sents an exposition of Feynman's positron theory for the elementary case without second quantization. The text derives coherence from the emphasis throughout on Feynman's procedures, for which pedagogical advantages of "visualization and ease of understanding" are claimed. Part II of this volume introduces standard field theory, including all types of coupling necessary for electromagnetic and mesonic interactions. The fields are next quantized, covariant perturbation theory is introduced, and its use in calculating the *S* matrix is discussed. The equivalence of the whole scheme with Feynman's techniques is established, following the procedures of Dyson and Wick. Almost the last third of the book is devoted to the renormalization of divergences, which forms so important a part of contemporary field theory. Concluding sections discuss recent developments.

There are a number of nice features in this book, such as the use of radiative corrections to Coulomb scattering as a means of calculating the Lamb shift and the magnetic moment correction $\Delta\mu/\mu = \alpha/2\pi$. The Bethe-Salpeter two-body equation is introduced early in an elementary way and then rederived in more detail in a concluding section. The style of the text is extremely readable and its freedom from typographical errors is remarkable. The chief omission seems to be in applications of the formalism to meson-nuclear problems: for instance, the Tamm-Dancoff method is not mentioned, nor is isotopic spin—all examples are worked out for neutral mesons. Of course these matters are taken up in volume II, but their lack makes volume I a little less self-contained. Although volume I may be of less widespread and immediate interest than volume II because of its formal character, by the same token, it is likely to be the more enduring member of the pair.

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An Introduction to Reactor Physics. D. J. Littler and J. F. Raffle. McGraw-Hill, New York; Pergamon, London, 1955. viii + 196 pp. Illus. $4.50.

This work is based on a set of introductory lectures that were delivered by the authors to a mixed audience of engineers and physicists who were involved in the design and construction of nuclear reactors. The book deals exclusively with reactors in which fissions are produced predominantly by thermal neutrons.

The first four chapters are introductory in nature. They deal with the radioactivity decay laws, nuclear binding energies, the organization of the periodic table, and other background information that is not directly applicable to the design of reactors. The kinetic theory of neutrons is presented in Chapters 5, 6, and 7. Topics treated include neutron nuclear interactions, the concept of the cross section, the diffusion equation, and general remarks on chain reactions. Chapter 8 deals with the critical conditions for unreflected, homogeneous reactors. Heterogeneous reactors are discussed in Chapters 9 and 10. The time-dependent behavior of reactors is discussed briefly in Chapter 11. Chapter 12 deals with a collection of miscellaneous problems related to the running of a reactor at power. These include the temperature coefficient of reactivity, the absorption of neutrons by fission products, the activity of fission products as a function of time after shutdown, and the radioactivity of the air in an air-cooled reactor. In Chapter 13, shielding against gamma rays is discussed. Chapters 14 and 16 treat radiation detectors and experimental methods for measuring reactor parameters. Radiation damage is the subject of Chapter 15.

The background material in the first four chapters is condensed in a terse fashion. For this reason, some of the examples require greater explanation. This terseness is also apparent in the section on neutron interactions where, for example, the inverse velocity law is mentioned only casually.

The behavior of thermal neutrons in lattice reactors is treated better than any other subject in the book. The treatment is of a handbook type with sufficient explanation, formulas, and examples to instruct the reader in the techniques of lattice calculations.

In general, the treatment of the subject matter is uneven. Undue attention is given to mathematical details in some places, while the physics is glossed over. The mathematical solution of the diffusion equation is discussed in detail, while hardly a mention is made of "age" theory. Derivations are carried part way with vigor and precision and completed by use of formulas whose origin is obscure.

It is not clear for whom the book is intended. The material is not sophisticated enough for the serious student, and yet it is not useful as a handbook for the reactor designer.

The shielding portion of the book discusses the various processes by which gamma rays are attenuated. The energy dependence of compton, photoelectric, and pair-production cross sections is given, but there is no mention of build-up factors. Principles of neutron shielding are not discussed at all.

The language in many cases is less precise than one would like. The assumptions underlying the derivations are not always stated. In addition, typographical errors, especially those in formulas, represent serious pitfalls for the reader.

