COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4066

Konkoly Observatory
Budapest
12 August 1994
HU ISSN 0374 - 0676

PHOTOMETRY OF THE ACTIVE STARS HD 127535 AND HD 202077

In this paper we present new photometry for the two southern active late-type stars HD 127535 and HD 202077 from June to July 1994.

HD 127535 = V841 Cen ($\alpha = 14^h34^m16^s$, $\delta = -60°24'27''$, 2000.0, $V = 8.5$ mag) is a rapidly rotating, single-lined spectroscopic binary with an active K1 subgiant as the primary component (Collier et al. 1982). The star exhibits strong Ca II H&K and Hα emission (Houk & Cowley 1975, Weiler & Stencel 1979, Collier et al. 1982), it shows high X-ray flux in the ROSAT 0.1–2.4 keV energy range (Dempsey et al. 1993) and also very high radio-flux densities (Slee & Stewart 1989). The orbital period is 5.998 days with zero eccentricity (Collier 1982a) while the photometric (= rotational) period of the K1 subgiant is 5.929±0.024 days (Cutispoto 1990). Thus, the orbital motion and the stellar rotation are bound but not quite exactly synchronous. Previous photometry of HD 127535 was presented by Collier (1982b) from 1980–81, by Innis et al. (1985) from 1981, by Udalski & Geyer (1984) from 1984, by Bopp et al. (1986) from 1985, by Mekkaden & Geyer (1988) from April 1987 and Cutispoto (1990) from February 1987, and most recently by Cutispoto (1993) from 1989. Randich et al. (1993) determined the Lithium abundance and the $v \sin i$. HD 127535 is listed as star number 118 in the "Catalog of Chromospherically Active Binary Stars" (Strassmeier et al. 1993).

HD 202077 = BM Mic ($\alpha = 21^h14^m31^s$, $\delta = -30°45'24''$, 2000.0, $V = 8.3$ mag) is an apparently single G6 IV/V star (Houk 1982) with Ca II H&K in emission (Lloyd-Evans & Koen 1987). Extensive photometry was presented by Lloyd-Evans & Koen (1987) for the observing period 1979–1981 who also determined the photometric period of HD 202077 of 14.6 days. With this period, the star showed a sinusoidal light curve with a full amplitude of 0.2 mag in Johnson V in 1979–1981. Otherwise there is nothing known about this star.

The new data in this paper were obtained on 15 nights at the 70-cm Swiss-telescope at ESO La Silla in Chile between June 24th and July 15th, 1994. All seven Geneva-colours were measured almost simultaneously. For a description of the Geneva-system see Rufener & Nicolet (1988). The observers were P. North and E. Paunzen. For the reduction we used the Geneva [U], [B] and [V] filters which are similiar to Johnson U, B and V (for relations see Cramer 1984). Every light-curve point for the two stars is the average of ten individual 60 sec measures taken within 10 minutes. The data were corrected for sky background and extinction. Tables 1 and 2 list the differential [V], [$U - B$], and [$B - V$] magnitudes for HD 127535 and HD 202077, respectively. Their respective comparison stars were HD 128227 ($V = 8.350$ mag; e.g. Collier-Cameron 1987) and HD 202540 ($V = 6.851$ mag, Lloyd-Evans et al. 1983).

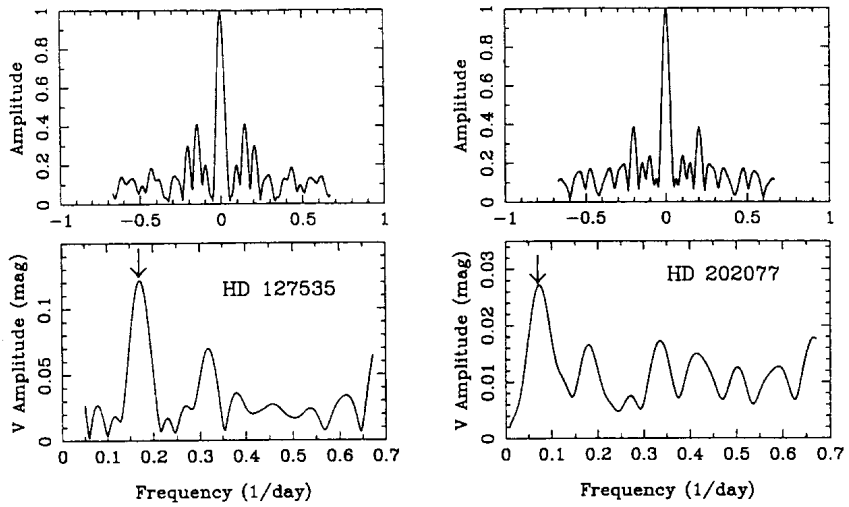

Figure 1: Periodograms from the [V] data of HD 127535 (left panels) and HD 202077 (right panels). The upper graph shows the window function and the lower graph is the periodogram for the two stars, respectively. The "best" periods are indicated and are 5.86 days for HD 127535 and 14.3 days for HD 202077.

