DISCUSSION (Adelman and Cowley)

KHOKHLOVA: How many stars in your sample of 21 are variable?

ADELMAN: If we went to the 0.5% level, probably all of them would be variable. At present, variability is definitely known for about 2/3 of the sample. The rest are probably either long period variables or stars seen pole-on.

KHOKHLOVA: I should make one other remark. If you are observing variable stars which have abundance patches, then you can not determine the actual microturbulent velocity parameter.

ADELMAN: In a strict sense, I agree with you; spots and patches complicate the analyses. This survey is a first-order approximation, and by means of suitable observations of the variability one could improve on the assumption that the hemisphere being studied is homogeneous.

One other point is worth mentioning. Are there any Ap stars which have normal (solar abundances) regions on their surfaces? This question can not be answered from the abundance studies, but the spectrophotometry shows that some of these stars approach normal flux distributions at certain phases: 63 And, CU Vir, and 56 Ari do this.

SCHÖNEICH: I would like to say something about ultraviolet observations of cool Ap stars with the ANS satellite. For each star, we have only a few observations, but the high accuracy of the ANS photometry and the well known periods permit some conclusions about the UV variability of these stars. Some years ago, Musielok noted that HD 188041 is one of two stars which has the "null wavelength region" in the visible; ANS photometry has confirmed this. The UV varies in antiphase with the red, and is in phase with the blue part of the spectrum. The amplitude in the 1550 Å band is greater than 0.3 mag. Also, 73 Dra varies at 4200 Å in antiphase with the other bands in the visible, while the UV variations are in phase with the 4200 Å band. The amplitude of the variation at 1550 Å is greater than 0.5 mag. The amplitude-wavelength relation for HD 71886 is very similar to that of 73 Dra, but the amplitude at 1550 Å is more than 0.75 mag. That means that a dark spot must cover half the star's disc to produce the observed amplitude. In view of this, it is surprising that you found a decreasing UV flux deficiency for the coolest Ap stars.

ADELMAN: The result that the UV flux deficiency decreases with decreasing effective temperature is statistical in nature, so there will be individual exceptions to this result. My impression is that 73 Dra is not as cool as the coolest Ap stars.

DWORETSKY: You mentioned hyperfine structure. Although one can calculate relative displacements within levels for hyperfine shifts, and relative strengths, one has to have laboratory data to determine absolute shifts and hence the structure of patterns. So, if I want to adjust, say, a Mn curve-of-growth for hyperfine structure, how do I go about it?

ADELMAN: With extreme difficulty! For certain spectra, like Pr II, the presence of hyperfine components is obvious from atomic spectroscopy. In some cases measurement of the stellar line with high S/N can help to tell about its presence. But, that's about all the help I can give . . .

C. R. Cowley et al (eds.), Upper Main Sequence Stars with Anomalous Abundances, 315–317.

there are no magic formulae.

MICHAUD: You have suggested log g ≈ 3.5 for Ap stars, and it is often suggested that Am-Fm stars also have similarly small values. Considering the small amount of time evolutionary models spend with such low gravities, isn't it likely that such small gravities indicate errors in the analysis?

ADELMAN: The gravities are obtained by fitting Hγ profiles from spectrograms to the predictions of model atmospheres. The latter are dependent on the model, on the theory of hydrogen line broadening, and on the He/H ratio. Of course, corrections must be made for scattered light. Errors in the He/H ratio can cause errors of order 0.1 dex. The VCS (Vidal, Cooper and Smith) hydrogen line broadening theory appears to be adequate for normal B and A stars and matches the line shape in the wings and line shoulders. The models for Hg-Mn stars are not too bad, and I am inclined to believe log g values which average 3.5 dex. For the magnetic Ap stars, the models are much worse. However, other investigators (e.g., Ryabchikova and Ptitsyn in a poster paper at this Colloquium) have also found such values. To check for photographic errors, it would be desirable to obtain Hγ profiles using a Reticon with high S/N and sufficient resolution to see the metal lines.

STĘPIEŃ: I have a short comment on Dr. Schöneich's question about the disappearance of the flux deficiency in the cooler Ap stars. I am not surprised to see it, because the cooler Ap stars have much less flux in the UV, hence less flux is available for redistribution. A 0.5-mag variation in the UV for a hot star involves much more energy redistribution than a 0.5-mag variation in a cool star.

SADAKANE: What is the most important factor causing your effective temperatures for cool Ap stars to be reduced by more than 1000 K?

ADELMAN: The main reason that effective temperatures are substantially lower in this paper, compared to those given in my thesis, is that I am now trying to fit the Balmer jump region as well as the Paschen continuum. In the original study, I demanded that I obtain the same log (Fe/H) value from Fe I and Fe II lines. The temperatures so obtained therefore depended on the gf-values. The use of spectrophotometric data and Hγ profiles, in addition to this condition, makes the values of log g and T_{eff} less dependent on gf-values.

ROMANOV: Did you determine the abundances of elements for 73 Dra and β CrB?

ADELMAN: I have not analysed 73 Dra; it is not part of this sample. However, β CrB is in the sample, but it is cooler than the five stars for which I fit continua and Hγ profiles. There are difficulties in fitting the Balmer jump and Paschen continuum simultaneously for that star. I decided to analyse the hotter stars first, because finding matches between predicted and observed continua is easier for them.

ALECIAN: You mentioned one star with a microturbulence velocity parameter ξ = 0.7 km/s, which is a rather low value. What is the precision of this determination, and if the precision is poor, why did you not simply adopt ξ = 0? Information about turbulence is very important for diffusion calculations.

ADELMAN: For normal and Hg-Mn stars, the errors in ξ are 0.4 km/s in the best cases, if one uses Fe I and Fe II lines. For HD 8441, one has to increase this value to allow for the uncertainty of the model, to about 0.6 km/s. I believe this star has a small, but non-zero, microturbulence which is about 1/3 that of normal stars of similar temperature. Microturbulences determined with similar gf-values and damping parameters for Fe I and Fe II lines have a minimum of 0.0 km/s near 13000 K, and increase monotonically for both hotter and cooler effective temperatures. My values are smaller than those of other analyses. I do not understand the temperature dependence, especially as I have come to regard ξ as a "fudge" factor. When model atmospheres with a better representation of the line opacity become available, I plan to repeat some of these normal star analyses to see how ξ changes. It is important to know whether it is an artefact of the analysis technique.
DWORETSKY: Microturbulence is the number that we put into the equations to get the answer we thought of originally.
ADELMAN: A fudge factor!