# THE PERIOD-LUMINOSITY RELATION FOR RED VARIABLES IN GLOBULAR CLUSTERS

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**Abstract.** Recent data for red pulsating variables in globular clusters are discussed. There seems to exist a period-luminosity relation in the near-by infrared but not in the visual magnitude.

In the last years some more data on red pulsating variables in globular clusters became available, and, hence, a possibility to look for a period-luminosity relation. Moreover, a new homogeneous system of distance moduli and colour excesses was derived recently by Kukarkin and Russev (1972).

The *B*, *V* and *I* magnitudes and the periods for 27 red variables in 8 globular clusters are collected in Table I. In several cases the period had to be corrected, for instance, a period of 71.2 days was found instead of the earlier one of 174 days (Sandage *et al.*, 1966; Rosino, 1966). Data are mainly from the third catalogue of variables in globular

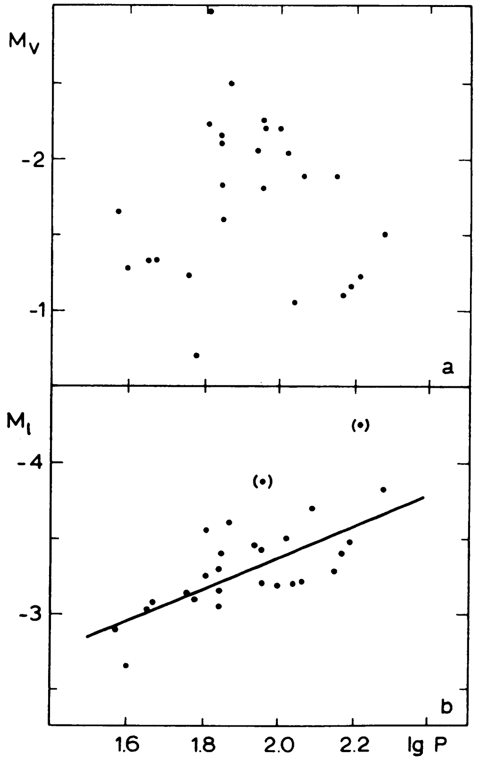


Fig. 1. The period-absolute magnitude diagram.

