A SEARCH FOR RED VARIABLE STARS IN THE LMC

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1. OBSERVATIONS AND REDUCTION

The observational material for this study consists of a series of 19 I plates (IVN+RG715) of the southern half of the LMC taken by the UK Schmidt Telescope over a six year period from 1977-1983. A small region of size 28'x56' centred on $\alpha(1950)$ = 5 28 50.7, $\delta(1950)$ = = -69 31 56 was scanned on all plates with a PDS microdensitometer and magnitudes were derived for typically 14000 stars per scan area. All magnitudes were converted to a common system by comparison of magnitudes to a standard plate; this comparison showed the individual rms measurement error to be 0.13 mag. No photoelectric standard sequence exists in the region studied but the instrumental magnitudes have been converted to preliminary I_K magnitudes by using the I_K magnitudes given by Blanco, McCarthy and Blanco (1980) for some of the red stars in the field.

Variables were defined initially as those stars whose standard deviation in magnitude about their mean I from all plates was > 0.14 mag. Light curves were then plotted for all (233) of these stars and 80 stars were selected with obvious amplitudes in I of > 0.5 mag. Periods were then searched for using the technique of Stellingwerf (1978). This search yielded 44 stars with a distinct period, 20 with $\Delta I > 1.0$ mag. and the remainder with $0.5 < \Delta I < 1.0$ mag.

In the field studied, Gaposhkin (1970) lists 46 Cepheids, 10 irregular variables, 7 red variables with periods, and 3 eclipsing variables. This survey found 6 of the Cepheids, 4 irregulars, and 5 of the red variables with periods (although only one, HV12048, was found by us to have a regular period). The present survey technique has therefore greatly increased the number of known red variables in the region studied. It is not, however, an efficient method for locating Cepheid variables.

2. DISCUSSION

The period distribution for the present sample of stars is shown in Figure 1 and compared with the period distribution for local Mira variables from Wood and Cahn (1977). The LMC red variables found in the

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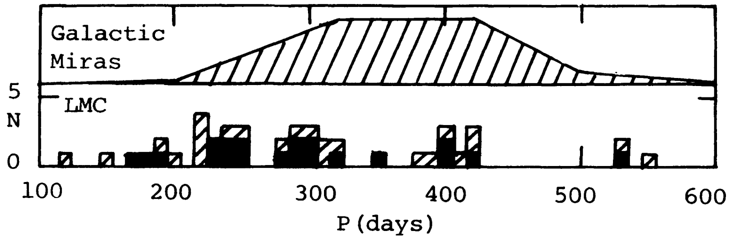

Fig. 1 Period distributions for LMC red variables with amplitude $\Delta I \gtrsim 1.0$ mag. (solid) and with $1.0 > \Delta I \gtrsim 0.5$ mag. (hatched). The period distribution of Galactic Miras is also shown.

present survey tend to be of shorter period than the local Mira variables (note that there will be a bias in our sample against periods of ~ 1 year). This result might be expected since the LMC is more metal poor than the Galaxy and Galactic Mira variables show a decrease in mean period with decrease in metal abundance. The 45% of our sample with I amplitudes > 1 mag. (similar to the amplitudes of ~1.5 mag. common in Galactic Mira variables - Eggen 1975) has a period distribution similar to that of the smaller amplitude variables (Fig. 1) so it is unlikely that the shorter period distribution the LMC objects can be accounted for by their being semi-regular variables rather than genuine Mira variables. Typical magnitudes at maximum are $I_{max} \sim 13.4$, with HV12048 (P=526d) being brightest at $I_{max} \approx 12.7$ mag. The magnitude $I \approx 13.4$ ($M_I \approx -5.3$) is in reasonable agreement with I_{max} for Galactic Miras ($M_I \approx -6.0$, Eggen 1975) and SMC red variables of Lloyd Evans (1978) ($M_I \approx -5.0$). The bolometric corrections for red variables given by Bessell and Wood (1983) indicate a mean bolometric magnitude for the bulk of the LMC variables in the present sample of ≈ -5 mag.

In summary, we have identified 80 red variables with amplitude $\Delta I > 0.5$ mag. in a 28'x56' region for the LMC and have obtained periods for 44 of these. We suggest that most of the stars are similar to the metal poor Mira variables in the Galaxy. The few longer period objects may be relatively massive AGB stars ($2 < M/M_\odot < 9$) (Wood, Bessell and Fox (1983).

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