THE MAIN SEQUENCE AT G2 V

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1. ABSTRACT

About 3/4 of the sky were searched spectroscopically for stars whose ultraviolet spectra (3640 - 4100 Å) match that of the Sun, at 20 Å resolution. Down to the limit of the BSC, only two were found: HR 7504 and HR 2290. No G2 V star matches the Sun. Stars that do match have $(B-V) = 0^m.66$. The search has a bearing on effective temperatures of G dwarfs and on metal-abundances relative to the Sun.

2. INTRODUCTION

When searching for a solar spectral twin to derive planetary albedos in 1974/75, I was surprised to find a G5 V MK standard (16 Cyg B = HR 7504 = HD 186427) match the solar energy distribution better than G2 V stars (Hardorp 1976). At the same time I discovered that a broad absorption feature near 3850 Å varied much more from star to star than did the energy distribution. This CN-band was subsequently used as the main criterion in a spectroscopic search for solar spectral twins in both hemispheres (Hardorp 1978).

3. OBSERVATIONS OF SOLAR SPECTRAL ANALOGS

77 G dwarfs were photoelectrically scanned with 20 Å resolution, using mainly 60 cm telescopes at ESO, Chile, and Mt. Hopkins, Arizona. Scans of the satellite Jupiter III and of the daylight sky represented the solar spectrum. The ratio spectra Sun/star of 9 of the 13 stars found most similar to the Sun are plotted in Fig. 1. HD 44594 = HR 2290 was subsequently calibrated from 3300 - 8500 Å by direct comparison with a black body (Hardorp and Tüg 1978), while HD 186427 will be compared to primary standards.

