which is somewhat hotter and has a magnetic field of 1000 gauss. The turbulent velocity here was noticeably smaller than in HD 140283, but I would not say that is was definitely zero.

St. Temesvary. I would like to point out that according to an earlier suggestion by Mrs Böhm-Vitense the velocity of convection as given by the mixing length theory can never reach the velocity of sound. So it seems clear that all observed supersonic velocities are more likely to be ascribed to acoustical phenomena than to the convection directly.

F. Faulkner. I would like to ask whether any attempt has been made to apply the mixing length theory to stars in the low temperature, low luminosity region of the HR diagram. Here I would expect that dissociation of molecular hydrogen would act in a way similar to the ionization of hydrogen in promoting the onset of convection.

E. Böhm-Vitense. Dr Vardya has especially investigated late-type stars. There is indeed another convection zone due to the H_2 dissociation.

A. Unsöld. I should like to comment on motions in the early-type super-giant atmospheres. Early-type super-giants (55 Cyg....) show fluctuations in light and radial velocity with characteristic times of some days. The spectra indicate macroturbulence somewhat smaller than the velocity fluctuations and still smaller microturbulence. Bright *Hα* points to a kind of extended chromosphere.

The observations can be explained as due to pulsation in many higher modes. The problem is: Why do so early-type super-giants have such noise-like irregular oscillations, while in the somewhat cooler cepheids the fundamental mode is by far the most important.

6. MICROTURBULENCE ABOVE THE HYDROGEN CONVECTION ZONE

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We would like to report here a possible interpretation of the profiles of middle strength Fraunhofer lines and especially the profiles of the strontium resonance line we obtained with an atomic beam spectrophotometer. Those profiles are particularly reliable because the experimental technique, which has already been described (1961), provides a resolution of 10^7, as no instrumental profile correction is required.

Theoretical profiles have been computed with the electronic computer of Meudon. We used models from Meudon and from de Jager (average model 1964). We assumed for a test local thermodynamical equilibrium or LTE. The absorption coefficient has been first computed with a constant microturbulence velocity. In agreement with Allen's result (1949) and Waddell's result (1958) we found that a r.m.s. velocity of 1·8 km/sec is needed for the profiles at the centre of the disk and more than 3 km/sec for limb profiles. But as Schmalberger recently remarked (1963) profiles are rather V-shaped at the centre of the disk and rather U-shaped near the limb so that computed profiles fit the observations much better near the limb. At the centre of the disk, the agreement with observed profiles is rather poor. As Dr Elste pointed out yesterday, computed wings are too narrow while the computed core is too wide. The difference in the wings is too important to be interpreted as an error on the damping constant.

There are two possible interpretations of the centre to limb increase of the microturbulence velocity. The first one is that turbulence is anisotropic. This was Allen's conclusion in 1949. The second one is a very rapid increase of turbulence with height at a certain level. We shall see that this second possibility leads to much more correct profiles.

We have recomputed profiles at the centre of the disk with de Jager's model and a turbulence discontinuity at a certain level. Observed profiles got perfectly fitted in placing the discontinuity exactly at the boundary of the convection zone given by de Jager, i.e. $\tau_0 = 0{\cdot}07$. This is probably not the limit of the unstable region but rather upper limit for convection of what Dr Spiegel spoke about this morning. The microturbulence velocities used were 1 km/sec inside the convection zone and 3·5 km/sec outside. The increase of the half-width of profiles from centre to limb is well obtained with this model in spite of the fact that equivalent width grows too fast. This effect does not exist with the model from Meudon (which is hotter at the surface), but profiles do not fit in this case as well. This may imply a modification of the model or departure from LTE, at least for ionization.

We should like to draw attention on the fact that if such a structure exists, the notion of depth of formation completely loses its signification since wings of profiles originate only from the more turbulent zone, i.e. from the surface. So we must not be surprised if such a structure is the opposite of that given by Unno (1959). To clarify this point, we applied the Unno-Goldberg method to our theoretical profiles. The result fits quite well with the curve from Unno rapidly decreasing with height.

This is an indication that our hypothesis explains the centre-limb variation of profiles as well as the variation with the number of absorbing atoms. For instance we were able to verify that our theoretical profiles give also account of the 'fish-bone effect' described by Lefèvre and Pecker so that it seems that its interpretation does not require inhomogeneities.

At last, it seems that the structure we propose can perhaps give a simple interpretation of Evans and Michard observations (1962–63). We have indeed only to assume that the boundary of de Jager's convection zone begins to oscillate at the arrival of hot ascending material or granule. Computed profiles show that a r.m.s. fluctuation of 25 km in height gives the intensity fluctuations observed by Evans and Michard at the centre of the lines. They are in fact width fluctuations so that their correlation with the intensity of the continuum may be small, whereas they must be correlated with velocity fluctuations. This is exactly what Evans and Michard recently observed (1963). This interpretation agrees perfectly with their conclusion: resonance oscillations excited by granules and rather limited in depth in the photosphere.

Besides, they observe a 50 sec delay between the maximum of brightness in the continuum and the beginning of the oscillations.

If we admit that it is the time necessary for a granule to get from the $\tau_0 = 1$ depth to $\tau_0 = 0{\cdot}07$, i.e. to travel over a distance of 120 km, their average velocity would be 2·4 km/sec. Then the description of the phenomenon would be the following:

When reaching the boundary of the convection zone, the ascent of granules stops and they begin to break into fragments (Rösch 1962). Convection energy is then converted into microturbulence, with perhaps local conservation, of the entire mechanical energy.

It seems to me that this description is compatible with Dr Spiegel's results.

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