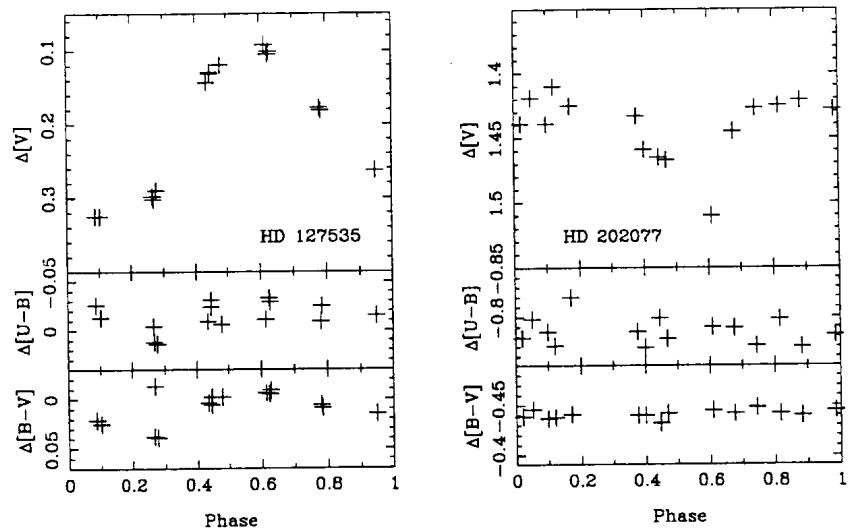

Figure 2: [UBV] light and color curves for HD 127535 (left panels) and HD 202077 (right panels). The HD 127535 data are plotted with the ephemeris JD 2,445,804.1+5.929×E and for HD 202077 with JD 2,449,000.0+14.3×E.

Table 1: Geneva [UBV] photometry of HD 127535 and HD 202077

HD 127535–HD 128227				HD 202077–HD 202540			
HJD 244+	$\Delta[V]$ (mag)	$\Delta[U-B]$ (mag)	$\Delta[B-V]$ (mag)	HJD 244+	$\Delta[V]$ (mag)	$\Delta[U-B]$ (mag)	$\Delta[B-V]$ (mag)
9528.0285	0.325	−0.026	+0.021	9528.3764	1.428	−0.782	−0.445
9529.1118	0.302	+0.012	−0.013	9529.3403	1.419	−0.798	−0.446
9530.0944	0.143	−0.009	+0.004	9530.3319	1.410	−0.771	−0.438
9534.0465	0.325	−0.013	+0.025	9534.3174	1.459	−0.769	−0.440
9535.0250	0.298	−0.004	+0.038	9535.3056	1.467	−0.778	−0.442
9536.0847	0.131	−0.031	−0.002	9537.3167	1.510	−0.790	−0.445
9537.1632	0.101	−0.029	−0.009	9538.2792	1.445	−0.789	−0.442
9538.0736	0.177	−0.009	+0.006	9539.2486	1.427	−0.771	−0.448
9539.0701	0.263	−0.015	+0.015	9540.2799	1.425	−0.798	−0.442
9541.0208	0.290	+0.014	+0.039	9541.2361	1.421	−0.770	−0.440
9542.0132	0.129	−0.024	+0.006	9543.1917	1.439	−0.779	−0.439
9543.0146	0.092	−0.011	−0.006	9544.3264	1.439	−0.785	−0.437
9544.0215	0.181	−0.025	+0.009	9545.3458	1.425	−0.820	−0.441
9548.1410	0.119	−0.006	−0.002	9548.2847	1.433	−0.785	−0.440
9549.0028	0.105	−0.033	−0.005	9549.2708	1.465	−0.799	−0.432

Our data were examined for periodicity with a standard period-finding program, and we obtained the greatest reduction of the sum of the squares of the residuals at a period of 5.86±0.10 days for HD 127535 and 14.3±0.5 days for HD 202077, in agreement with previous determinations. Figure 1 shows periodograms for both stars and their respective window functions. The full amplitudes in $[V]$, $[U-B]$ and $[B-V]$ are 0.23±0.02, 0.035±0.010, and 0.050±0.007 mag, respectively for HD 127535 and 0.060±0.015, ≤0.05, and ≤0.015 mag, respectively for HD 202077. The light and color curves are plotted in Fig. 2 versus rotational phase (data were phased with the photometric periods cited in the caption of Fig. 2).

As compared to earlier observations, HD 202077 seems to be in a low-amplitude state in mid 1994, while the light curve amplitude of HD 127535 is at the previously observed maximum of 0.25 mag from 1984 (Udalski & Geyer 1984).

If we assume that the photometric period of HD 127535 is the rotation period, the $v \sin i$ measure of 33±2(?) $\mathrm{km\,s^{-1}}$ (Randich et al. 1993) leads to a minimum radius of 3.8±0.3 $R_\odot$. Several sources quote a typical radius of ≈0.8 $R_\odot$ for a K1 dwarf, and ≈17 $R_\odot$ for a K1 class III giant. Thus, our radius determination is consistent with a slightly evolved star. No $v \sin i$ measure is available for HD 202077.

Acknowledgements. Work on stellar activity at the University of Vienna is supported by grants FWF P8942 and ÖAW OWP-40 to KGS.

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