DISCUSSION (Linsky; Lanz; Shore)

COWLEY: (To Linsky) Welcome to our group of peculiar people! I noticed that you discriminated between helium-weak and helium-strong stars, and did not seem to consider the SrCrEu etc. stars to be a member of either group. But I think that virtually all of the chemically peculiar stars a bit cooler than the helium-strong B2's have weak helium lines. Babcock's star and θ Aur, for example, are classical silicon stars, and we usually think of them as hotter analogues of the CrSrEu etc. stars. Perhaps as your sensitivity gets better you may find radio and x-ray emission from these objects as well.

LINSKY: In our papers we cite the spectral types of each star. I agree with your prediction that cooler CP stars will be detected as the sensitivity of x-ray and radio observations improves.

SHORE: You've shown well that if it walks like a duck and quacks like a duck it is probably an ostrich! The phenomenology of many MHD instabilities washes out the initial conditions. What are the specific diagnostic signatures of underlying mechanisms provided by the radio and/or x-ray emission?

LINSKY: You are correct that the MHD instabilities probably prevent us from making unique and definitive models of the underlying physics responsible for the stressed magnetic fields. My objective here is to call attention to the similarity of the x-ray and radio phenomena in CP and active late-type stars and to present a model that is consistent with the data. I make no claim of uniqueness for the model. My conclusion is that the wind in CP stars plays an analogous role to the convective motions for active late-type stars by stressing the magnetic field. I see no sensible alternative to this conclusion at this time.

STĘPIEŃ: What can be said about the radio emission of normal stars from the same spectral interval as the observed Ap stars?

LINSKY: This topic was reviewed in the paper by Dr Lanz. Only upper linits are currently available for the radio emission from normal A stars. I believe that the smallest upper limits are given in the paper of Brown et al. (Ap J, 361, 220, 1990).

STĘPIEŃ: (To Lanz) Your calculations refer to normal A stars. In magnetic stars the Lorentz forces will be very important in the outermost atmospheric layers, particularly when one expects winds or circumstellar matter. Would it not be useful to include magnetic effects into your calculations, e.g., by treating $g_{\rm eff}$ as a free parameter, and to see what can be the observational differences between normal A and magnetic Ap stars?

LANZ: Sure. Magnetic fields will be important in outer layers. Nevertheless, much progress was and still is needed to have more exact NLTE line-blanketed models to derive the structure of these layers in normal stars. Including the magnetic field is one obviously necessary step when the case of the normal stars is well understood. Moreover, including the magnetic field would not be straightforward, because it would involve a much more complicated geometry in the problem.

DWORETSKY: (To Shore) Dr Linsky described a model for helium-strong variables with magnetic and rotation axes aligned ($\beta \sim 0$) and asked us to demolish it. The classical Ap stars are in many cases characterized by non-alignment ($\beta \sim 60°$). My question is, are the statistics of helium-strong variables suggestive of the same β distribution as classical Ap's? I realize that the statistics are uncertain due to the small number of known stars of this type.

SHORE: The distribution of obliquities looks just like the other magnetic stars, although as usual there are awfully small numbers involved. For example, in Ori OB1 there are four HeS stars, of which three are variable with a range of β and one is not variable at small β. There are, I suspect, good reasons why the HeS slow rotators (non-variables) were picked out in objective prism searches, but the distribution over all of the roughly dozen HeS stars is essentially random.
STĘPIEŃ: The matter lost by thermal winds does not co-rotate until the Alfvén radius. Instead, it moves along spiraling magnetic lines with decreasing angular velocity carrying momentum away until infinity (in the idealized case). However, when one calculates total loss of momentum, due to wind matter and magnetic stresses, it is equivalent to the loss obtained for wind matter co-rotating until the Alfvén radius and then getting loose.
LINSKY: Please comment on what you mean by centrifugally driven winds for stars with effective temperatures less than 15,000 K. Many of these stars are slow rotators so that the centrifugal forces at 1 or 2 radii are small. Far from the star such forces are important, but what forces initiate the wind?
SHORE: Actually, among the few helium-weak stars we have that show magnetospheres, only α Scl is a slow rotator. Rotation plus some mass loss loading is very likely involved with the magnetospheric structure but I really don't know how the mass is injected. Perhaps this is an extension of the atmosphere which becomes unstable (the Balbus-Hawley instability gives this). But again, I'm not sure of this. For the helium-strong stars, the situation is clearer – here, radiative driving is much easier to arrange.