A. G. Davis Philip and D. S. Hayes (eds.), The HR Diagram, 423–426.

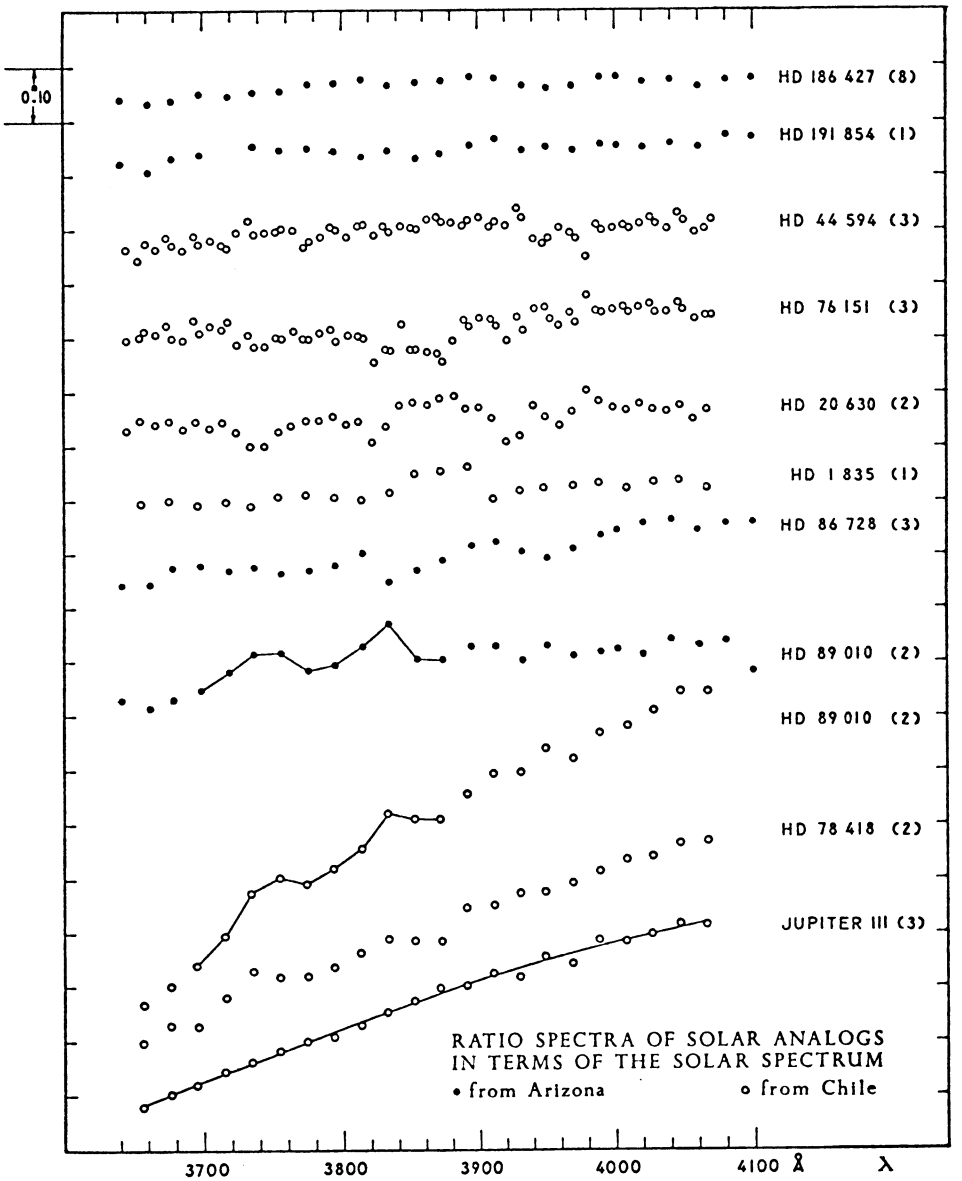

Figure 1. Ultraviolet spectra of stars found to be most similar to the Sun, in terms of the (tilted) spectrum of the daylight sky. Not corrected for extinction. The accuracy can be judged from the ratio Jupiter III/sky, which should be smooth in reality (in brackets, number of scans). HD 144585, 159222, 181655 were omitted from this graph for want of space. The three topmost stars-all of which have $(B-V) = 0^{m}.66$ - cannot be distinguished from the Sun with the accuracy achieved here.

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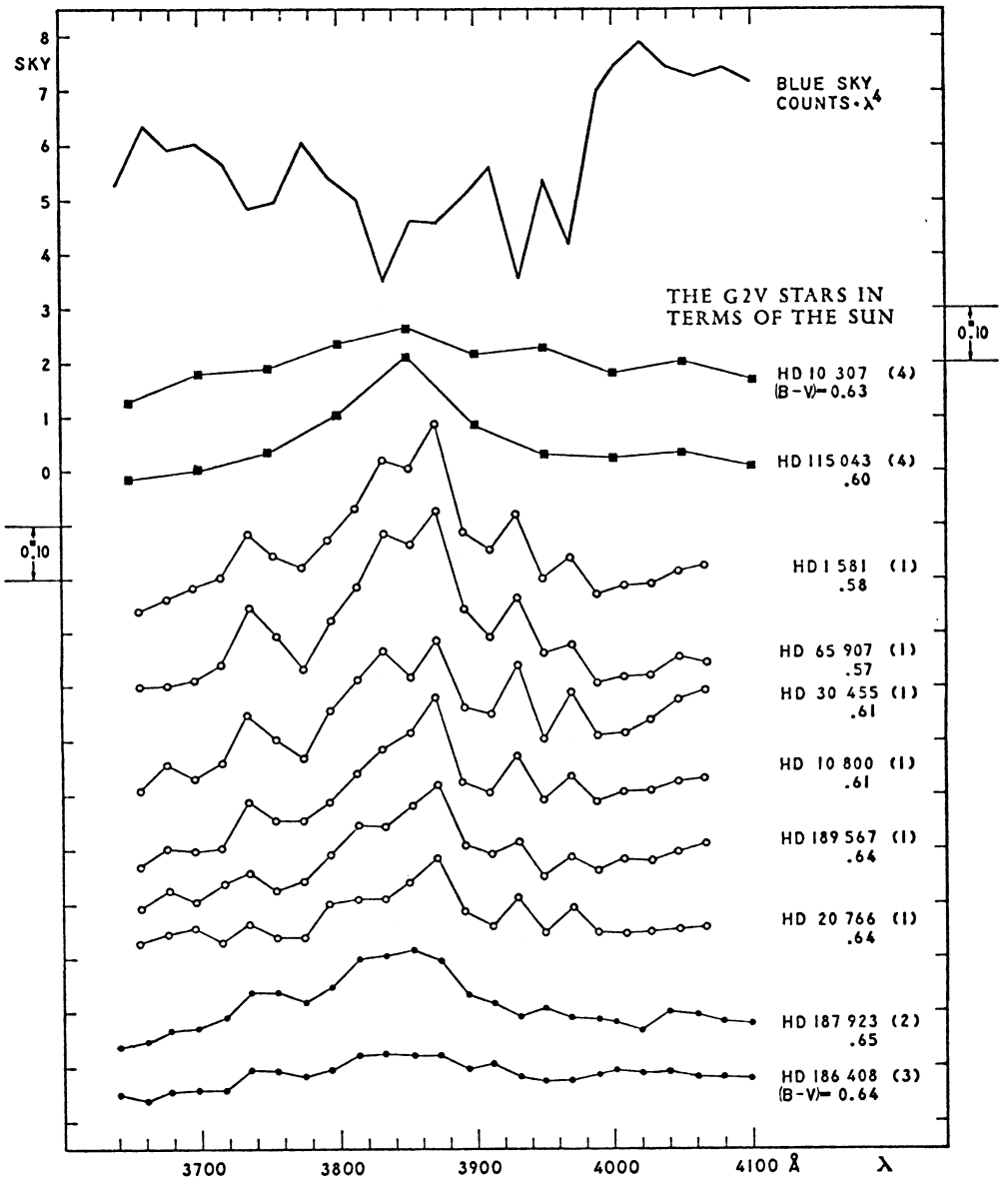

