Astron. Astrophys. Suppl. **29**, 321-326.

PHOTOMETRY OF THE DWARF CEPHEID EH LIBRAE

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Received December 3, 1976

Photoelectric *B* and *V* observations of the dwarf cepheid EH Lib are given. They enable us to detect small variations in the height of the maxima, whilst the minima appear to be constant. Ten new epochs of maximum are derived. An analysis of the published observations shows that the period is variable. The results are compared to the rate of period change calculated by Dziembowski and Kozlowski.

Key words: dwarf cepheids – AI Velorum stars – photometry

1. INTRODUCTION

EH Lib = BD −0°2911 is known to be an AI Velorum type variable star since 1950 (Code 1950). On account of the short period EH Lib has been frequently monitored photometrically. The first study, performed photoelectrically by Code, gave some indications that the light curve has fluctuations near the maximum with amplitudes of about 0.05 mag, so Code suspected a possible secondary periodicity effect to be acting in the variable. Since then a notable number of epochs of maximum has been obtained, from photographic or visual measurements, by Ashbrook (1952), Alantsya (1954), Phol (1955), Tsesevich (1956), Batyrev (1952, 1957, 1964), Burnicki and Krygier (1958), Harding and Penston (1966), Braune and Hubscher (1967), Braune *et al.* (1970, 1972), Berdnikov (1972) and Braune and Mundry (1973). Batyrev (1957), taking into account all the previous observations, gave the following elements:

$$\text{Max hel.} = \text{JD } 2433438.6100 + 0.08841320\, n.$$

Batyrev (1964) moreover pointed out that the brightness at the maximum was varying and he believed a beat phenomenon was present in the light curves of EH Lib. However the photoelectric measurements obtained by Fitch (1957) and by Fitch *et al.* (1966) give evidence of only small fluctuations of the heights of maxima (less than ± 0.015 mag). Sanwal and Pande (1961) observed EH Lib photoelectrically in two colours along 15 cycles and report that the light curve is quite regular and the period has not changed appreciably since 1950. Oosterhoff and Walraven (1966) obtained five-colour photoelectric measurements, gave an improved period, but did not report about the constancy of the light curve. According to Boardman and Heiser (1972) the period of EH Lib is constant since 1960. Their *uvby* observations however are too few to prove any light curve modulation; a new evaluation of the instant of maximum by least squares cubic fitting is listed in table 1. A photoelectric study performed by Terzan and Rutily (1974) gives new epochs of maximum light, a small correction to the period and a $U-B/B-V$ diagram like that obtained by Oosterhoff and Walraven. The colours however indicate a spectral type at the minimum even later than FO, an unusual value for a 0.09 days period dwarf cepheid. Berdnikov (1975) taking into account 24 instants of maximum, at the most normal epochs, reached the conclusion that the period of EH Lib is varying with the cycle of approximately 1800 days. A radial velocity curve has then been obtained by McNamara and Feltz (1975).

2. LIGHT CURVES AND PERIOD

On account of the contrasting conclusions about the presence of beat phenomena in EH Lib, we thought it useful to obtain a new set of measurements to permit a definitive statement about the stability of the light curves and to analyse all the epochs of maxima listed in the references reported above to check the trend of the period. The observations were obtained with *B* and *V* filters on six nights from April through May 1975, using the 102 cm reflector of the Merate Observatory, by means of a conventional integrating charge photometer. A rapid positioning of the telescope between variable and comparison star, via digital setting controls and short times of integration (typically 20 sec), allowed the reduction of the effects of variable sky transparency on the differential measurements.

EH Lib was compared to BD $-0°2909$, used also by Fitch (1957), who gives for it the values: $V=10^{m}.26$, $B-V=+0^{m}.44$; the check star was BD$-0°2903$. The Δm between the two comparison stars changed by $0^{m}.03$ in the interval GG 42519–549. As it will appear later from the study of the light curves, BD$-0°2909$ stayed constant but the check star became brighter.

The light curves of EH Lib are displayed in figure 3 and the individual observations, altogether 900, corrected for light time and differential extinction, are listed in tables 3 and 4. The corrections for the B measurements reach $0^{m}.01$ around the maxima, where the colour difference between variable and comparison star is stronger, but elsewhere and for the V measurements they are only a few thousandths of a magnitude or negligible.

No consistent changes are evident in the shapes of the light curves, like those well known in the dwarf cepheids with a Blazhko effect. However to see if EH Lib undergoes small cycle to cycle variations in the brightness at maximum light also during our observing season, as already claimed by Fitch (1957), cubic parabolas were fitted by least squares through the measurements encompassing the maxima and the minima. The epochs and the magnitudes derived are listed in table 1. The mean values are:

$$\text{Max } V=9^{m}.549 \qquad B-V=+0^{m}.175$$
$$\text{Min } V=10.080 \qquad B-V=+0.312$$
$$(\text{Max-Min})/\text{Period}=0.316$$

The uncertainty of a single Δm estimated by the fitting is at the minimum $0^{m}.004$ and at the maximum $0^{m}.007$. The latter larger value is likely due to the difficulty of monitoring in two colours the rapid light variations around the maximum light by means of discrete measurements. An inspection of the data in table 1 discloses that the magnitudes at the minimum are constant also if the r.m.e. of a minimum appears to be larger than expected, taking into account the uncertainty quoted above for a single observation. On the contrary the brightness at the maximum shows a systematic trend, as can be seen in figure 1. Representing the magnitudes by means of a linear regression it can be guessed that the maxima decrease $0^{m}.033$ each 100 cycles, in both colours.

