FUSE Observations of the UV-Bright Star vZ 1128 in the Globular Cluster M3

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1. Astrophysical Background

- vZ 1128 is a member of the globular cluster M3 (see Figure 1).
- vZ 1128 is the brightest star in M3 at ultraviolet wavelengths (see Figure 2).
- vZ 1128 is classified as a UV-bright star (Zin et al. 1972, A&A, 18, 390).
- UV-bright stars in globular clusters lie above the horizontal branch (HB) (Zin et al.) (see Figure 3) .
- vZ 1128 is a post-asymptotic giant branch (PAGB) star (Dixon et al. 1994, AJ, 107, 1388).
- The atmospheric parameters of vZ 1128 are T_{eff} = 35,000 K and log g = 4.0 (Dixon et al.).
- Abundance determinations of PAGB stars can provide insights into stellar nucleosynthesis on the AGB.

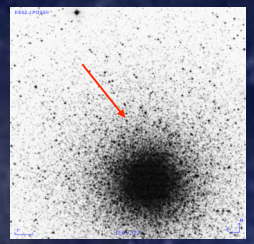

Figure 1 - Digitized image from the second Palomar Sky Survey showing the globular cluster M3 in the blue passband. The arrow indicates the position of vZ 1128.

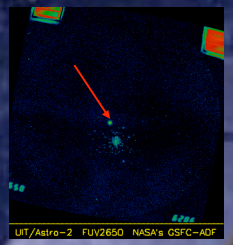

Figure 2 - Ultraviolet Imaging Telescope (UIT) image of M3 (FUV2650). The image was obtained with the far-UV B1 filter, which has an effective wavelength of 1521 Å with a FWHM of 354 Å. The star vZ1128 is the brightest object observed in this passband.

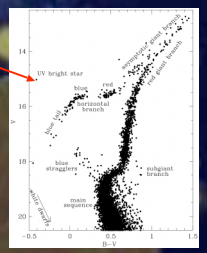

Figure 3 - Color-magnitude diagram for M3. The position of vZ 1128 is indicated by an arrow. [From Moehler (2001, PASP, 113, 1162) who used data published in Buonanno et al. (1994, A&A, 290, 69)]

2. FUSE Observations of vZ 1128.

- vZ 1128 was observed through the program P101 aimed at understanding the OVI absorption in the Galactic halo. Howk, Sembach, & Savage (2003, ApJ, 586, 249) have analyzed the line of sight in the direction of vZ1128 using the FUSE observations.
- The FUSE observations were obtained using the large slit (LWRS). The total exposure time is 33 ksec.
- Figure 4 shows the FUSE spectrum of vZ 1128. The photospheric lines detected in the atmosphere of vZ 1128 are identified above the spectrum.
- Table 1 gives the atomic parameters of the photospheric lines detected in vZ 1128. The observed equivalent width for each line is given in the last column of Table 1.

3. Results.

- We carried out an abundance analysis using NLTE models (TLUSTY; I. Hubeny & T. Lanz).
- Figure 5 illustrates a few examples of our best fits.
- Figure 6 summarizes the results of our abundance analysis: a) the abundance of C, N, O, Si, P, and S is a factor 3 to 100 lower than the solar abundance; b) no iron peak elements are detected; c) adopting the cluster iron abundance [Fe/H] = −1.4 from Cohen & Meléndez (2005, AJ, 129, 303), we derive C, N, O, Si, P, and S abundances of [X/Fe] = −0.6, 0.9, 0.2, −0.3, and 0.2, respectively. These values are consistent with those measured for red giants in M3, except for [Si/Fe], which is low by roughly 0.7 dex.

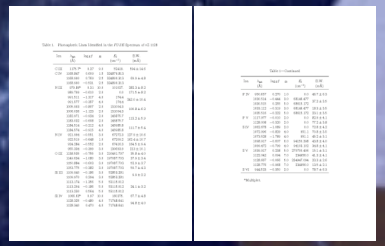

Table 1

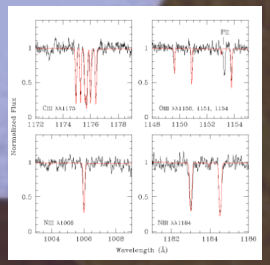

Figure 5 - Examples of photospheric lines observed in the FUSE spectrum of vZ 1128 (black lines), and best NLTE models (red lines) matching these absorption features.

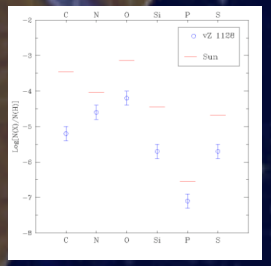

Figure 6 - Abundance relative to hydrogen by number observed in the atmosphere of vZ 1128 (blue open circles) compared to abundance observed in the atmosphere of the Sun (red small dashes).

Acknowledgement: P.C. is supported by CSA under a PWGSC contract. Financial support to W.V.D. has been provided by NASA contract NAS5-32985. L.T. and J.M.R. are supported by NASA contract NNG04D58G.

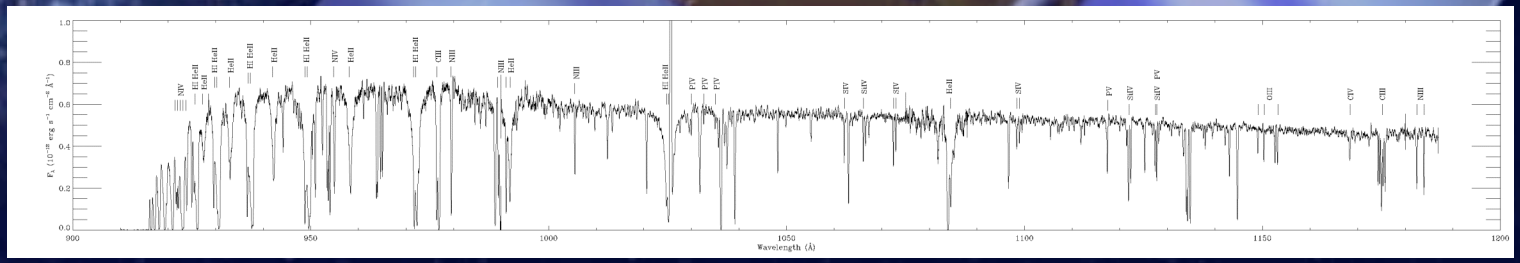

Figure 4 - FUSE spectrum of vZ 1128. This spectrum was obtained by merging the segments SiC1B, LiF1A, SiC2B, LiF2A, and LiF1B. Photospheric lines are identified above the spectrum. Interstellar lines (not identified here) were analyzed by Howk, Semback, & Savage (2003, ApJ, 586, 249).