physicists and may contain a great deal more of interest to nuclear engineers than does the present text.

An adequate subject index, but no author index, concludes the present volume.

*Edward M. Eyring (BA, physics, 1955, PhD, physical chemistry, 1960, University of Utah) is professor and formerly chairman of chemistry at the University of Utah. His research involves the determination of rates and mechanisms of reactions in liquid solutions and at solid-liquid interfaces. Nanosecond laser flash photolyses, laser Debye-Sears ultrasonic absorption measurements, and laser photoacoustic spectroscopy (but not picosecond spectroscopy) are numbered among his frequently used laboratory techniques.*

### A Shell Model Description of Light Nuclei

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| *Author* | I. S. Towner |
| *Publisher* | Oxford University Press (1977) |
| *Pages* | 383 |
| *Price* | $24.50 |
| *Reviewer* | Sidney A. Coon |

This book is one of a series, titled "Oxford Studies in Nuclear Physics," aimed at the beginning research student. It presents the traditional calculational apparatus of the shell model in a form accessible to the student, but its true subject is of great interest to the general nuclear structure theorist and experimentalist. Or, in the author's words, "the central theme of this book is to trace the steps from the free nucleon-nucleon interaction to the properties of light nuclei." Towner's goal is slightly more ambitious than that of George Bertsch's *The Practitioner's Shell Model* (1972), which emphasized the "qualitative effect of configuration mixing on the physical observables" in terms of the properties of the nucleon-nucleon interaction. This more recent book features a clear, patient exposition with many references for further study, but one sometimes misses the deep intuitive insight and novel results of Bertsch's book. The evident care that has gone into Towner's derivations, in many cases an improvement in pedagogy over the originals in the literature, and a wider range of subjects make this book more suitable for self-study.

After a chapter on mathematical preliminaries, Towner begins by discussing the computation of the binding energy of a spherical closed-shell nucleus in the Hartree-Fock approximation. The free nucleon-nucleon interaction features strong short-range components. They were tamed by Brueckner with the construction of a reaction matrix that expresses the interaction between a pair of nucleons in a background of spectator nucleons. This weakened effective interation can be used in a Hartree-Fock-like mean field theory (misnamed Brueckner-Hartree-Fock theory) to compute the binding energy and static properties of closed-shell nuclei. The simple particle-hole excitations of these nuclei are then discussed with a schematic effective interaction rather than a realistic (i.e., derived with the Brueckner approach) interaction.

In the second half of the book, the author discusses the shell model approach to the calculation of the properties of closed-shell nuclei with one or more additional particles, the so-called open-shell nuclei. He gives a readable presentation of the Bloch-Horwitz demonstration that degenerate perturbation theory could be used to produce an effective Hamiltonian in a truncated model space whose eigenvalues were the true energies of the system. The often-confusing business of eliminating the energy dependence of the resulting effective interaction by the introduction of "folded" Goldstone diagrams receives an especially clear treatment here.

The final two chapters are more phenomenological in that the discussions could be made without reference to the free nucleon-nucleon interaction. Angular momentum considerations dominate the calculation of observables from the eigenfunctions of a Hamiltonian chosen to describe a nucleus or set of nuclei with more than two particles outside a closed shell. The last chapter develops shell model expressions for spectroscopic factors of direct nuclear reactions in which one or more nucleons are transferred from a target to a residual nucleus.

The first half of this book relies heavily on review articles already in the literature. It is good, however, to have this material together with the standard, but daunting, treatment of the Racah angular momentum algebra. Valuable features are the short histories of results and applications at the end of each chapter. These histories seem to end in most cases with papers published in 1974, although the publication date of this typewritten book is 1977. This time lag between the literature cited and the publication date leaves the reader with more pessimism than warranted about progress toward the goal of calculating the properties of nuclei from the two-nucleon interaction. Work in the last four years inspires a modest hope that it is not an unrealistic goal. At any rate, the groundwork is well described in this book.

*Sidney A. Coon (PhD, physics, University of Maryland, 1972) is the author of papers on the free nucleon-nucleon interaction, static properties of closed-shell nuclei, and simple open-shell nuclei. He has worked at the University of Liège and the Technical University of Hannover and is currently a research associate in the Physics Department at the University of Arizona.*

### The Subnuclear Zoo

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| *Author* | Sylvia Engdahl and Rick Roberson |
| *Publisher* | Atheneum Publishers |
| *Pages* | 101 |
| *Price* | $5.95 |
| *Reviewer* | Hugh F. Henry |

This is an *extremely* broad-brush treatment of the entire field of atomic structure. In some 98 rather small pages using large type and including several drawings, the authors touch on essentially everything from the early spherical atom to subnuclear particles, mentioning types of accelerators as well as cosmic rays and fusion enroute. In fact, only some 40 pages, or less than half the book, are devoted to the subnuclear particles (really the results of current high-energy experiments) that are usually considered as inhabiting the "subnuclear zoo"; this section also includes discussion of the "unknown." The nonmathematical treatment is at approximately the level of a lecture (or so) given to high school students, preferably those interested in physics.