The course of the period can be examined over an interval of more than one hundred thousand cycles, about 25 years, well covered by the 129 epochs listed in table 2 along with the corresponding sources. The material is quite inhomogeneous: for the visual epochs observed simultaneously by most observers the uncertainty amounts to $\pm 0^{d}.006$; for our ten photoelectric epochs we estimate an internal precision of $0^{d}.0003$ (from the fitting); we obtain the same precision for the mean epochs of B and V values. After suitable weights (w) were given, typically $\sqrt{w}=1$ to a visual or photographic individual epoch and $\sqrt{w}=6$ for a photoelectric one, the following ephemerides and their standard errors were calculated:

$$\text{Max}=\text{hel. JD } 2433438.6082+0.0884132445\, n$$
$$\pm \quad 2 \qquad\qquad 30 \text{ m.e.}$$

The $O-C$ are listed in table 2. Their distribution does not appear to be gaussian, but a systematic trend results. Moreover we have seen no evidence of periodic oscillation in the residuals, in particular with a period near 1800 days (Berdnikov 1975). Since the dispersion of the visual and photographic residuals, when plotted against the cycle number n, indicates that these epochs have an uncertainty even larger than the value estimated above and more conspicuous than the small variation of the period displayed by the photoelectric observations, it seemed worthwhile studying the period considering the photoelectric epochs only. These observations, plotted in figure 2, appear to be gathered in some groups and give evidence that the period has a complicated variation that we merely represent by a broken straight line. In this way, it gives:

Interval	Period
0– 41000 cycles	0ᵈ.088413243
	± 2 m.e.
40000– 45000 cycles	.088413197
	31
45000– 78000 cycles	.088413318
	2
78000–103000 cycles	.088413142
	2

Looking at the m.e. the period seems certainly to have undergone some small long time scale variations.

CONCLUSIONS

The observations we obtained suggest the following conclusions:

a) the brightness of EH Lib seems to change at the maxima, whilst at the minima it remains perceptibly constant. Also if the dispersion of the measurements is rather appreciable in comparison to the effect guessed, the variation of the maxima is real in our opinion and supports the findings of Fitch (1957). Since the light amplitudes of EH Lib measured by the previous observers are about the same as those we observed, it is likely that the maxima change cyclically by a small amount. Our measurements are too few to indicate more about this variation. If the phenomenon should be periodic, a period of about 300 cycles (27 days) can be proposed. On account of the small amount of fluctuation in the maxima, no measurable effect can be expected in the instants of maximum as occurs for the RR stars known to have a Blazhko effect.

b) According to Frolov (Kukarkin 1975) instabilities of the period and of the light curves, as well as the Blazhko effect, are common in the dwarf cepheids. In this respect our results bear out that EH Lib confirms the rule. Dziembowski and Kozlowski (1974) calculate a series of models of low mass stars in the pulsation instability strip and find that the periods should be changed. The rate of change $-dln\ P/dt$ (expressed in year $^{-1}$) should be comprised between 3.10^{-8} and 5.10^{-7}. Making a comparison with the values observed for the AI Vel stars they find as possible candidates CY Aqr and EH Lib. In particular the supposed constant period of EH Lib restricts the possible rate of period change which has been guessed. As figure 2 shows, during the last sixty thousand cycles the period of EH Lib becomes shorter and a mean rate of change equal to 3.10^{-7} can be estimated. However, as the theory supposes a continuous decrease in the period and since it is possible that accidental variations add up to secular changes, only further observations covering a much longer time interval can prove the existance of a secular trend. At present we can only maintain that the period of EH Lib also doesn't appear to be constant, as it occurs for most dwarf cepheids.

ACKNOWLEDGEMENTS

This work was supported in part by the Consiglio Nazionale delle Ricerche.

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Table 1 Light curve parameters of EH Librae

	Maxima			Minima		
n	Hel.J.D.2442	B	V	Hel.J.D.2442	B	V
1	515.5531±.0001	$9^m.707$	$9^m.541$	515.5265±.0005	$10^m.385$	$10^m.081$
2	515.6410±.0005	9.694	9.534	515.6138±.0005	10.391	10.069
46	519.5314±.0001	9.719	9.539	519.5021±.0011	10.387	10.082
47	519.6201 0	9.717	9.559	519.5933±.0011	10.401	10.077
69	521.5654±.0003	9.727	9.557	521.5386±.0007	10.384	10.077
70	—	—	—	521.6229±.0010	10.390	10.075
361	547.3819±.0002	9.724	9.544	—	—	—
362	—	—	—	547.4437 0	—	10.080
384	549.4154±.0002	9.730	9.543			
385	549.5032±.0005	9.744	9.557	549.4762±.0002	10.401	10.091
407	551.4492±.0004	9.738	9.559	551.4220±.0002	10.393	10.081
408	551.5375±.0002	9.737	9.568	551.5101±.0008	10.395	10.086

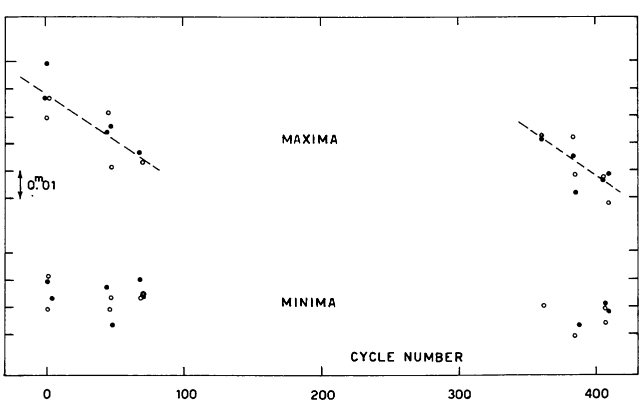

Figure 1 Magnitudes at maximum (top) and minimum light (bottom) of EH Lib. The regression coefficients of the linear regressions give respectively 0.81 and 0.74 for the two groups of maxima. The V measurements (◦) are shifted vertically with respect to the B ones (.) until the two groups merge together.

