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NOTE ON LMC VARIABLE STARS

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Of the 53 LMC variables studied by us in Region 35 (Hodge and Wright 1969, Paper 1; Wright and Hodge 1971, Paper 2), 36 have also appeared in the massive study published by Payne-Gaposchkin (1971). It is unusual to have so many stars common to different studies in the Magellanic Clouds, and it is particularly important, therefore, that a comparison be made so that previous suspicions of systematic errors – those due, for example, to selection effects – be checked. This note compares results and draws what conclusions seem reasonable.

1. Cepheids

Periods. Table 1 compares data for the 24 Cepheids common to the two surveys and gives period differences, which are quite small except for 3 cases (Fig. 1). The differences are probably due primarily to the fact that our study includes additional, more recent series of plates, the 1958-59 AHD and the 1969 CTIO series. Furthermore, we had plates in two colors, which provided additional aid in the photometry. The differences (Fig. 1) have a mean of 0.043×10^{-3}; three-quarters of the cases are less than this mean value. Three others are less than twice this value, while three have a larger difference. In the case of HV 5684, Wright and Hodge (1971) could obtain a fit of all observations only with a changing period.

Amplitudes. The differences in amplitudes for the Cepheids are plotted in Fig. 2. There is a tendency for our data to show larger amplitudes than do the Payne-Gaposchkin data, by as much as 0.5 mag for a few cases. The reason apparently lies in the methods of measurement and reduction. An amplitude that is too small can result from a slightly incorrect period from less precise measurements or from an averaging interval that is too large; an amplitude that is too large can result from an averaging interval that is too small. Future photoelectric measures will surely demonstrate which of these factors is responsible for the differences. In the meantime, it is clear that amplitudes from either survey should be used with reservation.

Mean magnitudes. Fig. 3 shows the differences found in the mean B magnitudes for the Cepheids. To transfer our magnitudes to the Payne-Gaposchkin system, we have applied her absorption corrections before plotting our data in Fig. 3. The differences show no significant systematic trends and are not inconsistent with the quoted absolute photometric uncertainties of the two studies. There is some indication of her magnitudes being somewhat (~ 0.1 mag) fainter at the faint end (around 16.5) and brighter for the two brightest variables (around mag 13).

2. Other Variables

For four of the non-Cepheid variables, our conclusions were significantly different. We have assembled these in Table 2.

We reported HV 2379 as "semiregular," while Payne-Gaposchkin termed it a long-period variable of 355 days. We have reviewed our 524 measures of this variable and still classify it as semiregular. As we noticed previously, it does show cyclic variation over 200 or 300 days, with irregularity. Its $\langle B \rangle - \langle V \rangle$ of ~ 3.7 indicates an N variable typical of the semiregular type. It might even be classified as irregular. It is certain that 355 days does not fit all our observations reasonably.

No period was given by Payne-Gaposchkin for HV 5715. Our period of 421 days fits our observations well, although there is more scatter in magnitude than usual;

a slightly longer period, of 422.9 days, fits all the earlier observations more exactly. Hence, there seems to be some irregularity, either in period or in magnitude. The mean light curve is shown in Wright and Hodge (1971, Fig. 12).

Classified as red irregular by Payne-Gaposchkin, HV 5654 is, according to our analysis, a V Hydrae-type variable, with one period around 2400 days and another of about 400 to 600 days. Individual observations are shown in Fig. 13 of Wright and Hodge (1971).

For HV 2360, our observations and analysis show more irregularity than indicated by Payne-Gaposchkin in her classification "long period of 790 days." Except for one instance where the interval between successive maxima is 500 days (from JD 2423000 to 2433000), the period of HV 2360 varies between 600 and 900 days, with an accompanying variation in range, as shown in our individual observations (Wright and Hodge 1971, Fig. 14).

For the W Virginis variable HV 2351, we have a changing period (Hodge and Wright 1969), while Payne-Gaposchkin has a constant one.

For the R Coronae Borealis variable HV 5637, there is reasonable agreement in magnitude.

Finally, for the four eclipsing stars common to the two studies, the period differences (listed at the end of Table 1 and shown graphically in Fig. 1 by triangles) are extremely small.

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Payne-Gaposchkin, C. H. 1971, The variable stars of the Large Magellanic Clouds, Smithsonian Contr. Astrophys., No. 13, 41 pp.

