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Light Variation of Magnetic Star HD 4174

by

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Abstract

The M2 type magnetic star HD 4174 shows periodic variations in luminosity with a period of 40·5 days and an amplitude of 0^m12. Long term light variations are also possible.

According to Babcock's investigations the magnetic field of the star HD 4174 ($\alpha_{1950} = 0^h\,42^m$, $\delta_{1950} = 40°\,24'$, $m_{pv} = 7{\cdot}5$) is varying between —1200 and +1100 gauss (Babcock 1958). The spectrum of this star is unusual — an absorption spectrum of a normal M2 giant with some emission lines and with a strong continuous spectrum in photographic region (Wilson 1950).

The photoelectric observations of HD 4174 have been made at the Wrocław Observatory during 45 nights from October 1961 to March 1963. The apparatus is described in an earlier paper (Jarzębowski 1959). Two comparison stars were used: HD 4322 (according to the HD Catalogue: F5, 7^m67) and HD 3914 (F5, 7^m05). The results of the observations are listed in Table 1. Each magnitude difference is a mean one of several comparisons (the number of comparisons is indicated in the Table).

The obtained results indicate that HD 4174 shows appreciable variations in luminosity. The greatest observed magnitude difference (HD 4174 — HD 4322) was of the order of 0^m21. The observations may be described by a mean period of 40·5 days. Significant deviations from this mean period were observed, however.

Relatively regular periodic light variations were stated in a five month interval from September 30, 1962 to February 26, 1963. The observations of this interval are plotted in Figure 1 for the period of 40·5 days. The mean observed amplitude of light variation was of the order of 0^m12.

The epoch of maximum light: J. D. $2437971 + 40^d5\,E$.

All measurements here discussed were made through a broad band filter, its effective wave length corresponding to $\lambda_{eff} \approx 5000$ Å.

Table 1.

Photoelectric Observations of HD 4174.

Date	J.D. 2430000+	Number of comparisons	HD 4174 - HD 4322		HD 4174 - HD 3914	
1961 Oct. 6	7579.60	6	+0.046	±0.005	-	
10	7583.40	15	+0.040	0.004	-	
11	7584.46	18	+0.041	0.003	-	
13	7586.40	2	+0.066	0.010	-	
22	7595.36	5	+0.005	0.015	-	
Nov. 19	7623.36	12	+0.118	0.004	-	
23	7627.41	12	+0.134	0.005	-	
1962 Sep. 26	7934.41	11	+0.010	0.005	-	
	7934.43	7	-		+0.586	±0.006
30	7938.41	10	-0.022	0.005	-	
	7938.43	5	-		0.531	0.006
Oct. 2	7940.50	12	-0.022	0.005	-	
	7940.53	8	-		0.533	0.007
3	7941.42	9	-0.033	0.004	-	
7	7945.44	10	+0.007	0.004	-	
	7945.46	1	-		0.569	
8	7946.36	12	+0.011	0.003	-	
	7946.37	12	-		0.574	0.004
11	7949.35	5	+0.021	0.007	-	
15	7953.34	12	+0.040	0.003	-	
	7953.37	5	-		0.621	0.005
20	7958.33	5	+0.012	0.005	-	
21	7959.36	10	+0.037	0.002	-	
	7959.38	9	-		0.596	0.004
22	7960.30	10	+0.028	0.004	-	
	7960.32	4	-		0.570	0.004
23	7961.28	10	+0.025	0.004	-	
	7961.30	7	-		0.587	0.005
24	7962.32	2	-0.020	0.010	-	
25	7963.48	6	-0.022	0.007	-	
	7963.49	6	-		0.526	0.007
26	7964.31	8	-0.013	0.004	-	
	7964.32	7	-		0.551	0.006
30	7968.25	2	-0.054	0.015	-	
Nov. 3	7972.25	6	-0.080	0.005	-	
	7972.26	6	-		0.482	0.006
	7972.29	6	-0.072	0.005	-	
	7972.30	4	-		0.495	0.006
4	7973.27	8	-0.073	0.003	-	
	7973.28	4	-		0.500	0.006
	7973.33	5	-0.067	0.004	-	
	7973.34	4	-		0.505	0.006
5	7974.25	9	-0.057	0.003	-	
	7974.27	3	-		0.510	0.010
6	7975.45	12	-0.060	0.004	-	
	7975.48	6	-		0.495	0.006
7	7976.42	10	-0.036	0.004	-	
	7976.43	5	-		0.530	0.006
16	7985.24	10	-0.010	0.004	-	
	7985.27	6	-		0.561	0.005
Dec. 2	8001.52	9	-0.021	0.010	-	
3	8002.19	6	-0.012	0.005	-	
	8002.20	6	-		0.531	0.006
	8002.24	6	-0.020	0.005	-	
	8002.25	8	-		0.526	0.005
	8002.26	4	-0.022	0.008	-	

Table 1 (concluded).