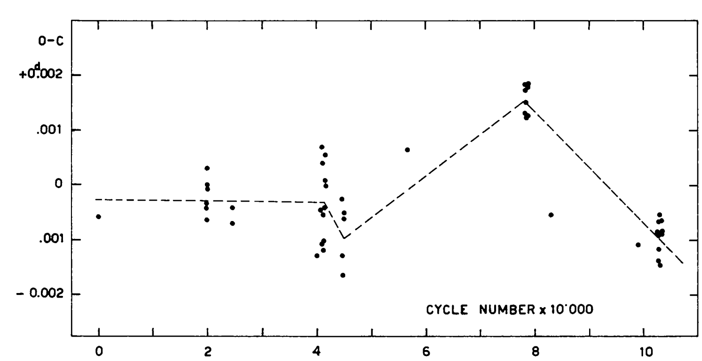

Figure 2 Plot showing variability of period. The residuals are calculated according to the ephemerides: Max = JD 2433438.6082 + 0.0884132445 n.

Table 2 Epochs of maximum light of EH Librae

	Hel.J.D. 243......	n	√w	O-C	Ref		Hel.J.D. 243......	n	√w	O-C	Ref
1	3438.6076	0.	6	-.0006	1	71	7054.3552	40896.	6	-.0011	9
2	3711.7165	3089.	2	-.0002	2	72	7075.2222	41132.	6	.0004	9
3	3737.7090	3383.	2	-.0012	2	73	7075.3109	41133.	3	.0007	9
4	3743.7220	3451.	2	-.0003	2	74	7075.3982	41134.	4	-.0004	9
5	3756.5460	3596.	1	.0037	3	75	7077.1670	41154.	4	.0001	9
6	3770.4223	3753.	1	-.0008	4	76	7082.2054	41211.	4	-.0010	9
7	3770.5110	3754.	1	-.0005	3	77	7105.1927	41471.	6	-.0012	9
8	3782.3570	3888.	1	-.0019	3	78	7114.3010	41574.	6	.0006	10
9	3819.3210	4306.	1	.0053	3	79	7116.2450	41596.	6	-.0005	10
10	3822.3200	4340.	1	-.0017	3	80	7116.3340	41597.	6	.0000	10
11	3824.3590	4363.	1	.0038	3	81	7403.3217	44843.	3	-.0016	9
12	3849.3810	4646.	1	.0048	5	82	7403.4115	44844.	2	-.0003	9
13	3858.3990	4748.	1	.0047	5	83	7408.3624	44900.	2	-.0005	9
14	3865.2890	4826.	1	-.0015	3	84	7410.3074	44922.	3	-.0006	9
15	4104.4490	7531.	1	.0006	5	85	7412.3402	44945.	3	-.0013	9
16	4104.5340	7532.	1	-.0028	5	86	8249.2600	54411.	1	-.0013	3
17	4104.5350	7532.	1	-.0018	5	87	8454.0270	56727.	3	.0007	19
18	4121.4220	7723.	1	-.0017	5	88	8822.7100	60897.	1	.0004	11
19	4121.5080	7724.	1	-.0041	5	89	8903.4370	61810.	1	.0061	12
20	4130.4480	7825.	1	.0061	3	90	8903.4390	61810.	1	.0081	12
21	4132.3940	7847.	1	.0070	3	91	8903.4440	61810.	1	.0131	12
22	4132.3880	7847.	1	.0010	5	92	8903.4500	61810.	1	.0191	12
23	4133.4500	7859.	1	.0021	5	93	8938.4430	62206.	1	.0005	12
24	4133.4510	7859.	1	.0031	5	94	8938.4440	62206.	1	.0015	12
25	4146.3570	8005.	1	.0008	3	95	8938.4530	62206.	1	.0105	12
26	4155.3750	8107.	1	.0006	3	96	9231.3570	65519.	1	.0014	13
27	4165.3680	8220.	1	.0029	3	97	9233.3940	65542.	1	.0049	13
28	4451.4740	11456.	1	.0036	5	98	9233.4870	65543.	1	.0095	13
29	4451.4730	11456.	1	.0026	5	99	9238.4260	65599.	1	-.0026	13
30	4451.5600	11457.	1	.0012	5	100	9260.4490	65848.	1	.0055	13
31	4451.5600	11457.	1	.0012	5	101	10365.6104	78348.	6	.0013	14
32	4451.6480	11458.	1	.0008	5	102	10368.6169	78382.	6	.0017	14
33	4451.6480	11458.	1	.0008	5	103	10368.7054	78383.	6	.0018	14
34	4455.4500	11501.	1	.0011	5	104	10387.5371	78596.	6	.0015	14
35	4455.4480	11501.	1	-.0009	5	105	10387.6253	78597.	6	.0013	14
36	4472.4190	11693.	1	-.0053	5	106	10387.7142	78598.	6	.0018	14
37	4472.4220	11693.	1	-.0023	5	107	10388.5100	78607.	6	.0019	14
38	4476.4920	11739.	1	.0007	5	108	10388.5978	78608.	6	.0013	14
39	4476.4910	11739.	1	-.0003	5	109	10780.6203	83042.	3	-.0006	15
40	4478.3500	11760.	1	.0020	5	110	11074.4190	86365.	1	.0009	13
41	4478.4380	11761.	1	.0016	5	111	11074.5100	86366.	1	.0035	13
42	4478.4330	11761.	1	-.0034	5	112	11421.4500	90290.	1	.0099	16
43	4478.4380	11761.	1	.0016	5	113	11422.3360	90300.	1	.0118	16
44	4484.4500	11829.	1	.0015	5	114	11422.5120	90302.	1	.0110	16
45	4484.4490	11829.	1	.0005	5	115	11423.3030	90311.	1	.0063	16
46	4485.5180	11841.	1	.0085	6	116	11423.3900	90312.	1	.0048	16
47	4498.4180	11987.	1	.0002	5	117	11424.2730	90322.	1	.0037	16
48	4498.4160	11987.	1	-.0018	5	118	11424.3620	90323.	1	.0043	16
49	4857.4660	16048.	1	.0020	5	119	11424.4470	90324.	1	.0009	16
50	4865.4220	16138.	1	.0008	3	120	11425.3270	90334.	1	-.0032	16
51	4912.3730	16669.	1	.0044	3	121	11425.4240	90335.	1	.0053	16
52	5223.7596	20191.	6	-.0004	7	122	11443.3690	90538.	1	.0024	17
53	5223.8478	20192.	6	-.0007	7	123	11443.4610	90539.	1	.0060	17
54	5223.9372	20193.	6	.0003	7	124	11445.4080	90561.	1	.0079	17
55	5225.7932	20214.	6	-.0003	7	125	11445.4880	90562.	1	-.0005	17
56	5239.4080	20368.	1	-.0012	3	126	11471.3890	90855.	1	-.0045	17
57	5243.7414	20417.	6	-.0000	7	127	11473.4250	90878.	1	-.0021	17
58	5243.8298	20418.	6	-.0000	7	128	11768.3760	94214.	1	.0024	16
59	5252.4050	20515.	1	-.0009	3	129	12178.7868	98856.	6	-.0011	18
60	5267.3480	20684.	1	.0002	3	130	12515.5531	102665.	6	-.0009	20
61	5279.3720	20820.	1	.0000	3	131	12515.6410	102666.	6	-.0014	20
62	5599.9580	24446.	2	-.0004	8	132	12519.5314	102710.	6	-.0012	20
63	5606.4160	24519.	1	.0034	3	133	12519.6201	102711.	6	-.0009	20
64	5622.6799	24703.	6	-.0007	7	134	12521.5654	102733.	6	-.0007	20
65	5622.7686	24704.	6	-.0004	7	135	12547.3819	103025.	6	-.0008	20
66	5976.4270	28704.	1	.0050	3	136	12549.4154	103048.	6	-.0008	20
67	5994.3700	28907.	1	.0001	3	137	12549.5032	103049.	6	-.0015	20
68	6336.3580	32775.	1	.0057	3	138	12551.4492	103071.	6	-.0005	20
69	6996.4443	40241.	6	-.0013	9	139	12551.5375	103072.	6	-.0007	20
70	7054.2674	40895.	6	-.0005	9						

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(1) Code, 1950; (2) Ashbrook, 1952; (3) Batyrev, 1952,1957, 1964; (4) Tsesevich, 1956; (5) Pohl, 1955; (6) Alantsya, 1954; (7) Fitch, 1957; (8) Burnicki, Kryğier,1958; (9) Sanwal, Pande,1961; (10)Oosterhoff, Walraven, 1966;(11)Harding, Penston, 1966;(12)Braun, Hubscher,1967;(13)Braun, et al., 1970, 1972; (14)Terzan, Rutily, 1974;(15)Boardman, Heiser, 1972;(16)Berdnikov, 1972 ;(17)Braun, Mundry,1973; (18) McNamara, Feltz, 1976; (19) Fitch et al.,1966; (20) present paper.