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Table 1

Differences in period

HV no.	Period (to 3 decimal places) (days)	Differences (Hodge and Wright – Payne-Gaposchkin) ($\times 10^{-6}$)	Differences as % of period ($\times 10^{-3}$)
		24 Cepheids	
2315	2.413	+125	+0.052
2391	2.482	00	000
5684	2.788	~ +360	+0.129
5567	2.794	− 27	−0.010
W48	3.113	− 13	−0.004
12972	3.165	+ 02	+0.001
W47	3.193	+ 32	+0.010
2355	3.622	− 26	−0.007
2375	3.636	− 63	−0.017
11987	3.665	+ 51	+0.014
5656	3.727	00	000
2287	3.784	− 29	−0.008
5591	3.968	+ 55	+0.014
5643	4.112	− 01	−0.000
5586	4.317	+373	+0.086
5579	4.461	− 63	−0.014
12979	4.510	+ 21	+0.005
12974	4.654	− 83	−0.018
2420	9.035	+ 10	+0.001
5543	9.048	+ 50	+0.006
2299	12.063	− 60	−0.005
5594	17.202	−1180	−0.069
2294	36.536	+5000	+0.137
2369	48.287	+20020	+0.415
		4 Eclipsing Stars	
2374	28.494	0	000
2401	2.945	+ 4	+0.001
2403	1.312	+ 6	+0.012
5549	6.066	− 73	−0.012

Table 2

Four non-Cepheid variables

HV no.	Hodge and Wright period (days)	Payne-Gaposchkin period (days)	Hodge and Wright amplitude	Payne-Gaposchkin amplitude	Hodge and Wright average B mag.	Payne-Gaposchkin range in mag.
5715	~ 421	omitted	1.13		16.90	
2379	Semiregular with cyclic variation over 200-300 days, with irregularity	355 long period	~ 3+?	2.56	17.4? or fainter	15.89 -18.45
5654	V Hydrae type; ~2400 ~400-600	very red irregular	1.4	1.99	14.9 deepest min.	14.44 -16.43
2360	600-900	790 long period	2.88	3.26	~15.5	13.85 -17.11

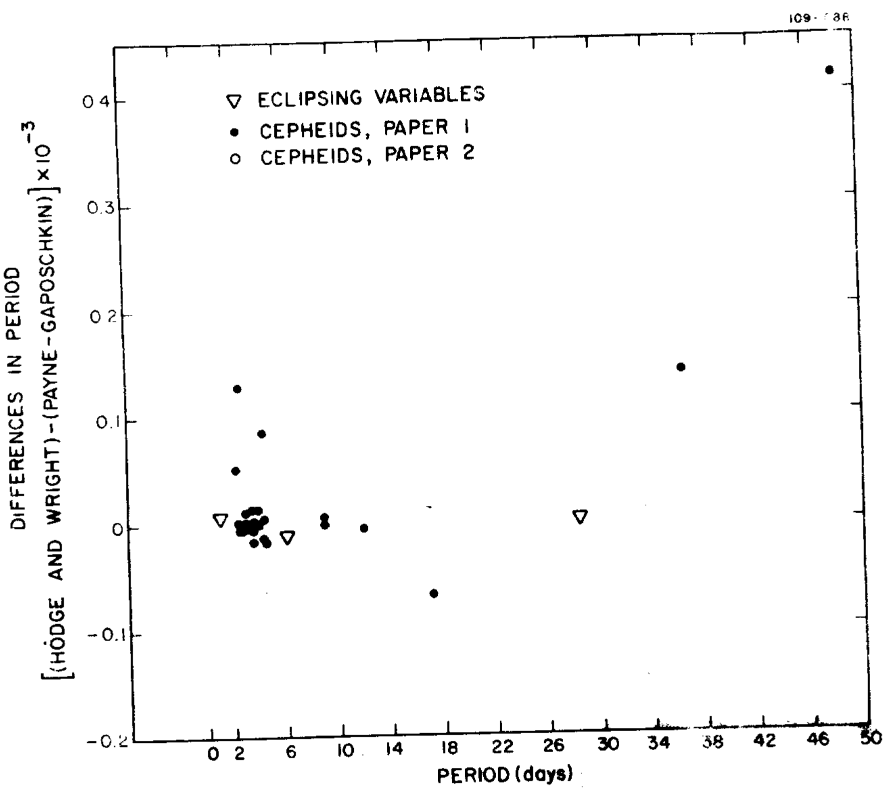

Fig. 1. Comparison of periods.

