ORIGIN AND RADIAL DISTRIBUTION OF FAINT BLUE HORIZONTAL-BRANCH STARS

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ABSTRACT: We report the identification of 23 faint blue horizontal branch stars in Omega Centauri similar to those discussed by Buonanno et al. (1985) in M15. We find that these stars are significantly concentrated towards the center of the cluster with respect to other giants. We suggest that they may have formed from the collision of a main sequence star and a white dwarf.

1) THE DATA

Faint blue horizontal branch stars (FBHBs) form a distinct sequence in several globular clusters. These stars have unreddened $B-V \leq 0.0$ and extend down to 2.5 magnitudes in V below the horizontal branch (HB). It is not clear whether these stars are true HB stars which for some reason have smaller envelopes than other HB stars (Demarque and Eder 1985, Buonnano et al. 1985 hereafter BB, and references therein) or are produced by some other mechanism (Wesemael et al. 1982) in which case their position in the HR diagram as an apparent extension of the HB is fortuitous.

The large core radius of ωCen permits complete photometry of the HB much closer to the center of the cluster (in terms of r_c) than in BBs study of M15. Here we make use of our CCD photometry (UBV) of ωCen obtained at CTIO in May 1985. Analysis of three CCD frames centered at 2 and 5 r_c indicates that the ratio of FBHBs/BHBs increases sharply towards the center of the cluster. Specifically, we find 23 FBHBs and 92 BHBs in the B frame (centered at $\approx 2r_c$), while there are 28 BHBs and *no* FBHBs in the two frames centered further out (see Figure 1). A Monte Carlo simulation showed only 3 such configurations in 1000 trials.

2) FORMATION SCENARIO

We suggest that FBHBs might be formed by a collision between a white dwarf and a main-sequence star, an event which may result in an essentially unchanged white dwarf surrounded by an extended atmosphere of a few percent

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of the original mass of the main-sequence star (Shara and Regev 1986). Such an object would have a core of similar mass to other horizontal branch stars, but a much smaller envelope. Also, such objects would be formed preferentially in the dense cores of globular clusters where collisions would occur most frequently.

It has been suggested (e.g. Hills and Day 1976) that blue stragglers could form from similar collisions between two main sequence stars. The number of collisions that have occurred between stars in a globular cluster strongly depends on its past dynamical evolution since this determines the history of the core density of the cluster. Thus the presence of blue objects in the color-magnitude diagram of a cluster may contain information about its dynamical history.

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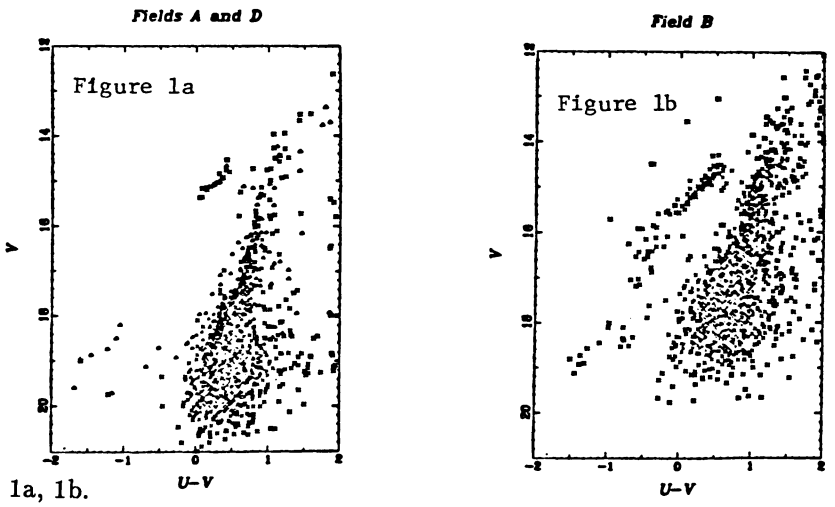

Fig 1a, 1b. Color magnitude diagrams of ωCen. The B field is centered at $r = 2r_c$ while the A and D frames are centered near $r = 5r_c$. The absence of FBHBs in the outer fields can be clearly seen. The data are *not* photometric.