

EVIDENCE FOR SPECTRAL DIFFERENCES AMONG 47 TUCANAE
TURN-OFF-REGION STARS

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Evidence that spectral differences observed among globular cluster giant stars with similar V and $B-V$ values persist to fainter absolute magnitudes has been slowly accumulating in the past few years. In the case of 47 Tucanae, photometric evidence for CN strength variations extending to $M_V=1.5$ mag was found from DDO photometry (Hesser, Hartwick and McClure 1976, 1977). Subsequently, CN strength variations at $M_V=+3.5$, i.e., stars at the base of the vertical rise on the subgiant branch, were found by low dispersion spectroscopy (Hesser 1978). Kraft (1979) and collaborators have found evidence for star-to-star variations in NH and CH strengths among subgiant stars below the horizontal-branch level in the metal-poor cluster, M92; and Hesser and Harris (1979) have found CN and CH features to exhibit wide ranges among similar stars in M22, a metal-poor cluster with some apparent similarities to the otherwise uniquely anomalous cluster, Omega Centauri.

Spectra of four turn-off region stars with $\langle V \rangle = 17.51 \pm 0.03$, $\langle B-V \rangle = 0.59 \pm 0.03$ mag, seemed to suggest that spectral differences might also be present among upper main-sequence stars in 47 Tuc, although availability of data from only one night precluded reaching a firm conclusion (Hesser 1978). On 2-4 Aug 1979 the CTIO 4-m telescope and the same equipment used for the 1977 observations were used to obtain new spectra of the two stars (1-9004, 3-2153) whose 1977 spectra suggested that spectral differences had been detected. Data were also obtained for three additional stars with similar magnitudes and colors, and one star a magnitude fainter. For the repeated stars the 1979 spectra showed, within the limits of the (noisy) data, the same gross characteristics as the earlier spectra. Addition of the 1977 and 1979 spectra for each star yields improved signal-to-noise ratios and strikingly demonstrates the existence of spectral differences in the region of the CN 3883A, 0,0 band-head. The spectrum of 3-2274 ($B=19.2$), which had to be extracted

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from near the edge of the vidicon frame where the calibrations and standard algorithms used are not entirely satisfactory, is also highly suggestive of moderately strong ultraviolet CN.

While proof of membership of any of these stars in 47 Tuc must await a proper-motion study, and while the data for these faint stars could be greatly improved, there is little doubt that spectral differences are occurring among 47 Tuc stars on the upper main sequence or at the turnoff. Invocation of primordial abundance differences to explain the 47 Tuc observations would appear to be avoidable only through identification of CNO mixing mechanisms effective during the main-sequence lifetime of a globular cluster star.

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