EVIDENCE FOR MASS SEGREGATION IN NGC 5466

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ABSTRACT: Forty-eight blue straggler stars have been discovered in NGC 5466, the only Galactic globular cluster known to contain an anomalous Cepheid of the sort found in dwarf galaxies. The stars were identified in color-magnitude diagrams constructed from photometry of deep photographic plates taken with the Canada-France-Hawaii 3.6 m telescope (calibrated with new UBV photoelectric photometry), and from point spread function photometry of CCD frames taken with the Palomar 5 m telescope. The stars typically have magnitudes $\langle V \rangle \sim 19\overset{m}{.}1$ and colors $\langle B\text{-}V \rangle \sim 0\overset{m}{.}2$. Forty-two of the 48 stars are situated inside of R=2.5 arcmin (see Fig.1), the projected radius containing half the cluster luminosity, and only six stars are found between 2.5 and 9 arcmin. A one-sided, two-sample Kolmogorov-Smirnov test (using the CCD data) establishes at the 98% significance level that the blue stragglers are more centrally concentrated than the subgiant stars of the same magnitude. By fitting multi-component King models to the projected radial distributions (Fig.2), the mean mass of the blue stragglers is shown to be ~1.5 to two times larger than the masses of the stars that contributed the light from which the core and tidal radii were derived (i.e. M(Blue Str.)=1.3±0.3 $M_{\odot}$). Because the central relaxation time for NGC 5466 is much less than the cluster age, the different radial distributions are attributed to mass segregation. A similar mass segregation is also observed in the globular cluster NGC 5053, where Nemec and Cohen (1986, in preparation) have recently identified ~30 blue stragglers. The low stellar density and small escape velocity of NGC 5466 make a recent epoch of star formation (during which the blue stragglers might have formed as massive single stars) seem unlikely. Instead, the blue stragglers probably are either close binary systems that have transferred mass, or are coalesced stars. The very low frequency of stellar collisions expected in the center of NGC 5466 suggests that the blue stragglers are primordial binary systems. The simultaneous presence in NGC 5466 of the blue stragglers and the anomalous Cepheid V19, and their relative numbers, supports the hypothesis that there is an evolutionary connection between the two types of stars. By fitting theoretical isochrones to the photographic c-m diagram, NGC 5466 is estimated to have an age of 18±3 Gyr.

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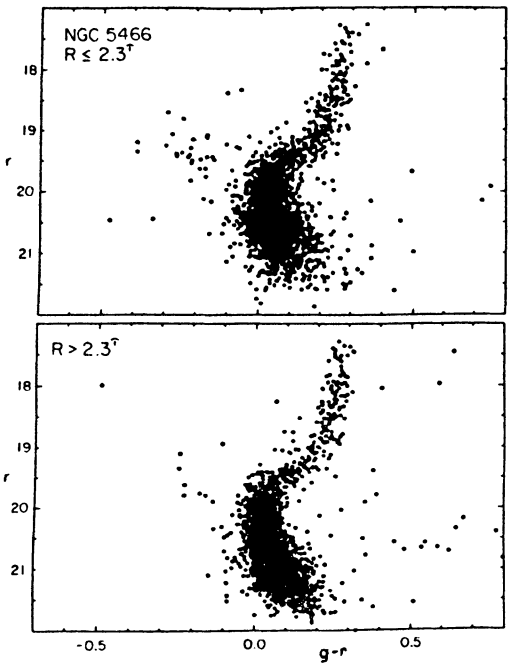

Fig.1 - C-M diagrams derived from photometry of the CCD frames taken with the 4-Shooter camera on the Palomar 5 m telescope. **Top panel**: 1963 stars interior to R=2.3 arcmin; **Bottom panel**: 1939 outer region stars. Note the pronounced central concentration of the blue stragglers.

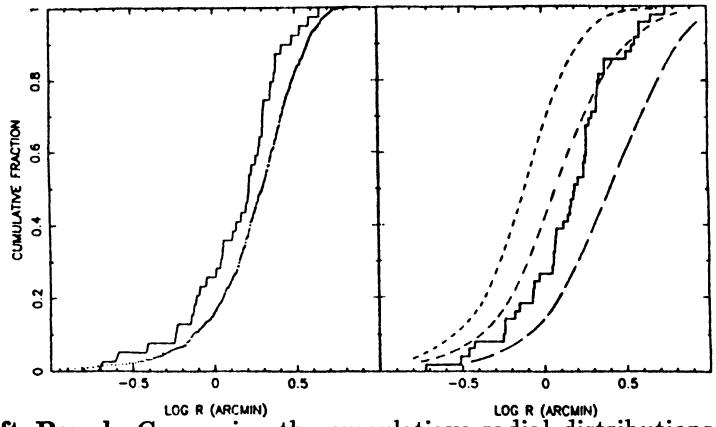

Fig.2 - Left Panel: Comparing the cumulatiave radial distributions of 38 blue stragglers (left) and 905 subgiants (right) in the same magnitude interval, measured on the CCD frames. The blue stragglers are significantly more centrally concentrated than are the subgiants. **Right Panel**: Comparing the radial distribution of all 49 blue stragglers with the distributions expected according to multi-component King models for stars of mass 0.8, 1.6 and 2.4 $M_{\odot}$. Interpolation shows that the dynamically derived mass of the blue stragglers is $\sim 1.3 \pm 0.3\ M_{\odot}$.

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