Table 3 *B* magnitudes of EH Librae

HEL. J.D. 24....	B	HEL. J.D. 24....	B	HEL. J.D. 24....	B	HEL. J.D. 24....	B	HEL. J.D. 24....	B
42515.4625	9.714	42515.5455	10.006	42519.4910	10.349	42519.5687	10.254	42521.5416	10.384
.4671	9.720	.5462	9.967	.4936	10.365	.5704	10.271	.5432	10.382
.4694	9.783	.5480	9.861	.4962	10.384	.5739	10.307	.5440	10.374
.4713	9.809	.5489	9.809	.4997	10.385	.5773	10.326	.5463	10.357
.4736	9.853	.5507	9.735	.5020	10.371	.5812	10.348	.5472	10.354
.4755	9.869	.5514	9.722	.5143	10.330	.5852	10.367	.5496	10.309
.4781	9.917	.5523	9.707	.5159	10.298	.5868	10.384	.5511	10.301
.4789	9.936	.5542	9.712	.5177	10.253	.5878	10.381	.5521	10.245
.4817	9.975	.5553	9.743	.5184	10.237	.5902	10.388	.5540	10.165
.4835	10.014	.5577	9.770	.5202	10.171	.5919	10.396	.5547	10.134
.4855	10.048	.5633	9.879	.5209	10.147	.5938	10.400	.5565	10.076
.4863	10.066	.5672	9.940	.5217	10.110	.5971	10.396	.5572	10.034
.4887	10.101	.5710	9.987	.5235	10.015	.5990	10.386	.5593	9.888
.4904	10.116	.5748	10.052	.5242	9.975	.5998	10.365	.5612	9.803
.4926	10.137	.5780	10.105	.5249	9.938	.6024	10.332	.5632	9.737
.4933	10.151	.5819	10.147	.5268	9.824	.6078	10.201	.5643	9.736
.4954	10.171	.5849	10.199	.5276	9.792	.6096	10.109	.5651	9.741
.4962	10.190	.5900	10.254	.5282	9.763	.6114	10.030	.5669	9.746
.4980	10.217	.5949	10.280	.5300	9.726	.6143	9.875	.5675	9.737
.4987	10.225	.6010	10.340	.5307	9.719	.6161	9.787	.5693	9.774
.5006	10.230	.6049	10.345	.5315	9.725	.6177	9.738	.5710	9.799
.5023	10.264	.6090	10.375	.5331	9.730	.6194	9.719	.5721	9.824
.5044	10.284	.6123	10.387	.5338	9.736	.6201	9.732	.5740	9.847
.5053	10.286	.6156	10.380	.5346	9.740	.6220	9.734	.5748	9.870
.5093	10.310	.6184	10.397	.5368	9.781	.6238	9.792	.5767	9.903
.5121	10.338	.6219	10.344	.5375	9.798	.6260	9.800	.5776	9.915
.5129	10.341	.6249	10.311	.5391	9.820	.6282	9.836	.5793	9.966
.5148	10.358	.6257	10.289	.5410	9.854	.6304	9.874	.5809	9.985
.5155	10.366	.6278	10.242	.5417	9.858	.6311	9.881	.5818	10.023
.5176	10.378	.6310	10.111	.5434	9.896	.6339	9.934	.5841	10.032
.5183	10.381	.6317	10.086	.5442	9.918	.6356	9.971	.5852	10.063
.5222	10.379	.6374	9.736	.5461	9.950	.6372	9.986	.5874	10.082
.5230	10.375	.6380	9.706	.5468	9.969	.6391	10.015	.5883	10.098
.5252	10.381	.6398	9.705	.5486	9.990	42521.4941	9.966	.5901	10.117
.5274	10.387	.6416	9.708	.5493	10.010	.4995	10.083	.5920	10.141
.5295	10.384	.6434	9.716	.5518	10.027	.5024	10.131	.5942	10.169
.5304	10.374	.6451	9.738	.5525	10.034	.5058	10.189	.5952	10.179
.5326	10.355	.6469	9.779	.5539	10.050	.5093	10.210	.5973	10.192
.5335	10.342	.6478	9.792	.5554	10.096	.5127	10.249	.5991	10.224
.5351	10.353	.6493	9.818	.5566	10.123	.5157	10.280	.6011	10.255
.5369	10.328	42519.4660	10.100	.5586	10.152	.5196	10.325	.6023	10.246
.5378	10.306	.4707	10.146	.5595	10.166	.5235	10.330	.5973	10.192
.5396	10.246	.4747	10.210	.5615	10.187	.5264	10.358	.6000	10.240
