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PHOTOMETRIC OBSERVATIONS OF
 SUSPECTED SMALL-AMPLITUDE CEPHEIDS

In the course of a search for stable stars in the Cepheid instability strip, Fernie and Hube (1971) found several stars which were slightly variable in brightness. Since these stars lay in or near the instability strip, they were good candidates for small-amplitude Cepheid variables, but Fernie and Hube's observations were too scattered in time to confirm the nature of the variability.

This paper reports on photometric observations of these stars, obtained during a one-week run at Kitt Peak National Observatory. The five stars on the program are listed in Table I. The spectral types and magnitudes are taken either from Fernie and Hube (1971) or from the Catalog of Bright Stars.

Table I

Program and Comparison Stars

Program Star	Comparison Stars		Visual		
	Name (Sp.T., m_V or V)	Spectrum	Magnitude	Variability	
ϵ Leo	μ Leo (K2 III, 3.94)	G0 II	2.96	variable ?	
HD 191010	HD 190788 (K5, 8.26)	G3 Ib	8.6	constant ?	
HD 213482	HD 213419 (A0, 8.6)	F8 Ib	8.6	constant ?	
HD 239994	HD 214259 (A0, 8.6)	F8 Ib	9.0	Cepheid variable	
HD 214847	HD 215177 (A0, 8.7)	G0 Ib	8.1	constant	

Observations

Photometric observations were obtained with the 41 cm telescope number 3 at Kitt Peak National Observatory during December 9-16, 1973. The photometric system consisted of a refrigerated 1P21 photomultiplier tube, a charge-integrating amplifier, and a chart recorder. Measurements were made through KPNO standard UBV filter set number 2, relative to the comparison stars listed in Table I. These measurements were corrected for differential extinction and reduced to the sun, but were left on the instrumental magnitude system. The measurements of ϵ Leo are slightly less accurate than those of the other

stars, because the comparison star is not quite as suitable.

The observations are listed in Table II and are plotted in Figure 1.

Table II

Photometric Observations of Suspected Small-Amplitude Cepheid Variables

ϵ Leo - μ Leo			HD 191010 - HD 190788		
JD 2440000+	$\Delta m(V)$	$\Delta m(B)$	JD 2440000+	$\Delta m(V)$	$\Delta m(B)$
2026.862	-0.908	-1.307	2027.609	+0.270	+1.033
2027.038	-0.914	-1.313	2028.580	+0.25	+1.055
2027.991	-0.848	-1.276	2029.570	+0.255	+1.032
2029.949	-0.906	-1.31	2030.567	+0.237	+1.019
2030.922	-0.902	-1.317	2031.576	+0.249	+1.015
2031.900	-0.920	-1.329	2032.571	+0.26	+1.018
2032.903	-0.927	-1.331			
HD 213482 - HD 213419			HD 239994 - HD 214259		
JD 2440000+	$\Delta m(V)$	$\Delta m(B)$	JD 2440000+	$\Delta m(V)$	$\Delta m(B)$
2027.628	-0.684	+0.178	2027.664	+0.689	+1.412
2028.602	-0.686	+0.168	2028.611	+0.626	+1.375
2029.594	-0.692	+0.166	2029.602	+0.872	+1.709
2030.583	-0.700	+0.163	2030.590	+0.667	+1.394
2031.591	-0.697	+0.168	2031.598	+0.660	+1.410
2032.594	-0.688	+0.175	2032.600	+0.873	+1.739
HD 214847 - HD 215177					
JD 2440000+	$\Delta m(V)$	$\Delta m(B)$			
2028.591	-0.541	+0.485			
2029.586	-0.531	+0.482			
2030.578	-0.537	+0.485			
2031.586	-0.528	+0.495			
2032.587	-0.534	+0.488			

Discussion of Individual Stars

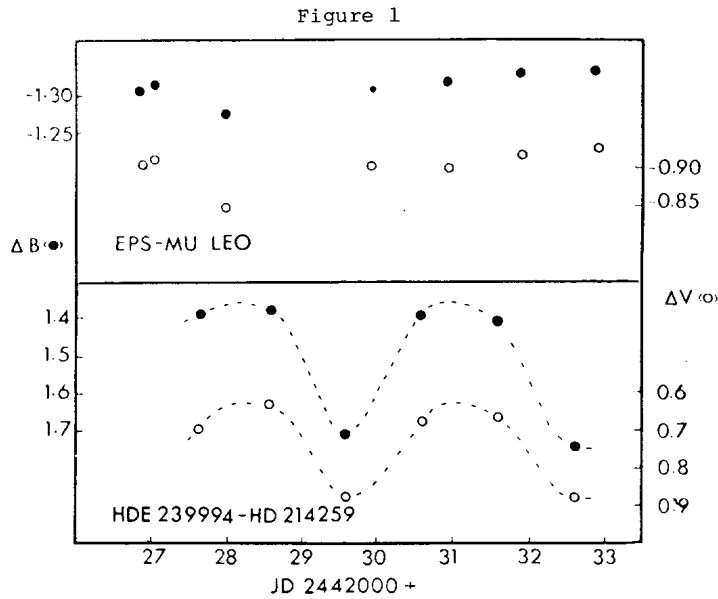
ϵ Leo: Fernie and Hube (1971) found that this star was variable with a range of $0^m.1$ or more. Significant variations occurred on a time scale of one day. The present observations give similar results, with a time scale of variation of a few days.

ϵ Leo does not lie in the instability strip if the luminosity class (II) is correct, but may do so if the luminosity class is actually (II-Ib). In this case a pulsation period of a few days would be reasonable. There is no evidence, amid the vast amount of radial velocity data for this star, that ϵ Leo varies in radial velocity by more than about $2 \text{ km}\cdot\text{s}^{-1}$. Furthermore, the rotation-

al period of a giant star would be much greater than a few days, so that it is unlikely that the variations are due to a rotational phenomenon. The variations may possibly be similar to the irregular variations which are frequently found in K and M giants.

HD 191010: There is no significant variation in brightness during the period of observation, though the scatter is rather larger than might be expected.

HD 213482: The variation in B and V during one week is only $0^m.015$, but may possibly be systematic. If the total range is as great as $0^m.06$, as found by Fernie and Hube (1971), then the "period" would be several weeks. The expected period of a Cepheid variable of spectral type F8Ib would be a week or less.



Photometric observations of ϵ Leo and HDE 239994. The comparison stars are indicated on the figure. The scale on the left applies to the blue magnitude differences (filled circles) and that on the right applies to the visual magnitude differences (open circles). The dashed lines represent the presumed trend of the observations.

HD 239994: This star is a Cepheid variable with a period of 3 days and ranges in B and V of $0^m.4$ and $0^m.3$, respectively. Fernie and Hube (1971) found a total range of $0^m.2$ in four observations.

HD 214847: The variation, on five consecutive nights, is no more than $0^m.01$ in B or V. Fernie and Hube (1971) found a total range of $0^m.05$ in four observations. The period of a Cepheid variable of spectral type GOIb would be about ten days; the present observations do not support the conclusion that this star is a Cepheid variable.

Acknowledgement

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Reference:

Fernie, J.D., and Hube, J.O. (1971), *Astrophys.J.* 168, 437