A preliminary analysis of the F3 III star 20 CVn

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ABSTRACT

We are performing a detailed spectral analysis of the F3 III star 20 CVn. Our 2.4 Å mm⁻¹ spectrometers obtained with the 1.22-m telescope of the Dominion Astrophysical Observatory and CCD detectors cover 3825-4940. Our preliminary atmospheric parameters are Teff = 6900 K and log g = 3.0. We calculated ATLAS9 (Kurucz 1993) model atmospheres and synthesized the spectrum using SYNTH (Avrett & Kurucz 1981). We compared the observed fluxes and H lines profile with calculated values to obtain our results.

1. Introduction

Our elemental abundance study of the Scuti star 20 CVn (AO CVn, HD 115604, HR 5017, BD +31° 2380, SAO 44549, HIP 64844) is being performed in a manner consistent with the "Elemental Abundance Analyses with DAO Spectra" series of Adelman and his associates (see, e.g., Adelman et al. (2000) for the superficially normal stars 28 And (AT XII, 8 Scuti) and 99 Her (FU VI)). Our preliminary atmospheric parameters are Teff = 6900 K and log g = 3.0 ± 0.9 km s⁻¹.

2. Observations and Reductions

Adelman obtained 2.4 Å mm⁻¹ spectrometers of 20 CVn at the Dominion Astrophysical Observatory (DAO) using the SITe2 and SITe4 CCDs with a typical signal-to-noise ratio of at least 200 and a wavelength coverage of 64 and 144 Å, respectively. The observed spectral range covered 3825-4940. They were rectified with the interactive computer graphics program REDUCE (Hill & Fisher 1986). A 3.5% correction was used to correct scattered light in the dispersion direction for most SITe2 spectrometers. For the later SITe2 and SITe4 spectrometers a scattered light correction was incorporated into the program CCRED (Gulliver, Hill & Adelman 1996).

3. Measurements and Identifications

We normalized all 15 spectrograms of 20 CVn (see Figure 1). Then the spectral lines were measured using the program VLIND (Hill & Fisher 1986). We derived v sin i = 5.6 ± 0.3 km s⁻¹ by fitting the clean weak lines with Gaussian profiles. For approximately 5000 lines, the equivalent widths, the central wavelength, the line depths and the FWHMs were measured (see Figure 2). In this process, the fixed parameter feature was used to better determine parameters of weak and closely blended lines. Gaussian profiles were fit through the stellar metal lines of 20 CVn. In this preliminary study we measured the radial velocity (see Table 2). In this process, the fixed parameter feature was used to better determine parameters of weak and closely blended lines. Gaussian profiles were fit through the stellar metal lines of 20 CVn. In this preliminary study we measured the radial velocity (see Table 2). We are performing a detailed spectral analysis of the F3 III star 20 CVn. Our 2.4 Å mm⁻¹ spectrometers obtained with the 1.22-m telescope of the Dominion Astrophysical Observatory and CCD detectors cover 3825-4940. Our preliminary atmospheric parameters are Teff = 6900 K and log g = 3.0. We calculated ATLAS9 (Kurucz 1993) model atmospheres and synthesized the spectrum using SYNTH (Avrett & Kurucz 1981). We compared the observed fluxes and H lines profile with calculated values to obtain our results.

4. Atmospheric Parameters and Microturbulent Velocity

To get initial estimates of the atmospheric parameters Teff and log g from the homogenous uvby observations of Hauck & Mengel (1998), we used the computer program of Napierstaki et al. (1993). The uncertainties are about ±200 K and ±0.2 dex (Lemke 1989). The results for 20 CVn are 7452 K and 3.66.

5. Summary

Our preliminary Fe abundance study shows that the abundances of 20 CVn might be solar. Fe I and Fe II were found to be independent of equivalent width. The scatter of abundances was determined as ±0.4 dex. The microturbulent velocities were determined as ±0.5 km s⁻¹. The abundances are independent of equivalent width and the scatter of abundances is ±0.4 dex. The microturbulent velocities are determined as ±0.5 km s⁻¹.

Table 1. Radial velocities for measured spectra in this study.

<table>
<thead>
<tr>
<th>Spectra Set</th>
<th>Wavelength (Å)</th>
<th>Radial velocity (km s⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R122_02_3494</td>
<td>3893-3944</td>
<td>8.4 ± 0.4</td>
</tr>
<tr>
<td>R122_02_3548</td>
<td>3893-3944</td>
<td>8.8 ± 0.4</td>
</tr>
<tr>
<td>R122_02_3592</td>
<td>3893-3944</td>
<td>8.8 ± 0.4</td>
</tr>
<tr>
<td>R122_02_3646</td>
<td>3893-3944</td>
<td>8.8 ± 0.4</td>
</tr>
<tr>
<td>R122_02_3692</td>
<td>3893-3944</td>
<td>8.8 ± 0.4</td>
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<td>8.8 ± 0.4</td>
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<tr>
<td>R122_02_3842</td>
<td>3893-3944</td>
<td>8.8 ± 0.4</td>
</tr>
</tbody>
</table>

From 104 Fe I lines we found that the microturbulence based on the abundances being independent of equivalent width was 2.8 km s⁻¹ and from the scatter about their mean was 2.7 km s⁻¹. For 29 Fe II lines both criteria for microturbulence was 2.6 km s⁻¹.

When we average the microturbulences we find 2.7 km s⁻¹. For these microturbulences, the average Fe I microturbulence was 2.8 km s⁻¹ and from the scatter about their mean was 2.7 km s⁻¹. For 29 Fe II lines both criteria for microturbulence was 2.6 km s⁻¹.

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References

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