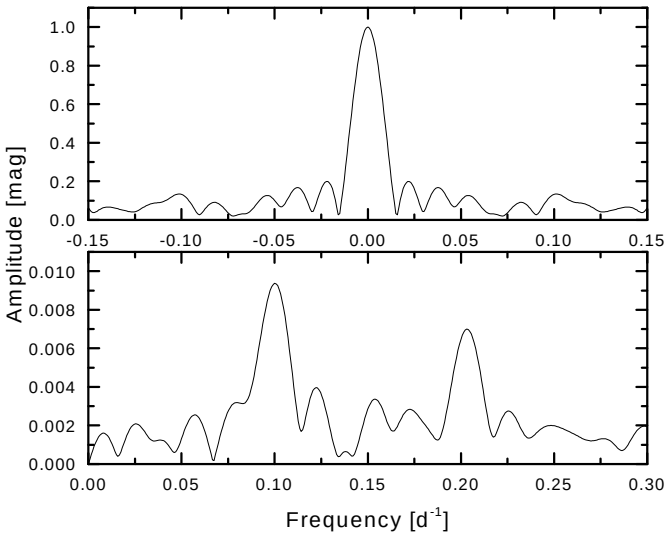

Figure 2. Result of a Fourier analysis on the data. The upper panel gives the spectral window, the lower panel the amplitude spectrum

The light curve is obviously asymmetric. Inspection of the mean light curve in Figure 3 as well as of the total light change (Fig. 1) reveals a bump on the descending branch of the light curve around phase 0.5. The light change is similar in both filters with an amplitude of about 0.04 magnitudes. The asymmetry of the light curve can also be seen as a second peak in the spectrum of the Fourier analysis (Fig. 2).

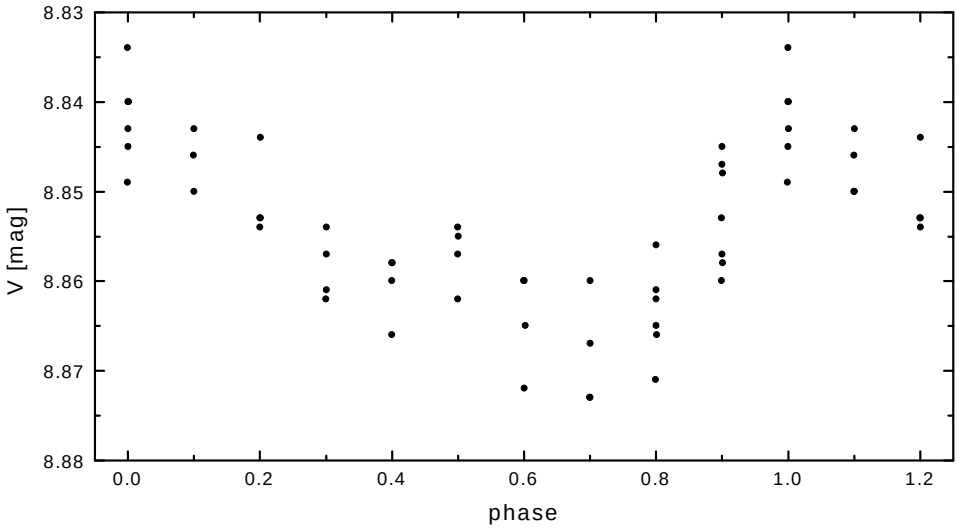

Figure 3. Phase plot of the light variations of HD 77191 using a period of 10.0 days. Data points between 1.0 and 1.2 are repeated for clarity

No investigation on this star has been reported in the literature. The Hipparcos catalogue (Perryman et al. 1998) gives a spectral type of G0 which is in agreement with the $B-V$ value of $0\overset{\mathrm{m}}{.}67$ derived both by Hipparcos and by our APT measurements. The Hipparcos parallax for this star of 15.58 ± 1.15 milliarcseconds gives an absolute V brightness $M_V = 4.83$ (without any corrections for reddening). It is therefore probably a main sequence G0 star, similar to our Sun. The Hipparcos measurements indicate that HD 77191 is a single star.

We propose that the reason for the star's variability are star spots on its surface. Several stars similar to the Sun have been found already to show such variability (Lockwood et al. 1997, Strassmeier et al. 1999). Strassmeier & Bopp (1992) presented the results of different star spot geometries on the photometric light change. Following their parameter study the light curve of HD 77191 may be explained by the assumption of two spots of different size at different latitudes on the star's surface (compare their Fig. 10 and 11).

The variability in $B-V$ is very small (total amplitude of about $0\overset{\mathrm{m}}{.}01$), but indicates that the star is reddest during its light minimum around phase 0.6. This is in agreement with "dark" spots on the stellar surface.

The measured period of the light change of 10 d is then the rotation period of the star at the latitude of the spot(s). This period is quite long for an active G0 dwarf (compare Fig. 1 in Hall 1991). Our data do not allow to derive any results on differential rotation of this star.

On the one hand, HD 77191 is very similar to our Sun in several aspects. On the other hand, there is an obvious difference in activity between the Sun and HD 77191. This makes this star an interesting object for further spectroscopic and photometric investigations to understand variability of main sequence stars in that part of the HRD.

Acknowledgements: This research has been supported by the Austrian Science Fund under project number S7301-AST and P14365-PHY. The author wishes to thank Klaus Strassmeier for helpful comments on the manuscript.

References:

Hall, D.S., 1991, in: The Sun and Cool Stars, eds. I. Tuominen, D. Moss, G. Rüdiger; Berlin, Springer, p. 353
Kerschbaum, F., Lebzelter, T., Lazaro, C., 2000, *A&A*, submitted
Lebzelter, T., 1999, *A&A*, **351**, 644
Lockwood, G.W., Skiff, B.A., Radick, R.R., 1997, *ApJ*, **485**, 789
Perryman, M.A.C., Brown, A.G.A, Lebreton, Y., et al., 1998, *A&A*, **331**, 81
Sperl, M., 1998, *Comm. Astroseismology*, **111**, 1
Strassmeier, K.G., Bopp, B.W., 1992, *A&A*, **259**, 183
Strassmeier, K.G., Boyd L.J., Epand, D.H., Granzer, Th., 1997, *PASP*, **109**, 697
Strassmeier, K.G., Serkowitsch, E., Granzer, Th., 1999, *A&A Suppl.*, **140**, 29