.5403	10.219	.4775	10.242	.5625	10.193	.5300	10.369	.6034	10.252
.5413	10.196	.4815	10.258	.5644	10.208	.5332	10.375	.6079	10.300
.5434	10.115	.4845	10.275	.5651	10.218	.5362	10.377	.6112	10.332
.5441	10.100	.4874	10.302	.5670	10.236	.5386	10.385	.6152	10.359
42521.6182	10.389	42549.4069	10.071	42549.5038	9.757	42551.4384	10.164	42551.5070	10.392
.6223	10.389	.4081	10.028	.5045	9.746	.4393	10.123	.5081	10.393
.6265	10.390	.4101	9.899	.5065	9.780	.4400	10.100	.5099	10.392
.6314	10.354	.4116	9.823	.5082	9.785	.4425	9.947	.5120	10.399
.6352	10.333	.4134	9.752	.5100	9.839	.4444	9.829	.5139	10.375
42547.3731	10.083	.4142	9.744	.5118	9.846	.4451	9.813	.5146	10.381
.3747	9.980	.4149	9.726	.5138	9.906	.4471	9.763	.5167	10.365
.3771	9.843	.4167	9.723	.5171	9.949	.4478	9.742	.5176	10.347
.3788	9.798	.4185	9.769	.5191	10.005	.4496	9.745	.5197	10.341
.3806	9.735	.4203	9.808	.5217	10.045	.4503	9.738	.5203	10.332
.3813	9.719	.4222	9.818	.5227	10.045	.4522	9.754	.5223	10.280
.3822	9.724	.4237	9.844	.5251	10.068	.4537	9.777	.5237	10.241
.3839	9.767	.4257	9.891	.5273	10.118	.4557	9.820	.5255	10.198
.3846	9.782	.4265	9.902	.5307	10.162	.4568	9.832	.5264	10.167
.3875	9.827	.4285	9.922	42551.3778	10.018	.4589	9.895	.5281	10.084
.3909	9.863	.4293	9.935	.3807	10.062	.4597	9.909	.5289	10.060
.3916	9.881	.4318	9.998	.3815	10.088	.4615	9.950	.5297	10.020
.3936	9.916	.4333	10.002	.3831	10.084	.4632	9.990	.5315	9.898
.3951	9.941	.4360	10.038	.3853	10.106	.4650	10.002	.5322	9.869
.3993	9.998	.4379	10.084	.3873	10.152	.4657	10.008	.5330	9.826
.4001	10.004	.4391	10.116	.3893	10.177	.4679	10.052	.5347	9.763
.4031	10.031	.4415	10.128	.3901	10.194	.4700	10.091	.5354	9.743
.4062	10.078	.4434	10.171	.3925	10.221	.4728	10.106	.5379	9.745
.4101	10.120	.4457	10.196	.3945	10.238	.4748	10.129	.5387	9.741
.4120	10.185	.4477	10.203	.3971	10.272	.4766	10.171	.5406	9.763
.4140	10.212	.4494	10.233	.3979	10.286	.4773	10.167	.5414	9.764
.4160	10.224	.4517	10.250	.3999	10.286	.4791	10.193	.5436	9.798
.4179	10.251	.4536	10.262	.4015	10.295	.4806	10.205	.5443	9.815
.4202	10.280	.4562	10.286	.4036	10.309	.4844	10.221	.5463	9.845
.4232	10.309	.4601	10.315	.4045	10.324	.4864	10.260	.5471	9.859
.4269	10.336	.4640	10.352	.4076	10.335	.4872	10.263	.5490	9.894
.4310	10.356	.4689	10.374	.4094	10.354	.4891	10.294	.5497	9.913
.4349	10.372	.4738	10.400	.4138	10.371	.4907	10.305	.5514	9.935
.4389	10.378	.4779	10.396	.4173	10.386	.4926	10.316	.5549	10.004
42549.3925	10.385	.4832	10.371	.4196	10.388	.4933	10.316	.5561	10.013
.3958	10.378	.4877	10.335	.4236	10.389	.4956	10.326	.5601	10.095
.3977	10.335	.4907	10.220	.4253	10.393	.4964	10.323	.5606	10.115
.3993	10.290	.4938	10.147	.4275	10.373	.4979	10.336	.5628	10.152
.4017	10.249	.4965	10.002	.4310	10.343	.4986	10.358	.5644	10.162
.4024	10.222	.4973	9.950	.4320	10.331	.5025	10.382	.5664	10.170
.4043	10.174	.4994	9.821	.4339	10.287	.5052	10.389	.5706	10.242
.4049	10.145	.5009	9.753	.4362	10.227				

