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EVIDENCE FOR A BUMP IN THE LIGHT CURVE OF VARIABLE 1 OF M13

That there is a relationship between the pulsation period of population I cepheid variables and the occurence of a secondary bump in the light curve has long been known (Hertzsprung 1926, B.A.N. 3, 115). Recent theoretical calculations predict that a similar relationship should exist for the population II cepheids with periods in the range 1-3 days and Stobie (1973, Observatory 93, 111) showed that bumps do occur in the light curves of seven halo and old disk cepheids with periods in this range, including two globular clusters members.

The importance of the detection and observation of the bumps is that a determination of the phase at which the bump occurs permits the mass and radius of the star to be calculated. Cepheids with bumps in globular clusters are particularly important since the derived masses and radii can be compared with similar values for cepheids or horizontal branch stars determined by independient methods.

Variable 1 of the globular cluster M13 has a period in the range where a bump is predicted and indeed there is some evidence for a bump in the m_{pv} light curve of this star published by Arp (1955, A.J. 60, 1). In an attempt to confirm if the suspected bump really does exist we have collected together all the published photometric observations of M13-Var.1 and plotted the light curves of the various authors using the same period. The data are not very satisfactory, most being eye estimates of the photographic magnitudes. Nevertheless, the observations of Sawyer (1942, Publ. David Dunlap Obs. 1, 231), Kollnig-Schattschneider (1942, A.N. 273, 145) and Osborn (1969, A.J. 74, 108) show evidence for a bump in the light curve near phase 0.8. The observations of Shapley (1915, Mt. Wilson Contrib. 6, 301), Demers (1971, A.J. 76, 445) and Russev (1973, Variable Stars 19, 181) either have too few observations or do not cover the appropiate part of the light curve and give no evidence one way or the other. However, the fact that all the apparent bumps occur at aproximately the same phase as the bump seen in Arp's more accurate light curve from iris photometry indicates that the feature is probably real.

Assuming that there is a bump in the light curve of M13-Var.1 at phase 0.8 we can use the equations given by Stobie to calculate the stellar radius and mass. The results are R= 5.8 $R_\odot$ and M= 0.2 $M_\odot$. The values are somewhat smaller that those found for the other population II cepheids studied by Stobie but they agree with the mass and radius of this star calculated by Böhm-Vitense et al (1974, Ap. J. 194, 125), who also commented on the apparently anomalously low values. It is interesting that Osborn's masses for two asymptotic branch stars in M13 were also very small. It is obvious that the determination of a good photoelectric light curve for this star would be worthwhile.

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