OBSERVATIONS OF STELLAR ROTATION AND LINE STRENGTHS FOR OB STARS

WILLIAM BUSCOMBE

Northwestern University, Evanston, Ill., U.S.A.

For 121 southern stars of spectral types between O5 and A3, including 35 supergiants, equivalent widths and values of $v_e \sin i$ have been measured for absorption lines on direct-intensity tracings of coudé spectrograms from Mount Stromlo, with original dispersion 150 microns per angstrom. For stars of a particular temperature and luminosity class, the strength of the hydrogen lines is weaker and the triplet helium lines stronger in fast rotators than in sharp-lined objects which are rotating more slowly. Full details are in print (*Monthly Notices Roy. Astron. Soc.* **144** (1969), 1): subsequent papers in press present detailed profiles of the Balmer lines for 23 slowly rotating stars and details of emission features shown by several fast rotators.

The investigation is being continued with spectrograms of northern B stars secured at the Dominion Astrophysical Observatory, supported in part by grant GP-13544 from the National Science Foundation.

Discussion

Slettebak: I notice that for a number of stars in common, your rotational velocities are generally higher than mine. Do your velocities contain corrections for limb or gravity darkening?

Buscombe: No: the profiles are treated as approximately Gaussian, with a half-width parameter $= v_e \sin i\,(\log_e 2)^{1/2}$. However, for stars in which the empirical $v_e \sin i$ term < 60 km/sec, an adjustment was made for an instrumental profile of half-width 20 km/sec in the same parameter.

Slettebak: I believe that it is difficult to find any stars earlier than O9 with really sharp lines, which would imply that macroturbulence must play a role in these stars. Did any of your O-type stars show sharp lines?

Buscombe: The star HD 57682, with $V = 6.4$ and $v_e \sin i = 40$, has not quite as sharp lines as 10 Lac.

Slettebak: The fact that the O9.5 V star, Zeta Ophiuchi, has exceedingly broad lines and yet has never been observed to show emission lines is interesting, as you pointed out. The critical rotational velocity for break-up rises rather sharply as one moves from the B-stars into the O-stars, however – the star may not be rotating quite rapidly enough to produce an emitting ring.

Buscombe: Since the value of $v_e \sin i$ determined from half-widths on my microphotometer tracings substantially exceeds that quoted by you and other investigators, it will be of interest to attempt a convolution of the line profiles for a slow rotator in the hope of fitting the observed distribution of intensity.

Collins: I would like to point out that this work is one of the strongest justifications for the existence of rotational effects on equivalent widths of spectral lines. The qualitative behavior of all lines mentioned is in accord with theory. However, the magnitude of the effects is somewhat less than one would expect if there were many stars rotating at or very near the critical velocity.

Buscombe: Although I was aware of the results of Deeming and Walker, I had not studied your predictions in detail before reducing my own measurements. It is remarkable that the selection of material analyzed by Hyland did not make the effects more noticeable.

A. Slettebak (ed.), Stellar Rotation, 115.