incompatible with the higher tone of the formal discussions. For example, some figures showing fits of crude, phenomenological, coordinate-space optical potentials to data and pages of Glauber-theory results—some even at energies near 100 MeV—do not include the more fundamental results available. In addition, some captions for figures of experimental versus theoretical results are inadequate for a text.

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The Brightest Stars

C. de Jager
458 pp. Reidel, Dordrecht, 1980. $60.00

As techniques for astronomical observation have proliferated, it is a rare person who will tackle the problem of melding together the empirical information and the theoretical gropings that originate in such a wide variety of sources. C. de Jager is a former secretary-general of the International Astronomical Union and has been one of the prime movers of Dutch studies of stellar atmospheres. His book, a welcome addition to Reidel's series, *Geophysics and Astrophysics Monographs*, bears the stamp of classical Dutch astronomy: a conservative blend of empiricism and theoretical analysis.

During the late 19th and early 20th centuries, stellar spectra were arranged into a continuous one-dimensional classification. Annie J. Cannon classified about one-quarter million stars for the *Henry Draper Catalogue*, and, following the lead of a colleague, Antonia C. Maury, she occasionally noted peculiarities of the spectra, such as absorption lines that were unusually sharp or unusually fuzzy. Eijnar Hertzsprung showed that the sharpness of the lines was associated with high intrinsic brightness, and Walter S. Adams and Arnold Kohlschutter, were able to make this relation explicit by adding a second dimension to the empirical system of spectral classification.

Quantitative theoretical work began in the early 1920s with the development of a theory for thermal ionization. The first monograph on the interpretation of stellar spectra was Cecilia Payne's *Stellar Atmospheres*, which appeared in 1925. Payne showed that the most striking features of the spectral sequence could be correlated with temperature; the effects of density and of chemical composition could be ignored.

However, the second book on the topic, Payne's *The Star of High Luminosity* (1930), told a different story. Among the brightest stars, the secondary effects could not be ignored. Remarking on that book in an autobiographical memoir written late in life, Payne-Gaposchkin said she found that "the superficial simplicity of [her] first treatment had become blurred . . . .the physical picture was becoming confused and the confusion has increased from that day to this."

Indeed it has. As de Jager says in his foreword, there is no group of stars that shows a more pronounced diversity than the stars of high luminosity. "Can one visualize a larger difference then between a luminous, young and extremely hot . . . star and a cool, evolved pulsating star of the Mira type, or an S-type supergiant, or . . . the compact nucleus of a planetary nebula?" This diversity, including not only differences of temperature and density but often variations of chemical composition, results from individual histories. Uniformity is now seen to be an oversimplification.

Despite all of this, de Jager makes a valiant reach for unification: "I have . . . tried to stress the mutual relationships . . . .In addition I have tried to show how similar phenomena occur in stars of greatly differing types." Radiation pressure, mass-exchange between components of binary systems, outward flow, convection that can generate hydromagnetic waves, accretion flow that can produce gas hot enough to generate x radiation, pulsation, dust formation, maser action—they are all here, if only briefly.

This book is not easy to read. It is dense with information, and many of the data remain undigested and enigmatic. Of the 1831 references, some 45% was published in the three years prior to the completion of this book. Unfortunately, the titles of the papers are not included, and the book has no index, although cross-references are frequent in the text.

Research workers and graduate students will find a balanced introduction to a variety of phenomena, and a challenge for physical interpretation. It seems to me that the next step is to forget the details and to set about developing a unified theory of dynamical atmospheres.

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The Sun in soft x rays by Skylab. *The Brightest Stars* discusses active magnetic regions of the Sun's corona, which are seen here. (Courtesy, *American Science and Engineering*.)

An Introduction to Atmospheric Physics (Second Edition)

R. G. Fleagle, J. A. Businger
446 pp. Academic, New York, 1980. $29.50

This is the second edition of a well-received book, first published in 1963. Both authors have outstanding reputations. Under the leadership of Robert G. Fleagle, the Department of Atmospheric Sciences at the University of Washington developed from relative obscurity to its current eminent posi-