Figure 2: Ratio spectra star/sky of G2 V stars, whose types were taken from the Bright Star Catalogue. Not corrected for extinction. Squares: observed from Arizona with 50 Å resolution. Other symbols as in Fig. 1 (in brackets, number of scans). The daylight sky is displayed on a linear scale on top of the figure. The three G2 V stars omitted from this plot look similar to HD 65907. No G2 V star has ultraviolet absorption features as strong as the Sun.

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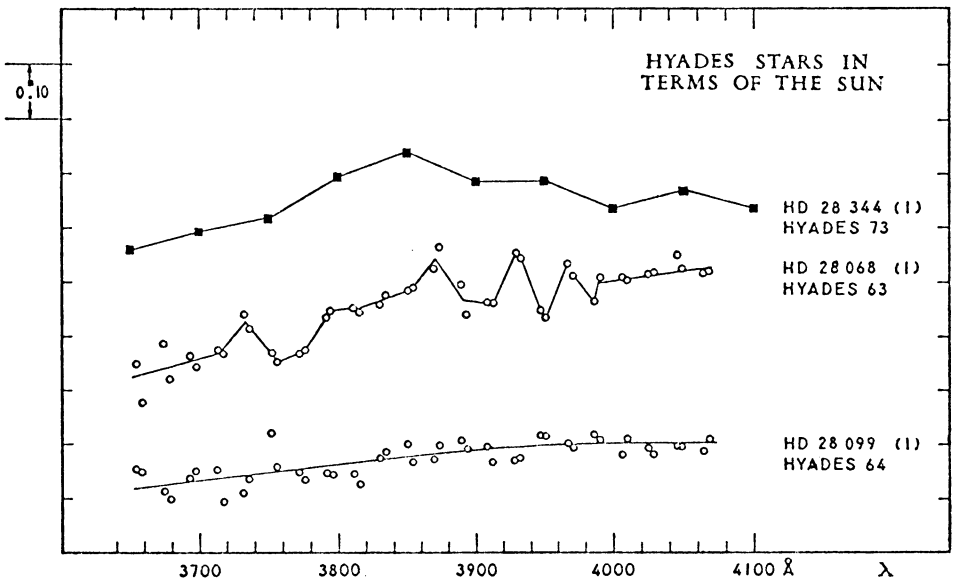

Figure 3. Within the limited accuracy obtained here, Hyades 64 is a solar spectral twin, while 63 and 73 are hotter than the Sun. Not corrected for extinction, symbols as in Fig. 2.

4. G2 V STARS AND HYADES DWARFS

13 G2 V stars were among the stars scanned, 10 of which are plotted in Fig. 2. None of them matches the Sun, all have weaker absorption features in the ultraviolet, even the two MK standards HD 10307 and 186408. MK types are obviously not a good criterion for preselection of solar spectral twins. The Geneva photometry was found much more useful for this purpose. THE SUN IS EITHER COOLER, MORE METALRICH OR OF DIFFERENT LUMINOSITY THAN ANY G2 STAR.

Fig. 3 shows that the Hyades dwarf HD 28099 could be of solar temperature, if it had solar abundances, while HD 28344 and 28068 are definitely hotter. Since most abundance analyses of Hyades dwarfs have been done assuming lower temperatures, these abundances may have to be revised. Energy distributions of Hyades G dwarfs should be measured to settle the question of their effective temperatures.

REFERENCES

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