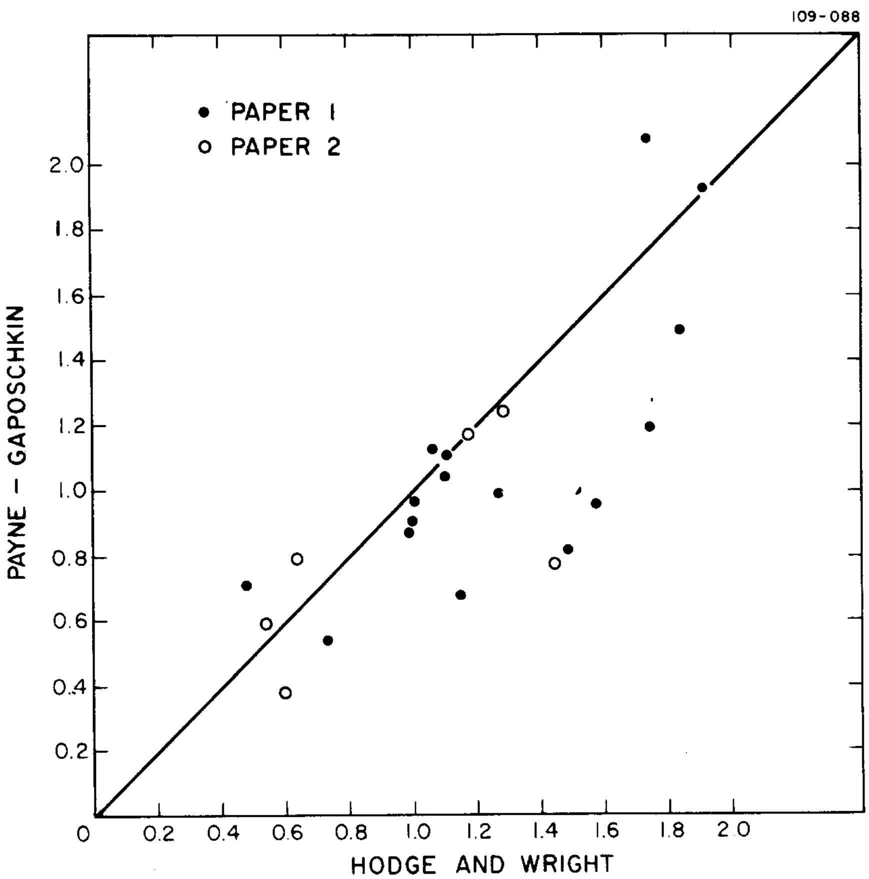

Fig. 2. Comparison of amplitudes for Cepheids.

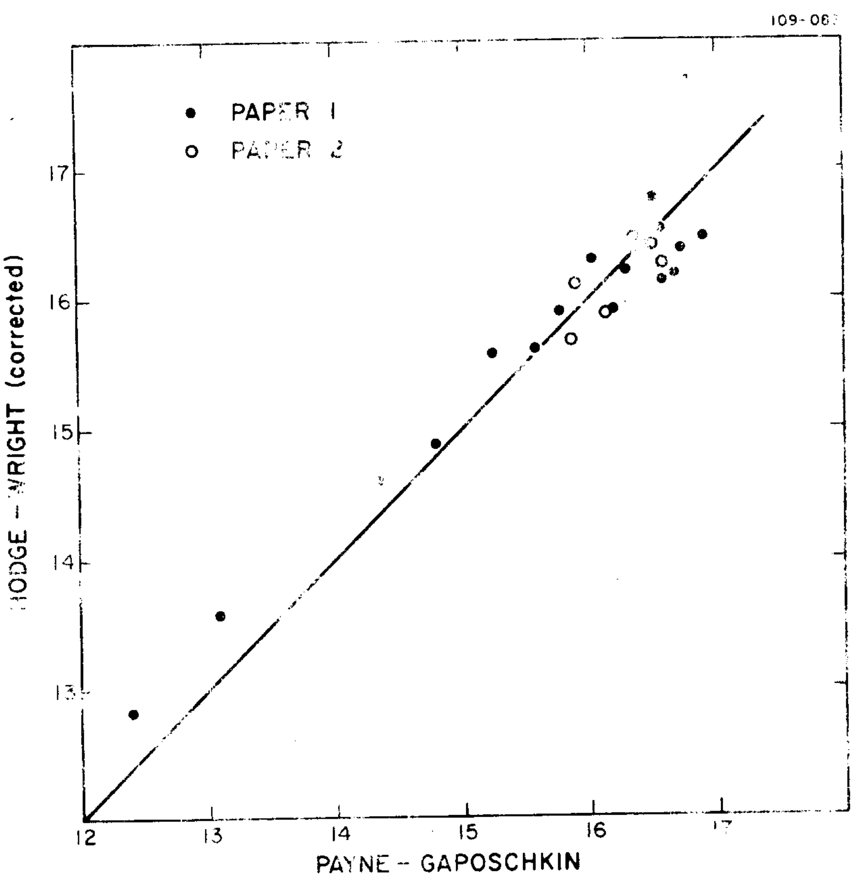

Fig. 3. Comparison of B magnitudes for the Cepheids.