Table 4 *V* magnitudes of EH Librae

HEL. J.D. 24....	V	HEL. J.D. 24....	V	HEL. J.D. 24....	V	HEL. J.D. 24....	V	HEL. J.D. 24....	V
42515.4629	9.623	42515.5437	9.849	42519.4908	10.025	42519.5742	10.011	42521.5261	10.045
.4675	9.568	.5451	9.783	.4936	10.054	.5769	10.029	.5296	10.056
.4698	9.617	.5459	9.756	.4967	10.068	.5828	10.053	.5328	10.064
.4717	9.622	.5476	9.675	.5000	10.075	.5870	10.068	.5359	10.076
.4739	9.651	.5485	9.634	.5027	10.082	.5908	10.073	.5402	10.077
.4759	9.676	.5504	9.569	.5068	10.075	.5955	10.078	.5439	10.061
.4785	9.718	.5510	9.557	.5137	10.026	.5994	10.060	.5470	10.048
.4793	9.717	.5519	9.539	.5162	10.002	.6002	10.057	.5499	10.019
.4820	9.748	.5539	9.537	.5181	9.967	.6019	10.043	.5515	9.989
.4839	9.783	.5548	9.562	.5187	9.958	.6036	10.023	.5524	9.955
.4859	9.803	.5595	9.617	.5205	9.891	.6073	9.946	.5543	9.889
.4867	9.819	.5656	9.681	.5213	9.872	.6082	9.918	.5550	9.865
.4891	9.848	.5715	9.758	.5220	9.849	.6100	9.852	.5568	9.811
.4908	9.858	.5765	9.821	.5238	9.764	.6118	9.783	.5576	9.786
.4929	9.877	.5803	9.878	.5246	9.742	.6140	9.693	.5596	9.669
.4936	9.882	.5839	9.923	.5253	9.700	.6158	9.604	.5608	9.620
.4957	9.903	.5871	9.949	.5271	9.623	.6182	9.569	.5627	9.578
.4966	9.916	.5929	9.978	.5279	9.594	.6207	9.555	.5646	9.563
.4984	9.931	.5976	10.004	.5285	9.573	.6235	9.593	.5654	9.567
.4990	9.937	.6026	10.052	.5303	9.543	.6263	9.626	.5672	9.563
.5009	9.954	.6066	10.058	.5310	9.544	.6281	9.649	.5678	9.572
.5027	9.970	.6106	10.069	.5318	9.546	.6288	9.661	.5698	9.596
.5048	9.990	.6135	10.063	.5334	9.559	.6307	9.690	.5716	9.619
.5056	9.988	.6166	10.065	.5341	9.562	.6314	9.706	.5724	9.643
.5090	10.011	.6196	10.066	.5349	9.576	.6335	9.728	.5743	9.652
.5106	10.021	.6221	10.051	.5371	9.601	.6353	9.742	.5751	9.679
.5125	10.036	.6245	10.028	.5379	9.609	.6382	9.807	.5770	9.705
.5133	10.032	.6253	10.021	.5394	9.637	.6417	9.834	.5779	9.712
.5152	10.056	.6272	10.006	.5413	9.656	.6428	9.845	.5796	9.738
.5161	10.060	.6306	9.897	.5420	9.666	.6443	9.855	.5813	9.747
.5180	10.062	.6314	9.861	.5438	9.698	.6457	9.860	.5821	9.754
.5186	10.059	.6359	9.656	.5445	9.710	42521.4937	9.742	.5845	9.777
.5217	10.073	.6377	9.563	.5465	9.728	.4952	9.783	.5856	9.801
.5227	10.065	.6383	9.555	.5472	9.742	.4981	9.834	.5878	9.830
.5249	10.077	.6401	9.543	.5490	9.770	.5008	9.842	.5886	9.844
.5270	10.086	.6428	9.550	.5498	9.785	.5016	9.852	.5908	9.870
.5291	10.075	.6455	9.578	.5528	9.839	.5038	9.886	.5923	9.884
.5300	10.073	.6472	9.589	.5559	9.845	.5052	9.902	.5946	9.894
.5323	10.055	.6481	9.612	.5581	9.869	.5070	9.911	.5955	9.914
.5331	10.054	.6496	9.629	.5591	9.885	.5089	9.922	.5976	9.915
.5347	10.047	42519.4668	9.847	.5612	9.906	.5103	9.934	.5994	9.941
.5365	10.039	.4703	9.867	.5620	9.907	.5125	9.954	.6022	9.956
.5374	10.034	.4743	9.911	.5640	9.927	.5134	9.961	.6060	9.996
.5393	9.983	.4771	9.940	.5648	9.934	.5152	9.974	.6100	10.011
.5399	9.953	.4812	9.963	.5666	9.953	.5169	9.983	.6135	10.033
