Book Reviews

Decay Schemes of Radioactive Nuclei. By B. S. Dzhelepov and L. K. Peker. Pergamon Press, London, 1961. 786 pp. (essentially all illustrations). $20.00

The authors, located at the Radium Institute of Leningrad, are both active in the Academy of Sciences of the U.S.S.R., and have been interested in the decay pattern of radioactive nuclides for some time.

The book is composed almost exclusively of diagrams for the isobaric chains of nuclides, whether as diads, triads, tetrads, etc. The ordinate depicts the energy content of a nuclide. On the abscissa are given the details of the transformation from one element to another. The over-all net effect is that isobaric transformations are shown by a large V, giving the details of transformations from neutron deficiency (β^+ decay) to neutron excess (β^- decay) through the point of maximum stability (i.e., minimum point of V on graphical representation).

The book represents an extension of a technique for representing isobaric decay of radioactive nuclides which was started by Hornyak and Lauritsen in 1948. There are some modifications of the details for representing certain types of transformations (i.e., Coulomb excitation) but, basically, the book attempts to represent the known information on transformations among all isobaric nuclides. The earliest work by Hornyak and Lauritsen in 1948 was for the very light nuclides ($A \leq 20$). Aside from the fact that the details of nuclear structure are still being resolved in the minds of many experimentalists and theoreticians, there is much in this endeavor to merit attention. With certain exceptions (among the light nuclides), the unraveling of the details of nuclear structure is just beginning. This book, as a first attempt, represents a firm foundation upon which more detailed information in the future may be built. As an example of the meaning of this statement, I might refer to a paper by A. J. Grench and S. B. Burson, *Phys. Rev.* **121,** 831 (1961), on the "Decay of Er^{161} (3.1 hr)." The proposed spins and parities for the energy levels of Ho^{161} (2.5 hr) are based on some detailed studies of Er^{161} decay. The Grench and Burson paper, I am sure, represents only the first of many to elucidate details of the energy levels for radioactive Ho^{161}. The tentative state of the art may be illustrated as follows: so little is known about this particular nuclide that the decay scheme cannot be represented in the book under review. This is true, also, for hundreds of other nuclides that are removed by more than one atomic number unit from stability. Even the data among the alpha-particle emitters, which represent the first form of radioactivity discovered, is just beginning to be elaborated, and there remains much to be learned. In any event, this book represents a good beginning to a vast and complex field of investigation.

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[Editor's Note: Dr. William H Sullivan, best known for his authorship of "The Trilinear Chart of the Nuclides," is currently at the Oak Ridge National Laboratory. After receiving his Ph.D. in physical chemistry at the University of Michigan and working several years as a chemist, he came to Oak Ridge in 1944, moving to Hanford shortly thereafter. He was U. S. Scientific Representative at Chalk River, Canada in 1947–48 and Scientific Director, Naval Radiological Defense Laboratory, 1948–51. He returned to the Oak Ridge National Laboratory that year. During the period 1946–51 he was chairman of the Subcommittee on Nuclear Constants, National Research Council.

Steam Cycles for Nuclear Power Plant. By W. R. Wootton. Simmons-Boardman, New York, 1958. $2.75.

This small volume is mistitled; a more appropriate title would have been "Elementary Steam Cycles with Particular Attention to Gas Cooled Reactors." No more than the most cursory treatment has been given the large and complex field described by the title. The monograph, 64 4 in. × 6 in. pages, including 39 figures and 6 pages of tables of the heat content of carbon dioxide, is insufficient to fill more than partial text requirements for a third year college survey course which includes gas cooled reactors as a part of its curriculum. The first 23 pages of the monograph are concerned with descriptions of steam cycles employed in the gas cooled, graphite moderated nuclear plants currently being constructed in Great Britain. The author's connection with this type of reactor has enabled him to present a clear, though elementary, discussion. No economic optimization factors are included, and therefore interpretation of the information presented is left as an exercise for the reader. The basic concepts for establishment of steam pressure and temperature conditions as affected by parameters such as inlet and outlet gas temperature, feedwater temperature, and boiler power consumption are well illustrated, as are limiting conditions of the pinch-point between gas and saturated steam temperatures.

Six pages are devoted to pressurized water and boiling water steam cycles; unfortunately the approach taken is even more superficial than in the gas cooled case. Representative steam plant conditions are given, although no basis for design selection could be gained from this brief treatment. The single page of text dealing with liquid metal cooled reactors is both inadequate and misleading. The ancient canard of violent alkali metal–water reactions is again perpetrated; the statement is made that any possibility of leakage of water into coolant must be eliminated. Of course, the violent reaction associated with high school chemistry demonstrations is the reaction of hydrogen with atmospheric oxygen, and not directly from the metal–water reaction itself. An adaptation of the Loeffler cycle is proposed for liquid metal use; to the reviewer's knowledge this scheme has never been seriously considered by those concerned with liquid metal cooled reactor systems, due to the complication and expense involved. The six appendices give information on steam cycles, Mollier charts, elementary thermodynamics, and turbine characteristics which should be familiar to the well informed college junior majoring in mechanical engineering.