Date	J.D. 2430000+	Number of comparisons	HD 4174 - HD 4322		HD 4174 - HD 3914	
1962 Dec. 4	8003.22	10	-0.026	±0.003	-	
	8003.25	10	-		+0.545	±0.003
7	8006.37	10	-0.027	0.005	-	
	8006.39	6	-		0.516	0.010
	8006.40	6	-0.038	0.008	-	
1963 Jan. 10	8040.25	12	-0.004	0.005	-	
18	8048.27	9	-0.040	0.004	-	
	8048.27	7	-		0.514	0.008
19	8049.21	10	-0.053	0.004	-	
	8049.23	6	-		0.507	0.007
20	8050.27	5	-0.066	0.007	-	
25	8055.31	10	-0.065	0.003	-	
30	8060.25	12	-0.051	0.003	-	
Feb. 7	8068.23	7	-0.004	0.005	-	
22	8083.25	7	-0.007	0.006	-	
26	8087.25	10	-0.017	0.007	-	
28	8089.25	12	-0.009	0.007	-	
Mar. 14	8103.26	6	-0.039	0.010	-	
16	8105.27	10	-0.057	0.010	-	

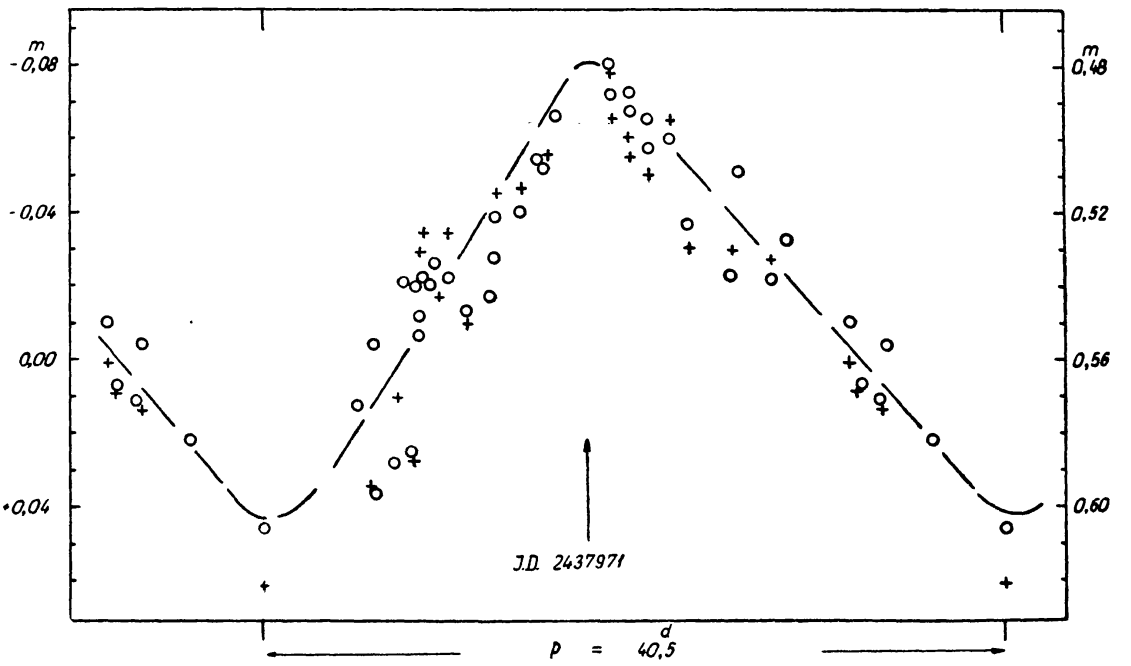

Fig. 1. The light of HD 4174 (September 30, 1962 to February 26, 1963) plotted for the period of 40·5 days.
Circles — the values: 2·5 log (HD 4322/HD 4174) — the scale on the left.
Crosses — the values: 2·5 log (HD 3914/HD 4174) — the scale on the right.

Some measurements (not listed in Table 1) were also made in $\lambda_{eff} =$ 4200 and $\lambda_{eff} = 5600$. The amplitude of light variation for λ 4200 was

somewhat larger, while for λ 5600 correspondingly smaller than for λ 5000 Å.

The magnitude differences obtained in 1961 cannot be plotted in Figure 1, for the mean luminosity of the star in that time was explicitly smaller. It can be concluded that some long term luminosity variations may also occur.

As mentioned by Babcock (1958), appreciable changes of the magnetic field of this star occur in intervals of a few weeks. We tried to plot Babcock's measurements for the period of 40·5 days, but they do not define a smooth curve. The variations of the field could eventually be plotted for a somewhat shorter period, but it seems that any conclusions concerning the relationship between magnetic and light variations would be premature.

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