SEARCH FOR SLOW LIGHT VARIATIONS OF RED-DWARF STARS

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ABSTRACT. The results of a search for slow light variations of 13 K2e-M4.5e dwarf stars using the Sternberg Institute plate collection are presented.These variations are discovered for PZ Mon and V577 Mon,confirmed for BY Dra and BD+26^{0}730 and suspected for V639 Her and V654 Her.

1. Introduction

There are many evidences from many years of spectral and photometric observations as well as photographic measurements of brightness that for late-type active dwarfs that there exist cycles in periodic light variations. The plate collection of the Sternberg Institute was founded in 1895 and there is a possibility to search for cycles of long-term brightness variations about 20% of the known flare stars.For several of them these variations would sugnificantly exceed the measurements' accuracy. In this paper the results of measurements for 13 stars selected from [1,2] are given. For three stars-BY Dra,BD+26^{0}730 and V577 Mon-the long-term variations are already known [2-5].

2. Measurements and results

The brightness value for studied stars was measured relatively to the comparison stars and to estimate the measurement's accuracy the control late-type stars were used.When the magnitude for these stars was not known,they were measured relatively to photometric standards at the plates obtained on the 40-cm astrograph whose photographic magnitudes are close to B band with the accuracy of about 0.05-0.2 mag. The list of investigated stars is exhibited in Table 1.,and in Figures 1,2 the black circles indicate their light curves, and plotted standard deviations.The light variability for all control stars is random and its amplitude did not exceed 0.1 mag.It is not more than standard deviation equal to 0.05-0.08 mag. Figure 1. shows the yearly mean magnitudes for

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stars with variability exceeding 0.3 mag.For BY Dra and BD+26°730 these data were supplemented from [2,3] - crosses and dashes, and from [4] - the pluses.The magnitudes for V577 Mon in [5] were measured relatively to comparison stars, which were observed photoelectrically. These magnitudes are brighter than those from the Sternberg Institute plates.By two coinsided dates was found the magnitude's discrepancy about of 0.25 mag. Thus, in Figure 1. for V577 Mon open circles show the yearly mean data from the table in [5],and the triangles -data from the Sternberg Institute plates with the reduction at the indicated correction.

Table 1.

Dwarf stars	Spectral type	Time scale (years)	Plate's number	Amplitude for mean magnitude (Δ B)	Observed cycle (years)
BD+26°730	K5e	1905-1988	370	0.6	60
V577 Mon	M4.5-7e	1909-1988	91	0.4-0.5	40
PZ Mon	K2e	1896-1988	130	$\gtrsim$1	50
BF CVn	M1.5e	1899-1989	104	0.2	-
DT Vir	M1.5-2e	1911-1967	66	0.2	-
EQ Vir	K5e	1914-1988	53	0.1	-
V654 Her	K4V	1907-1988	295	0.3	?
V639 Her	M4e	1910-1983	191	0.5	?
BY Dra	M0e	1904-1989	131	0.3-0.4	60
V1216 Sgr	M4.5e	1960-1988	237	0.13	-
V1285 Aql	M2-3e	1899-1987	108	0.2-0.3	-
V1396 Cyg	M3e	1896-1982	184	0.15	-
DO Cep	M4.5e	1899-1989	152	0.25	-

3. Discussion

The sufficiently good agreement for all known data for BY Dra and BD+26°730 confirmed the cyclical light variations for them with time scale of about 50-60 years and amplitude of 0.3-0.6 mag.A possibility,that BY Dra has the shorter activity cycle-about 10-15 years still exists. V577 Mon shows the light variability with an amplitude of 0.4-0.5 mag that occures approximately once in 40 years. PZ Mon has the light amplitude of about 1 mag.There are two minima for the average magnitudes with possible interval of 50 years. The time scale for the data of V639 Her and V654 Her is exhibited in several series of mean light and one may only notice its changes by 0.3-0.5 mag. Figure 2. shows the light curves for stars whose brightness amplitude does not exceed 0.2 mag.Probably,for several of them it can be explained by the absence of data for individual years.

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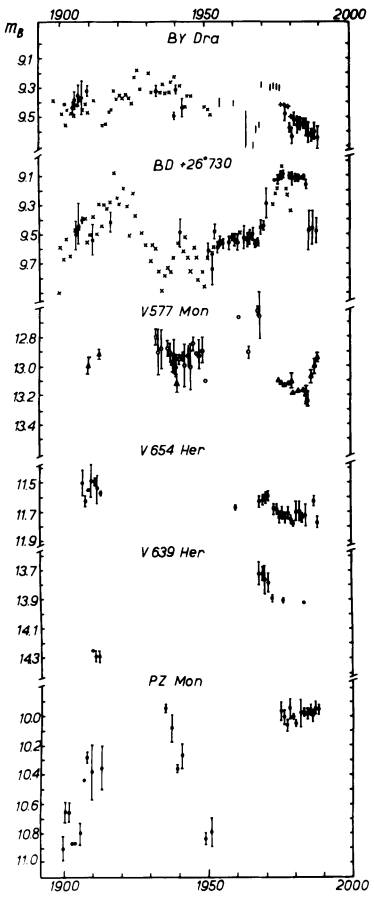

Fig.1.-The cyclical light variations

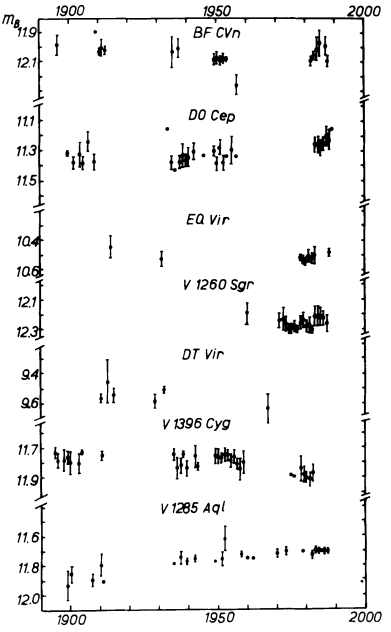

Fig.2.-The long-term light variations with small amplitude.

5. References

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PETTERSEN: How did you remove flares from your data set?

BONDAR: It was not possible to exclude flares from the plate collection data. We have looked for longer variations than those of flares.

PETTERSEN: My point is that individual flares would introduce high data points in your plots and lead to overestimation of variability amplitudes.

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