The monograph suffers from attempting to survey a large and important field in a few brief pages. When the author is dealing in a subject with which he is familiar, graphite moderated gas cooled reactors, his presentation is succinct although somewhat superficial. His presentation of steam cycle engineering situations outside the scope of this reactor system should be disregarded.

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[*Editor's Note: Mr. Dickinson is currently Director of the Sodium Reactor Department at Atomics International. He has been concerned with the development of sodium cooled reactors since joining Atomics International in 1956. Prior to this, he was associated with the naval reactor program in the capacity of a Naval Officer, technically associated with the direction of system component development, including propulsion machinery. He holds a Bachelor's degree from the University of California, Master's degree in mechanical engineering from the U. S. Naval postgraduate school, and a Master's degree in nuclear engineering from the Massachusetts Institute of Technology.*]

Radiation Biophysics. By Howard L. Andrews. Prentice-Hall, Englewood Cliffs, New Jersey, 1961. 328 pp., 105 illustrations, $11.35.

Howard L. Andrews is author of other books and many articles about the biological effects of radiation. As Radiation Safety Officer, National Institutes of Health, and Executive Secretary of the Biological Effects of Atomic Radiation Committee, National Academy of Sciences, he is eminently qualified to write on the subject of radiation biophysics.

In his most recent book, *Radiation Biophysics* he offers a unified account of the physical principles, chemical action, and biological effects of ionizing radiation. Andrews begins with the structure of the atom and proceeds to discuss the various kinds of radiations and how they are produced, the interaction of radiation with matter, methods of dosimetry, chemical effects of radiation, effects on macromolecules, effects on cells, clinicopathological effects, and health protection. Problems and bibliographic references are included at the end of each chapter, and tables of useful physical constants and biological data are appended at the back of the book. Helpful diagrams, formulas, working graphs, and illustrative examples are used generously throughout, and the subjects covered are listed in an inclusive index.

The author's terse, lucid, and engaging style should make the book intelligible to a wide audience of nonspecialized readers. Since, however, none of the subjects is treated exhaustively, the volume should be more useful as a guide to students and others wishing to survey the field of radiation biophysics, than as a reference book for workers in radiobiology, radiology, health physics, and related disciplines. Nevertheless, an unusually broad range of questions is covered coherently and concisely, without sacrifice of objectivity or timeliness, and with creditable accuracy. One might only wish that the author's skill would be applied to an expanded treatment of the same material in later editions.

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[*Editor's Note: Dr. Arthur C. Upton was educated at the University of Michigan, receiving his B.A. in 1944 and M.D. in 1946. After instructing in pathology at that university, he came to Oak Ridge National Laboratory's Biology Division where he is now chief of the Pathology Physiology section. He is on many committees concerned with effects of radiation, notably the NAS-NRC Subcommittee on Long-Term Effects, the American Cancer Society Advisory Committee on Research on Etiology of Cancer, and the International Committee on Radiological Protection Subcommittees on Radiation Biology and Relative Biological Effectiveness.*]

Nuclear Reactor Theory. By J. J. Syrett. Simmons-Boardman, New York. 76 pp. $1.95.

This work is a very brief treatment of the subject of reactor theory originally published by Temple Press Limited in 1958 as one of several monographs on nuclear engineering. The material in this monograph was developed from lectures presented by the author to students of engineering and physics at the University of Manchester. The author is a member of the Reactor Division of the Atomic Energy Research Establishment, Harwell.

The expressed purpose of the monograph is to provide an outline of the physics of nuclear reactor design for the benefit of the nonspecialist in the field. It was the author's intent to achieve a light treatment at low cost. Knowledge of elementary calculus and nuclear physics is assumed. The treatment introduces the essential physical concepts and ideas by brief descriptions and discussion, with some use of mathematical analysis to develop the more complicated notions. Concepts and methods used in the reactor theory which were drawn from other areas of physics and analysis are introduced with a simple reference to a classical source.

The text includes chapters on: nuclear chain reactions, diffusion of thermal neutrons, slowing down of neutrons, the calculation of critical size, lattice calculations, reactor operation at power, and types of reactors and fuel cycles. The first four chapters (47 pages), in the order mentioned, are general treatments, with an occasional reference to the relevant properties of natural uranium and graphite systems. In the last three chapters, emphasis is placed on the detailed characteristics of heterogeneous, uranium-graphite, gas-cooled power reactors of the type developed for power stations in the United Kingdom. The individual chapters are divided into sections (varying from 5 to 15), some so brief as to consist of only a few sentences; thus, descriptive passages tend to be extremely short. Many working formulas (relevant to uranium-graphite systems) and recipes are reported.

Of these seven chapters the ones on diffusion and criticality are the most satisfactory. The ideas are developed systematically and the various sections are nicely related. The use of mathematical tools are prevalent here, and this aids in achieving continuity and completeness. The chapter on lattice calculations is very short and involves almost no