SPECTRUM ANALYSIS OF THE COOL
WHITE DWARFS G 128-7 AND G 165-7

R. Wehrse

Institut f. Theoret. Astrophysik
Universität Heidelberg

and

J. Liebert

Steward Observatory
University of Arizona

The cool white dwarf stars G 128-7 and G 165-7 have a quite different character: While the line spectrum of G 165-7 is the richest of all white dwarfs known, G 128-7 shows only a strong Hα line ($W_\lambda \sim 5.5$ Å) and a much weaker Hβ line ($W_\lambda \approx 1$ Å).

Analysis of G 128-7

Comparison of the spectrum of this star with synthetic spectra (Wehrse, 1977) shows immediately that the effective temperature is $T_{eff} \leqq 6000$ K. The absence of metal lines indicates a metal deficiency of a factor of 10^4 compared to the sun. For subsequent fine analysis we mainly used Greenstein's multichannel observations (1976a), Lick IDS scans (Liebert, Angel, Landstreet, 1975) and a Steward intensified Reticon scan. The last two sets of data were mainly used to fit the Hα profile. Using a slightly modified version of the model program described earlier (Wehrse, 1975), we obtained a best fit for the following parameters:

$$T_{eff} = 5800 \text{ K}$$
$$\log g = 8.5$$
$$\epsilon_{He}/\epsilon_{tot} \leqq 0.2$$
$$[M/H] \leqq -4$$

The determinations of the helium abundance and the gravity are interdependent: The Hα profile could be fitted as well by $\epsilon_{He}/\epsilon_{tot} = 0.8$ and log g = 8. But in this case we get differences in the colors up to

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0.1 mag, mainly as a consequence of changes in the adiabatic gradient, when molecular hydrogen is replaced by atomic helium.

These results indicate that for cool hydrogen-rich white dwarfs of relatively high mass convectional mixing is not effective.

Analysis of G 165-7

For the analysis we used Greenstein's multichannel colors (1976b), Steward Digicon, and Lick IDS spectrophotometric data. In the wavelength range 3600 - 5800 Å we identified more than 100 metal lines, however no hydrogen lines were found. The model calculations were performed with the same model program as above, but now about 2000 spectral lines were included in order to take the metal line blanketing into account. We obtained as best parameters:

$$T_{eff} = 7500\ K$$
$$\log g = 8$$
$$\epsilon_H/\epsilon_{tot} \leq 10^{-4}$$
$$\epsilon_M/\epsilon_{tot} \approx 4 \cdot 10^{-5}$$ (i.e. about 1/30 of the solar value)

The hydrogen abundance is deduced from the non-visibility of Hα, whereas the metal content is found from the colors (mainly blue colors, since there the blocking is strongest) and from detailed fits of the profiles of the Ca I 4226, Na I D and Mg I b lines. In general the abundances of the metals relative to each other seem to be solar with the exception of Ca, which is approximately a factor of 3 more deficient than the average.

Of special interest is the Mg I b band, since it is highly asymmetric with a strong extended blue wing. This profile is interpreted as being mainly due to static v. d. Waals interaction, which is dominant over impact broadening for the high densities of this model and the relatively high C_6 constant.

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