CONTENTS

5. STELLAR ATMOSPHERES AS INDICATOR AND FACTOR OF STELLAR EVOLUTION

Introduction-Observational Evidence

B.E.J. PAGEL / Introductory Talk 103

R. CAYREL and G. CAYREL / Observational Evidence for Atmospheric Physical Characteristics Relevant to Stellar Evolution 105

R. FOY / Behaviour of Microturbulence with Evolution 115

B.E.J. PAGEL / Observational Evidence for Atmospheric Chemical Composition Peculiarities Relevant to Stellar Evolution 119

Stellar Atmospheres as Boundary Condition of Internal Structure

P. DEMARQUE / Sensitivity of Internal Structure to the Surface Boundary Condition 137

R.N. THOMAS / Boundary Conditions with Mass Loss: General Considerations 143

C. DE LOORE / Mass Loss in Stars of Moderate Mass by Stellar Winds and Effects on the Evolution 155

D. MIHALAS / Boundary Condition with Mass Loss: The Radiatively-Driven Wind Model 175

Alteration of Surface Chemical Composition of Stars by Transport Phenomena

G. MICHAUD / Stratification of Elements in a Quiet Atmosphere: Diffusion Processes 177

G. VAUCLAIR and S. VAUCLAIR / Competition Between Diffusion Processes and Hydrodynamical Instabilities in Stellar Envelopes 193

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Alteration of Surface Chemical Composition of Stars by Nuclear Reaction

M. SCHWARZSCHILD / Mixing Between Burned Core Material and Surface Layers 205

A.M. BOESGAARD / Decay of Light Elements in Stellar Envelopes 209

R. CAYREL / Conclusion 217

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INTRODUCTORY TALK

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Welcome to this Joint Discussion on stellar atmospheres and interiors. For stellar structure, the atmospheres are of importance for two reasons, first as a source of information on effective temperature, gravity (or mass: luminosity ratio), chemical composition and dynamical effects, and secondly as an outer boundary condition for stellar models.

In the last few years there have been substantial advances in stellar atmospheres as a result of both improved theories and new measurements. In the particular field of abundance determination, non-LTE theory has at last come of age and provided a certain number of corrections that are both realistic and significant, for example in reconciling the neon abundance in B stars with that in nebulae and solar flare particles. Solar abundances have been improved by the provision of better oscillator strengths and better treatment of line broadening, generally with the effect of leading to still closer agreement with carbonaceous meteorites. Nevertheless, he would be a bold man who claimed to know the initial solar abundance parameters Y and Z to better than, say 25 per cent, even if we grant that the photosphere is a true sample of the initial interior abundances - an assumption that is now being questioned (again) in view of the solar neutrino problem.

Another phenomenon revealed by quantitative stellar spectroscopy is the presence of velocity fields including the notorious "microturbulence". The existence of such small-scale velocity fields has been questioned on grounds (among others) of the effect of a non-LTE source function in pushing up the flat part of the curve of growth. In G and K giants and supergiants, however, one needs microturbulent parameters approaching 2 km s^{-1} and 5 km s^{-1} respectively even if one uses a curve of growth in which all re-emission in lines is neglected; so the velocity fields have to be real and they can be credibly interpreted as a field of acoustic waves coming up from the convective zone.

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The most striking evidence for the existence of these velocity fields comes from stellar chromospheres in the form of the Wilson-Bappu effect in Ca^+ and its analogues in Hα and Mg^+. The slow but steady increase in width with luminosity, and the decline in K-line emission with age among main-sequence stars, are powerful signs of an intimate relationship between stellar atmospheres and basic features of internal structure and evolution. A fully coherent theory of the Wilson-Bappu effect still does not exist, but a reasonable scaling law can be derived on the assumption that the FWHM is proportional to the Doppler width with something like 10^{-5} of the radiative flux being propagated upwards as mechanical energy with increasing velocity amplitude through the chromosphere. This fraction of 10^{-5} is comparable to the power needed both to heat the solar corona and to drive mass loss according to the formula suggested by Reimers, although this mass-loss rate is still very uncertain, of course.

These problems are also related to the effect of atmospheric phenomena on the outer boundary condition for stellar models, going back to the old arguments as to whether the dog wags its tail or the tail wags the dog. From textbooks one has the impression that for hot stars there is really no problem, but in cool stars with convective envelopes the adiabatic constant, and therefore the whole structure, depends on a proper treatment of the atmospheric opacity and other details. I look forward to hearing today about the current state of this problem with special reference to the effects of mass loss. So let battle commence and I trust that we shall leave at the end of the day with a better understanding of both stellar atmospheres and interiors.