VARIABILITY OF ω CENTAURI BLUE STRAGGLERS: CLUES TO THEIR ORIGIN

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The four possible origins usually discussed for blue stragglers in stellar systems are (a) mass transfer in, or coalescence of, close binaries; (b) main sequence lifetime extension either through internal mixing or high non-thermal pressures; (c) complete mixing events in evolved stars at the core helium flash; and (d) ongoing star formation over long intervals. However, alternative (d) can be ruled out for the case of globular clusters because any residual gas in the cluster is very efficiently swept out as the cluster passes through the galactic disk, an event that occurs approximately every hundred million years. Hypotheses (a) and (b) both predict masses for the blue stragglers that exceed the turnoff mass but if alternative (c) is correct, then the blue stragglers should have masses less than or equal to the turnoff mass.

Can we determine the mass of a blue straggler? In general the answer is no, but the discovery of at least 3 dwarf cepheid variables in the ω Cen blue straggler sequence (see Jorgensen and Hansen 1984; Da Costa, Norris and Villumsen 1986) enables an estimate of the mass of these stars, relative to that of the RR Lyraes, to be made via the equation:

$$\log M(BS)/M(RR) = 2\ \Delta\log Q - 2\ \Delta\log P - 0.6\ \Delta m(bol) - 6\ \Delta\log T_{eff}$$

This calculation was first performed by Jorgensen and Hansen (1984) who derived a mean blue straggler mass of $1.2 \pm 0.2\ M_{\odot}$ on assuming a mass of $0.6\ M_{\odot}$ for the RR Lyraes. In making this calculation, they assumed on the basis of light curves derived from a small number of observations, that the dwarf cepheids were fundamental oscillators. The alternative assumption of first overtone pulsation however, yields a very different mass: $0.5 \pm 0.1\ M_{\odot}$ (Da Costa, Norris and Villumsen 1986). Thus it is of some importance to improve the determinations of the light curves of these variables.

Figure 1 shows new light curves for the dwarf cepheid variables E39 which is a confirmed radial velocity member (Da Costa, Norris and Villumsen 1986), and NJL220 which has similar color and magnitude to E39. Based on the asymmetry of these light curves, we conclude that both are indeed fundamental oscillators. Consequently, they have masses exceeding the turnoff mass and their origin lies either with

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mass transfer in binaries or with main sequence lifetime extension in single stars. A search for radial velocity variations in the photometrically non-variable blue stragglers is required to distinguish between these ideas.

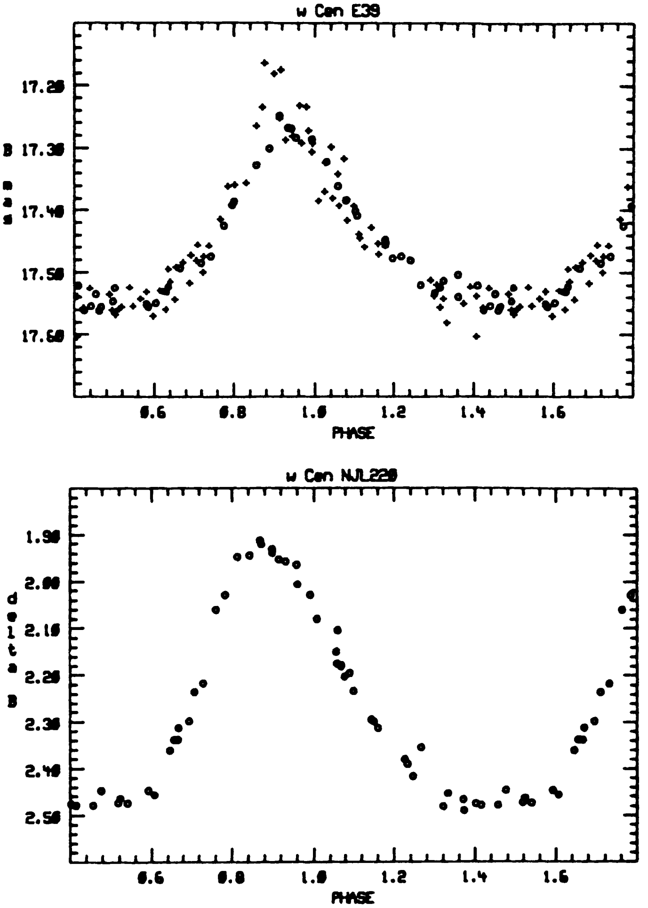

Fig. 1. The upper panel shows the light curve for the dwarf cepheid E39. The period is 82.70 minutes; open circles are CCD observations made over a 4 night interval, plus signs are photoelectric observations from the night following the CCD observations. The lower panel shows similar data for the star NJL220. The period is 67.95 minutes.

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