Accepting the rather vague and unspecified "ground rules" that seem to apply to semipopular treatments such as this, the book is technically adequate, having no gross errors or inaccuracies beyond what might be acceptable in leaving a generally correct impression. However, this reviewer does find it somewhat disturbing to read that "fermions are particles affected by forces" and "bosons are particles that carry forces," even as it is recognized that these statements rather crudely express an interpretation of certain observations. Furthermore, a statement that "a quantum number is a measurement of some characteristic of the particle—charge for example" is a little more inclusive definition than may be desirable. Unfortunately, the authors do not indicate as clearly as might be desirable that many of their "facts" concerning particles really reflect interpretations based on current theories, about which there are currently some differences of opinion. At the level of their approach, however, this is probably just as well.

Overall, this reviewer had difficulty in evaluating the purpose of the book or in describing an audience to which it might be directed, other than the original comment above. It attempts so much and its treatment is thus necessarily so broad that clarifying details are obviously not included. Similarly, the descriptions and explanations given in nonquantitative terms suffer from the corresponding necessary imprecision of both analysis and language. On the other hand, its coverage is remarkably good. Thus, although a case might be made for its inclusion in a high school or college library for rather casual reading, it cannot be recommended as a book one would like to obtain for reference or even to reread. It would certainly be rather inappropriate and of little use to someone with prior knowledge in the general field.

*Hugh F. Henry has been head of the Physics Department of DePauw University since 1961. Prior to that time, his responsibilities at the Oak Ridge Gaseous Diffusion Plant included those of criticality safety and health physics. His publications in these general fields include the book* Fundamentals of Radiation Protection, *which was published by Wiley Interscience in 1969. He spent a sabbatical leave during 1968-1969 at the National Reactor Testing Station in Idaho Falls, and spent a similar leave during 1975-1976, with his time divided between the National Radiological Protection Board and the U.K. Atomic Energy Research Establishment, both at Harwell, England. He is a member of the U.S.A. Standards Institute (USASI) Committee on Radiation Protection and has been a U.S. delegate to meetings of the International Standards Organization (ISO) in this field.*

### Pulse Radiolysis

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| *Author* | Max S. Matheson and Leon M. Dorfman |
| *Publisher* | American Chemical Society (1969) |
| *Pages* | 202 |
| *Price* | \$8.50 paper; \$14.75 hardback |
| *Reviewer* | James B. Smathers |

I was quite taken back when asked in 1978 to review a book written in 1967 and copyrighted in 1969. After reading through the book, though, I realized that indeed no mistake had taken place. What was an excellent review of the state-of-the-art in 1967 has become a well-written introductory treatment of the area of pulse radiolysis. The material is presented in a clear, concise manner and lends itself to be used as an introductory text on the subject. The obvious deficiency of references that extend only through 1968 is a detraction, the magnitude of which readers will have to determine for themselves.

Chapters 1 through 4 consider radiation sources, detection systems, and dosimetry. The dating of the book is particularly evident in these sections. Chapter 5 treats kinetics nicely. Chapters 6 through 9 treat aqueous systems, hydrated electrons, organic systems, and gaseous systems in turn.

In summary, the book, a paperback American Chemical Society monograph, is considered a worthy library addition for anyone interested in a basic background in pulse radiolysis.

*J. B. Smathers (PhD, University of Maryland, 1967) is presently professor and head of bioengineering and professor of nuclear engineering at Texas A&M University. His experience includes eight years in research reaction utilization and nine years in the biomedical applications of nuclear energy.*

### Nuclear Methods in Mineral Exploration and Production

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| *Editor* | Jerome G. Morse |
| *Publisher* | Elsevier Scientific Publishing Company (1977) |
| *Pages* | 280 |
| *Price* | \$39.95 |
| *Reviewer* | William C. Peters |

This book will appeal to scientists and engineers interested in applications of nuclear technology to the exploration, development, and processing of energy and nonenergy minerals. One of the Elsevier series, "Developments in Economic Geology," this book provides an overview of nuclear techniques that lend themselves to the rapid detection and identification of naturally occurring elements and minerals in field outcrops, mines, drill holes,