.5409	9.927	.4841	9.983	.5684	9.960	.5196	9.999	.6170	10.073
.5431	9.878	.4870	9.985	.5700	9.974	.5231	10.026	.6205	10.065
42521.6245	10.071	42547.4619	9.824	42549.4912	9.940	42551.4233	10.080	42551.4980	10.043
.6289	10.073	.4634	9.752	.4937	9.885	.4248	10.081	.4990	10.049
.6328	10.028	.4644	9.708	.4946	9.861	.4272	10.065	.5029	10.056
.6367	9.998	.4663	9.630	.4971	9.747	.4316	10.038	.5049	10.053
.6396	9.990	42549.3911	10.058	.4976	9.719	.4326	10.017	.5068	10.079
42547.3726	9.849	.3931	10.066	.4995	9.611	.4346	9.988	.5078	10.078
.3774	9.678	.3955	10.069	.5010	9.570	.4365	9.928	.5098	10.086
.3789	9.569	.3975	10.044	.5039	9.560	.4390	9.865	.5112	10.091
.3809	9.552	.3989	10.001	.5049	9.559	.4399	9.844	.5137	10.070
.3818	9.541	.4014	9.979	.5068	9.590	.4404	9.813	.5142	10.073
.3823	9.566	.4023	9.958	.5088	9.592	.4429	9.694	.5161	10.067
.3843	9.582	.4038	9.930	.5103	9.632	.4448	9.620	.5171	10.052
.3848	9.600	.4048	9.898	.5122	9.647	.4453	9.600	.5190	10.040
.3867	9.628	.4067	9.840	.5142	9.695	.4473	9.571	.5200	10.046
.3887	9.626	.4072	9.799	.5166	9.718	.4482	9.554	.5220	10.006
.3911	9.664	.4077	9.790	.5186	9.741	.4497	9.565	.5234	9.969
.3921	9.671	.4097	9.710	.5210	9.776	.4507	9.576	.5249	9.935
.3940	9.709	.4111	9.645	.5220	9.797	.4526	9.588	.5259	9.918
.3955	9.721	.4131	9.562	.5249	9.817	.4541	9.606	.5278	9.874
.3979	9.742	.4136	9.561	.5269	9.827	.4565	9.621	.5283	9.847
.3999	9.771	.4146	9.549	.5308	9.852	.4570	9.637	.5293	9.816
.4097	9.859	.4165	9.544	.5337	9.885	.4595	9.662	.5313	9.726
.4116	9.905	.4180	9.572	42551.3779	9.814	.4600	9.672	.5317	9.692
.4136	9.910	.4199	9.613	.3818	9.833	.4619	9.707	.5327	9.657
.4155	9.950	.4219	9.616	.3833	9.844	.4634	9.731	.5342	9.604
.4004	9.782	.4233	9.628	.3862	9.869	.4653	9.754	.5352	9.581
.4033	9.832	.4253	9.670	.3877	9.878	.4663	9.767	.5366	9.573
.4082	9.847	.4263	9.692	.3896	9.912	.4683	9.806	.5376	9.567
.4126	9.907	.4282	9.705	.3906	9.918	.4707	9.835	.5381	9.571
.4165	9.955	.4287	9.713	.3931	9.928	.4731	9.857	.5405	9.579
.4199	9.985	.4316	9.743	.3950	9.943	.4751	9.878	.5410	9.586
.4229	9.997	.4331	9.765	.3975	9.980	.4771	9.909	.5439	9.627
.4263	10.020	.4355	9.788	.3984	9.975	.4775	9.901	.5449	9.647
.4307	10.034	.4375	9.832	.4004	9.977	.4795	9.928	.5469	9.654
.4351	10.065	.4399	9.847	.4019	9.997	.4810	9.945	.5474	9.573
.4390	10.072	.4443	9.875	.4038	10.016	.4839	9.956	.5493	9.703
.4434	10.075	.4482	9.936	.4048	10.018	.4863	9.980	.5498	9.708
.4478	10.072	.4521	9.955	.4077	10.034	.4868	9.989	.5518	9.735
.4507	10.072	.4570	9.972	.4097	10.049	.4888	9.994	.5557	9.779
.4536	10.038	.4619	10.021	.4131	10.063	.4902	9.997	.5610	9.851
.4551	9.992	.4658	10.051	.4136	10.066	.4922	10.008	.5630	9.870
.4561	9.987	.4707	10.066	.4160	10.062	.4932	10.011	.5649	9.875
.4575	9.952	.4756	10.095	.4175	10.077	.4951	10.026	.5669	9.917
.4585	9.945	.4810	10.083	.4199	10.079	.4961	10.035	.5708	9.942
.4600	9.877	.4849	10.055						

