SUPERGIANT STARS AS CHEMICAL COMPOSITION INDICATORS*

(Abstract)

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By investigating massive stars' theoretical evolution, it has been found that the fractions of time spent in the different effective temperature intervals in respect to the total core He-burning lifetime, which give the probabilities of finding the star in these temperature ranges, are very sensibly dependent on the initial chemical composition. The evolutionary tracks are computed under the assumption of the Schwarzschild-Härm criterion for semiconvective instability and neglecting the effect of mass loss from single stars, because no completely satisfactory theory of dealing with it, has so far been presented although it might be a very important effect.

The above lifetime fractions can be converted into percentages in terms of predicted number of stars expected in the different effective temperature intervals. The comparison of the theoretical percentages with the observed ones suggests the possibility of investigating whether differences in initial chemical composition exist among Population I stars.

Such an inhomogeneity in the chemical composition for young stars was already suggested by several authors, and moreover some features of the composite experimental HR diagrams of supergiant stars in our own Galaxy, Large and Small Magellanic Clouds (Humphreys, 1970; Brunet and Prevot, 1971; Osmer, 1973, respectively) seem to require it. From the above experimental sources we have derived the percentage distribution in the different temperature intervals by considering only those supergiants more luminous than -7^m in M_b and excluding also the Ib luminosity class, up to spectral type B2, stars for which it has been suggested, on the basis of their position in the HR diagram compared with evolutionary tracks, that they are in core H-burning phase.

An attempt is made to assign the average metal and hydrogen contents for supergiants stars in the three galaxies, and the following sequence is derived: $X_G < X_{LMC} < X_{SMC}$ and $Z_G > Z_{LMC} > Z_{SMC}$. This result is in quite satisfactory agreement with the indications derived by the period-colour relationships of Cepheids in the three galaxies.

A more complete account of this work will be submitted for publication to *Astronomy and Astrophysics*.

References

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