known (in Peierls's words) "one of the great physicists and one of the great characters of our generation."

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Energy and Human Needs

S. C. Curran, J. S. Curran
330 pp. Halsted (Wiley), New York, 1979. $24.95

Energy and Human Needs bills itself as being for the serious reader, to leave "him in a position in which he can arrive at his own considered judgement." This is an area in which the layperson needs information. Sadly, this book is no help; though it was published in 1979, it leaves the reader bemused and unable to understand the discussions of the last decade. I am reminded of the story of a German poet who was asked where he would like to spend the Last Day. He replied London, since it always took London a decade to catch up with the rest of the world.

The thesis of this book is that without growth in energy supply, economic growth will cease: "How can the continuous growth of energy comsumption, at the high rate maintained during the past fifty years, be sustained?" The authors neither look at what energy is used for, nor why demand grew. They overlook elementary energy economics, in which demand as well as supply plays a leading role. Given this position, they are forced to present nuclear power as the solution:

> In 1971 Chauncey Starr [of the Electric Power Research Institute] probably spoke for the majority of scientists and engineers, and possibly for the public at large when he said, "there is no question that nuclear power is a saving technical development for the energy prospects of mankind.

Times have changed. In the February 1981 special energy issue of *National Geographic* magazine Starr is quoted as saying, "Only conservation can be implemented quickly enough to make a substantial difference." The idea of energy growth as *a priori* justified has faded, to be replaced by a concept of energy as just one of a number of inputs to the economy. Where more efficient devices or processes are available, they may substitute for energy growth, leading to decreased energy use with increased GNP. The flow of ideas has left this book high and dry.

Beached ideas may be of interest; many an elegant theory has been slain by a stubborn fact. On the basis of this book, however, the cause of death was simply lack of brain. The analysis presented is incompetent, as illustrated by the discussion of the development of nuclear power in the UK. The move from Magnox to advanced gas reactors (AGR) is described, but without any exploration of why it happened. There is no mention of the enormous difference in burnup between the Magnox uranium metal fuel and the AGR uranium oxide fuel. To further complicate matters, the pressurized water reactor is falsely stated as using metal fuel, while the boiling water reactor is correctly stated as using oxide fuel. Compounding the analysis is armchair pontification. Small power plants are dismissed because they "offend the aesthetic sensibilities of many more country and urban dwellers," and as a global solution to acid rain "the acidity of waters in rivers and lakes might be corrected by adding lime."

Finally, a word must be said about the sources of information cited. They range from such tracts as *The Health Hazards of Not Going Nuclear*, by Petr Beckmann, to newspapers such as *The [London] Times*, and *The Scotsman*, through popular scientific literature such as *Scientific American*, finally to literature such as *Nature* and *Science*. The layperson could easily read most of these in the original.

The information gap between professionals and the public is not served by this type of regurgitation. The book simply cannot be recommended for any audience.

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Theory of Meson Interactions with Nuclei

J. M. Eisenberg, D. S. Koltun
415 pp. Wiley, New York, 1980. $39.95

In the last fifteen years a new specialty in nuclear physics, "intermediate-energy physics," has matured to the point that it is being pursued with great intensity at meson factories, laboratories and theorists' desks. This specialty can be defined as the study of phenomena involving nuclei and mesons or nuclei and nucleons at energies higher than those customary for nuclear physics. Its goal—in addition to increasing the understanding of these phenomena—is to elucidate better the structure of nuclei and to discover new physics that occurs in a multinucleon environment.

Theory of Meson Interactions with Nuclei by Judah Eisenberg and Daniel Koltun describes some of the theoretical methods used in intermediate-energy physics. Because of its clear, fairly short, yet pedagogically strong discussion of the basis for the working tools of the specialty, it should be a valuable text for advanced graduate students or new (and some present) workers in the field. Because by design it is neither a comprehensive text nor a review, the serious reader will have to look elsewhere for the details of the present state of the art (a task made easier by this readable and thoughtful volume). The authors are well suited for their task: Both have been popular and engaging rapporteurs at conferences; both have conducted original research in many of the topics covered in the text; and both have previously written works of considerable pedagogical value.

The text concentrates on the description of pion (and to a much lesser extent, kaon and nucleon) interactions with nuclei provided by multiple-scattering theory. Where the conventional Schrödinger equations dynamics may no longer be adequate is noted, for example, in the influence of meson absorption on elastic scattering. In fact, the combination of quantum field theory, multiple-scattering theory, many-body physics techniques, nuclear physics, and particle physics presented here epitomizes what makes this specialty appealing. The authors present an excellent discussion of the theory of the two-body (meson–nucleon) and three-body (meson–deuteron) problems, a treatment which complements G. E. Brown and A. D. Jackson's *The Nucleon–Nucleon Interaction*. They are then able to contrast their discussion of multiple scattering from a many-nucleon system to the simpler three-body problem and relate the meson–nucleus optical potential to the elementary two-body physics. They also cover comprehensively both the approximations necessary for deducing some popular optical potentials and the possible importance of higher-order corrections not usually included in the popular potentials. The text is rounded out by a clear description of the "P & Q" formulation of the optical potential and of the delta-hole description of meson–nucleus interactions.

Although the book is strong in formalism, its description of phenomenological and computational aspects of the field is uneven. A student would need the supplements provided by the texts by W. O. Lock and D. F. Measday or R. J. Barrett and D. F. Jackson, or some of the reviews in *Physics Reports*, *Annual Reviews*, and so forth. Beyond that, the authors do not appear to provide the same level of appreciation or degree of understanding of the applications of the theory as they provide for its derivation. In particular, their "results" appear too simple and somewhat

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-