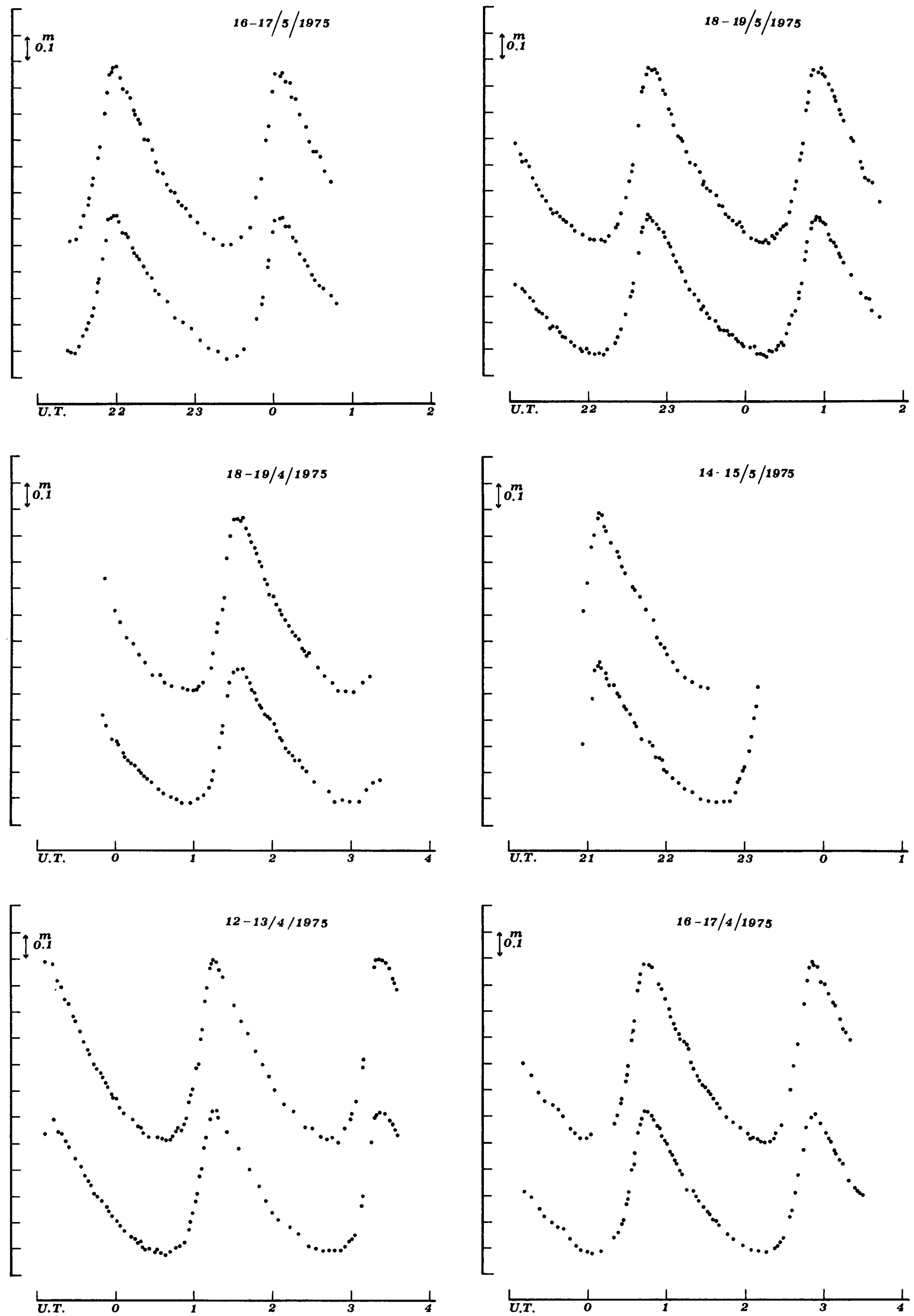

Figure 3 *B* (upper) and *V* light curves of EH Lib.