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TABLE I

Data for 27 red variables in 8 globular clusters

| NGC | Var. | Lg $P^d$ | $\langle I \rangle$ | $\langle B-I \rangle$ | $\langle V-I \rangle$ | $Mod_I$ | $E_{B-I}$ | $M_I$ | $M_V$ | $\langle B-I \rangle_0$ | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 104 | 3 | 2.283 | $9^m.05$ | $+3^m.91$ | $+2^m.46$ | $12^m.88$ | $0^m.22$ | $-3^m.83$ | $-1^m.50$ | $+3^m.69$ | 1, 3, 4 |
| | 4 | 2.217 | (8.63:) | 4.59 | 3.16 | | | 4.25 | 1.22 | 4.37 | |
| | 5 | 1.653 | 9.86 | 3.45 | 2.82 | | | 3.02 | 1.33 | 3.23 | |
| | 6 | 1.672 | (9.80:) | 3.48 | 1.87 | | | 3.08 | 1.34 | 3.26 | |
| | 7 | 1.763 | 9.75 | 3.69 | 2.03 | | | 3.13 | 1.23 | 3.47 | |
| | 8 | 2.190 | (9.40:) | 3.87 | 2.46 | | | 3.48 | 1.15 | 3.65 | |
| 362 | 2 | 1.954 | 11.23 | 3.22 | 1.52 | 14.42 | 0.22 | 3.19 | 1.80 | 3.00 | 3 |
| 5139 | 6 | 2.041: | (10.45) | 3.95 | 2.35 | 13.64 | 0.35 | 3.19 | 1.05 | 3.60 | 2, 3, 10 |
| | 17 | 1.778 | 10.52 | 4.33 | 2.63 | | | 3.12 | 0.70 | 3.98 | |
| | 42 | 2.174 | (10.25) | 4.10 | 2.50 | | | 3.39 | 1.10 | 3.75 | |
| | 53 | 1.845 | 10.6: | 3.17 | 1.42 | | | 3.04 | 1.83 | 2.82 | |
| | 138 | 1.873 | (10.03) | 2.93 | 1.32 | | | 3.61 | 2.50 | 2.58 | |
| | 148 | 1.954 | (10.22) | 3.10 | 1.38 | | | 3.42 | 2.25 | 2.75 | |
| | 152 | 2.093 | (9.95) | 3.15 | 1.35 | | | 3.69 | 2.55 | 2.80 | |
| | 161 | 2.000 | (10.46) | 3.01 | 1.21 | | | 3.18 | 2.18 | 2.66 | |
| | 162 | 1.845 | 10.49: | 2.85 | 1.26 | | | 3.15 | 2.10 | 2.50 | |
| | 164 | 1.570 | 10.75 | 3.16 | 1.45 | | | 2.89 | 1.65 | 2.81 | |
| 5897 | 5 | 1.845 | 12.02 | 2.91 | 1.38 | 15.32 | 0.38 | 3.30 | 2.15 | 2.53 | 3, 8 |
| 6121 | 4 | 1.813 | 8.45 | 3.10 | 1.55 | 11.70 | 0.88 | 3.25 | 2.23 | 2.22 | 3 |
| | 13 | 1.602 | 9.05 | 3.65 | 1.90 | | | 2.65 | 1.28 | 2.77 | |
| 6205 | 11 | 1.963 | 10.0: | 3.35 | 1.73 | 13.88 | 0.08 | 3.88 | 2.20 | 3.27 | 6, 7 |
| | 15 | 2.147 | 10.6: | 2.95 | 1.45 | | | 3.28 | 1.88 | 2.87 | |
| 6656 | 8 | 1.813: | 9.25 | 2.71 | 1.05 | 12.80 | 0.82 | 3.55 | 2.99 | 1.89 | 3 |
| | 9 | 1.943 | 9.35 | 3.84 | 1.90 | | | 3.45 | 2.04 | 2.96 | |
| 6712 | 2 | 2.020 | (11.0:) | 3.82 | 2.10 | 14.51 | 1.02 | 3.51 | 2.03 | 2.80 | 4. 5, 9 |
| | 8 | 2.066 | (11.3:) | 3.87 | 1.95 | | | 3.21 | 1.88 | 2.85 | |
| | 10 | 1.852 | (11.1:) | 4.60 | 2.42 | | | 3.41 | 1.61 | 3.58 | |

*References to Table I*


(1) Arp *et al.* (1963).
(2) Dickens *et al.* (1972).
(3) Eggen (1972)
(4) Lloyd Evans and Menzies (1972)
(5) Rosino (1966).
(6) Russev (1974[a]).
(7) Russev (1974[b]).
(8) Sandage and Katem (1968).
(9) Sandage *et al.* (1966).
(10) Woolley (1966).

clusters (Hogg, 1973). Infrared magnitudes are in Johnson's photometric system (1966) or, if in parentheses in Kron and Smith's system $I_k$ (1951).

If no infrared light curve is available a colour is added to the magnitude. The colour excesses $E(B-I)$ are derived from the relation $E(B-I)=2.5\,E(B-V)$ as found by Kukarkin and Russev (1972).

Figure 1a is a plot of $M_V$, Figure 1b of $M_I$ against the logarithm of the period. We assume that the systematic differences between Johnson's system of infrared magnitudes and the Kron-Smith system can be neglected in this case. No period-luminosity relation seems to exist in the case of the $M_V$'s. However, for the $M_I$'s a linear relation

$$M_I = -1.32 - 1.03 \log P$$
$$\pm 0.20 \pm 0.38$$

is derived by the least squares method. The two points in parentheses in Figure 1b were not included in the solution. They concern inaccurate data. Adopting according to Eggen (1971)

$$M_{\rm bol} = M_I + 1\overset{\rm m}{.}0,$$

we find

$$M_{\rm bol} = -0.32 - 1.03 \log P$$

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