PERIOD CHANGES OF RR LYRAE STARS IN THE LMC GLOBULAR CLUSTER NGC 2257

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The period changes of RR Lyrae stars can be compared with models of horizontal branch stars as a means of investigating the physical properties of the stars themselves, and of the stellar systems in which they are found (Smith and Sandage 1981). The present study is the first in which period change rates of extragalactic RR Lyraes have been estimated.

The RR Lyraes in NGC2257 were first investigated by Alexander (1960). Since 1971, over 100 plates have been taken of NGC2257 at CTIO to study the cluster and field RR Lyraes (see Hesser, Nemec and Ugarte 1980). Their properties include (Nemec, Hesser and Ugarte 1983, in preparation):

	$\langle P_{ab} \rangle$	s.e.	N	$\langle P_c \rangle$	s.e.	N	P_{trans}	$P_{ab,max}$	$\langle B \rangle$	
Cluster	0.589	0.08	14	0.351	0.03	21	0.493	0.686	19.40	0.10
Field	0.563	0.08	12	0.362	0.04	9	0.423	0.728	19.60	0.15

Note that NGC2257 now appears to lie ~4-5 kpc in front of the LMC, rather than ~9 kpc as we reported earlier. The revision is due to an improved radial background light correction.

By combining new PDS photometry of 45 of the Radcliffe plates, taken from 1953-1961, with the photometry of the CTIO plates, period change rates have been estimated for 19 of the 41 RR Lyraes in NGC2257. Eight plate groups were formed, light curves were plotted with JD2440000.0 as zero phase, and phases at maximum light were measured from the light curves. Linear and parabolic regressions were fit to the data, plotted as a function of time (Fig.1). Upward curves correspond to increasing periods (2 stars), downward curves to decreasing periods (10 stars), and straight lines to constant periods (7 stars), with period change rates ranging from -1.85 to +0.98 d/Myr. Thus for these extragalactic RR Lyraes decreasing periods appear to be more frequent than increasing periods, and the rates of change are similar to those of most Galactic RR Lyrae stars. Only with continued observations will it be possible to distinguish between abrupt vs. continuous period changes.

S. van den Bergh and K. S. de Boer (eds.), Structure and Evolution of the Magellanic Clouds, 39–40.

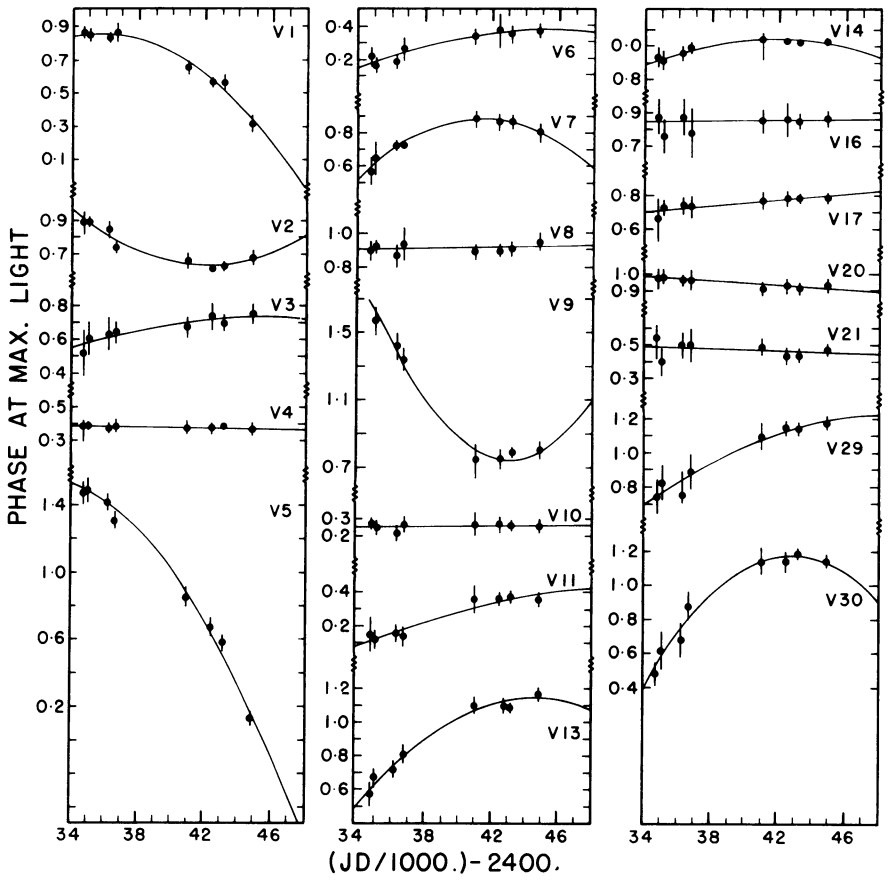

Figure 1: The phase-shift diagrams for 19 RR Lyrae stars in NGC 2257

A few Blazhko effect stars, and several possible double-mode RR Lyrae stars also were found. One such star, with P_1=0.4065 and P_1/P_0= 0.7463 implying M/M_o=0.65, is similar to the double-mode RR Lyrae stars in M15 (Cox, Hodson and Clancy 1983) and the Draco dwarf galaxy (Nemec 1983,1984). Metal abundances and radial velocities for the NGC2257 cluster and field RR Lyrae stars will be useful for evaluating Freeman, Illingworth and Oemler's (1983) claim that the LMC does not possess a halo population.

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https://doi.org/10.1017/S007418090003984X Published online by Cambridge University Press