

# reviews

## Stellar atmospheres

Bernard Pagel

*Stellar Atmospheres.* (Second edition). By D. Mihalas. Pp.631. (Freeman; San Francisco, 1978.) \$24.95.

THE 'atmosphere' of a star is a thin surface layer that is of importance for two fundamental reasons: (a) it is the part that can be seen from outside and thus gives information on the fundamental stellar parameters of effective temperature, surface gravity and chemical composition which in turn are related to internal structure and evolution; and (b) it plays an essential part in the internal economy of the star by radiating away the power generated by nuclear processes in its interior. In addition, stellar surface layers are the seat of a wide range of interesting physical effects, including solar activity (which undoubtedly has counterparts in other stars) and the presence of kinetically hot, tenuous outer regions which interact with the interstellar medium through continuous mass loss and other effects.

The classical theory of stellar atmospheres, which developed from pioneering studies by W. H. McCrea in the early 1930s through R. Wildt's discovery of the dominant role of  $H^-$  in solar-type stars in 1938 to the moderately accurate stellar abundance analyses of the 1950s and 1960s, rested on a number of simplifying assumptions: radiative and hydrostatic equilibrium and the approximation of local thermodynamic equilibrium (LTE). The latter, first introduced mainly for computational convenience, has proved remarkably successful in accounting for the continuous spectrum and most absorption lines (though not emission lines) from the Sun and many other stars, and can indeed be quantitatively justified for the visual continuum of the Sun and all but the hottest stars along the main sequence. It was strongly challenged in the 1950s and 1960s, however, on grounds that were quite justified in general terms; but no improvement over LTE interpretations of absorption lines was achieved until the development of really accurate non-LTE theories, for which the author of the present book was largely responsible, in the 1960s. It is largely as a result of his deep insight and his expertise in computational methods

that we now have a viable non-LTE theory of stellar atmospheres which shows that, in the hottest stars and stars of high luminosity, the more general assumption of a local steady state indeed leads to a much more accurate interpretation of stellar continua and line profiles; in solar-type stars however, the departures from LTE are large for emission lines and for certain lines in the infra-red, but are quite small for the total intensities of other lines.

The first edition of this book, which appeared in 1970, was a masterly exposition of the physics and mathematical methods involved in both the LTE and the non-LTE theories of stellar atmospheres, with special emphasis on the continua and absorption line spectra of the hotter stars. The present edition has been considerably enlarged to include newer developments, particularly in the study of extended atmospheres and moving media, and treats the whole problem from a more general point of view, including the hydrodynamics of stellar winds, as well

as discussing the radiative transfer problems that formed the main emphasis in the first edition. Another refinement is the discussion of departures from complete redistribution in frequency of scattered photons; 'partial redistribution' (which approximates the concept referred to as 'coherent scattering' in the older literature) is essential in the discussion of such phenomena as the chromospheric emission cores of the broad  $Ca^{2+}$  and  $Mg^{2+}$  absorption lines in cooler stars, a point which had been overlooked in many of the non-LTE treatments of this effect. Finally, the author has added a number of well chosen problems which serve both to carry the argument along and to impress it on the reader's mind.

The new edition of this outstanding book is thoroughly up to date and is in every way a classic worthy of its predecessor. □

*Bernard Pagel is a Deputy Chief Scientific Officer at the Royal Greenwich Observatory and Visiting Professor of Astronomy at the University of Sussex, UK.*

## Susceptibility to environmental pollutants

*Pollutants and High-Risk Groups: The Biological Basis of Increased Human Susceptibility to Environmental and Occupational Pollutants.* By E. J. Calabrese. Pp.266. (Wiley: New York and Chichester, UK, 1978.) £13.75.

It has been recognised by toxicologists for a long time that sensitivity to certain toxic agents depends on sex, age, nutrition, circadian rhythms and pre-existing morphological and biochemical disorders. Experience has also proved the value of medical examinations in preventing the occupational exposure of those who might be susceptible to chemical and physical hazards. This book, being a comprehensive review of known and hypothetical 'high risk' groups, helps one to appreciate that increased susceptibility to environmental pollutants is a widespread problem which must be kept in mind in the development of environmental health standards. One chapter deals with age, pregnancy and circadian rhythms; other chapters deal

with genetic disorders, nutritional factors and diseases. There is a list of screening tests and a general discussion on the public health implications of high risk groups. Approximately 900 publications are referenced in alphabetical order and with title.

The pioneer enthusiasm of the author is evidenced by a coverage which oversteps the legitimate boundary of the subject. Thus, the reader is assured that due to developmental and circadian weak points in our life cycle and daily lives, every individual at some point is at increased risk. This overzealous approach leads to statements like: "These programs (that is the hot-lunch program for the elderly) are needed in the inner cities, where diets are notoriously poor and environmental pollutant levels (eg ozone) are usually high". Hypotheses are sometimes presented as facts and inadequate proof is not criticised. By linking a report on 20 cases of CO poisoning in pregnant women to increased CO production in pregnancy, the author gives