THE ASTRONOMICAL JOURNAL

FOUNDED BY B. A. GOULD

PUBLISHED BY THE AMERICAN ASTRONOMICAL SOCIETY

VOLUME 53

1948 February ~ No. 1168

NUMBER 4

ABSTRACTS *

Aller, Lawrence H. Atmospheres of early type stars.

The importance of early type stars with absorption spectra lies on the one hand in that the stellar absorption coefficient should be predictable in detail from theory and on the other in that they provide clues to the abundances of the light elements, hydrogen, helium, carbon, nitrogen, oxygen, neon, etc., which are of interest in connection with the stellar energy generation problem.

Mt. Wilson coude plates of 3 supergiant and 3 main sequence B stars have been utilized to determine line profiles and equivalent widths. With the aid of exact f -values for hydrogen and approximate f -values for other light elements it has been possible to estimate the relative abundances of H , He , C , N , O , Ne , Mg , Al , Si , P , and S , the electron density, the number of atoms above the photosphere, and the effective surface gravity.

Uncertainties arise not only from our ignorance of the true f -values, the damping constants appropriate for the stronger lines, and possible "turbulence" in supergiant atmospheres (more precisely the non-equality of kinetic and effective temperatures), but also from inaccuracies in the effective temperature. The relative proportions of C , N , O , Mg , and Si appear to be in fair agreement with the results of Unsöld for τ Scorpii, and the writer for 10 Lacertae, but the ratio of hydrogen to oxygen may be greater in the dwarf stars. The lines of $NeII$ have been measured in ϕ Orionis with the result that neon appears to be about a fifth as abundant as oxygen.

Supergiant atmospheres present perplexing problems. The kinetic temperatures of the atmospheres of ϵ Canis Majoris and χ^2 Orionis appear to be larger than the effective temperatures but the curve of growth is not sufficiently precise to

fix the values. The effective surface gravity of the latter star as determined from the electron pressure and mass above the photosphere is about 10^{-2} that estimated from the mass and radius of the star, in accordance with the results found by Miss van Dien. The line profiles suggest the broadening arises from the Doppler motion of the radiating atoms.

The high central intensities of the strong absorption lines suggest that they are formed according to Milne's scheme of local thermodynamic equilibrium. The exact value of the central intensity will depend on the wave length, the ratio of the continuous absorption coefficient at the point in question to the mean absorption coefficient, $\kappa_\lambda/\bar{\kappa}$, and the effective temperature T_e . If $\kappa_\lambda/\bar{\kappa}$ is constant with optical depth we can use the tables by Chandrasekhar and Miss Breen to predict the central intensities. A model atmosphere has been computed for 10 Lacertae, and the choice of the value of $\kappa_\lambda/\bar{\kappa}$ for an optical depth of 0.65 yields a satisfactory agreement between the observed and predicted central intensities of $H\beta$, $H\gamma$, $H\delta$, and $H\epsilon$.

Since we have a satisfactory theory of the stellar absorption coefficient for the hotter stars and since f -values may be computed for the observable lines of the light elements, an investigation similar to that carried out by B. Strömgren for the sun would appear to be in order. It would appear desirable to concentrate on a few lines whose f -values can be determined accurately and compute theoretical profiles and total absorptions.

Kirkwood Observatory,
Indiana University,
Bloomington, Ind.

* Of papers presented at the Seventy-seventh Meeting of the American Astronomical Society, Evanston, Illinois, September 3-6, 1947. The first five are abstracts of papers that constituted a symposium on Stellar Atmospheres.