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Principles of Guided Missile Design. *Guidance.* Arthur S. Locke in collaboration with Charles H. Dodge, Samuel F. George, Laurence F. Gilchrist, William C. Hodgson, John E. Meade, John A. Sanderson, and Charles F. White. Van Nostrand, New York, 1955. xvii + 729 pp. Illus. $12.50.

This book, which is the first of a series in the field of guided missile design, is intended for the serious graduate student as well as for workers in the field. The complete series, which will include, among others, topics on propulsion, aerodynamics, launching, testing, and operations research, is edited by Grayson Merrill. A. S. Locke, who wrote most of the volume on *Guidance,* was greatly assisted by seven principal collaborators, each of whom is an expert in a given field.

This book represents the first serious attempt to collate the voluminous declassified literature in the various areas that collectively form the field of missile guidance. This Herculean task has been performed quite well by the author and his collaborators. It is not easy reading, nor is this its intent. The symbolism for the mathematics varies considerably through the volume, but each chapter is essentially self-contained in that the notations used are, in general, sufficiently well defined to avoid confusion.

Some of the chapters go into great detail on certain subjects—for example, "Transmission of radio waves," in which most of the material is not new or even presented in a better form than may be found in standard texts on this subject. Other chapters, which discuss subjects that are bound to play an increasingly important role in the future of missile guidance, are abbreviated or only present elementary principles. These omissions are entirely excusable on security grounds. However, the chapter on the measurement of missile motion, although satisfactory as an elementary presentation of the problem, could have been expanded considerably without a violation of security regulations. The fundamental laws that govern the action of gyros and their associated parts are well known and have been recorded in great detail in texts and other publications in countries abroad. References to these works are not even included at the end of this chapter. In general, in this area, too few references are given to other works on the various subjects in most of the chapters, and yet, in many ways, the volume is not self-sufficient.

The book, however, contains many very practical hints and suggestions that were obviously born out of the experiences of the author and his collaborators. The chapters on "Target considerations" and "Prelaunching and launching" are particularly significant in this regard. The book also gives many examples of economic considerations, such as Chapters 15, 19, and 20, all of which are so necessary to guide our young and brilliant engineers in this highly important field.

In general, the book provides a valuable aid for advanced courses in universities, either as source material or as an advanced part-time text in specialized courses. Its primary value, however, is that it provides source material and refresher material to engineers who must perform daily tasks as advanced systems designers in both civilian and military establishments in this highly complicated field.

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Astrophysical Quantities. C. W. Allen. Athlone Press, London, 1955 (distributed in the United States by John de Graff, Inc., New York 10). xi + 263 pp. $10.

Here is a volume that every teacher and research worker in astronomy and its allied sciences will want handy for quick reference. A large number of physical constants and quantities are tabulated, in addition to what the author considers to be the best available data on the earth's atmosphere and interior, the sun, stars, planets, nebulae, and galaxies. Great care has been taken to give clearly the units of every quantity that is tabulated, and numerous conversion formulas are included. Copious references provide the reader with the sources from which much of the information is drawn. The judgments by which the author derived the tabulated values are not given.

The material embraced in this compilation runs over such a wide range of subject matter that it is scarcely to be expected that all topics would be covered to the same degree of thoroughness and reliability. More data pertaining to radio astronomy might have been included advantageously. In a number of instances, better data than those quoted exist in the literature. The temperatures quoted for the interior of the earth seem improbable. The failure to distinguish between the Rosseland and Chandrasekhar mean absorption coefficients in section 65 is unfortunate. Section 95 does not do justice to the various three-color systems such as those of Becker, Johnson, and Morgan, which appear to be of increasing importance in photometric work. The table of line emissions in planetary nebulae would have been much better if it had contained the actual data for some particular nebulae. The table of partition functions is somewhat inadequate.

Various minor shortcomings are manyfold offset by the great service that has been rendered in putting together in a concise fashion so much of the basic useful quantitative data in astrophysics.

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Principles of Physical Metallurgy. Morton C. Smith. Harper, New York, 1956. 417 pp. Illus. $6.

This book is the first of a two-volume series. The second book, *Alloy Series in Physical Metallurgy* was not available for this review. The author's expressed purpose is to ". . . assist the thoughtful metallurgist . . . in achieving a fundamental understanding of metal behavior." Smith recognizes the difficulty in pleasing both the scientist and the engineer in one book, but, unfortunately, it appears that his efforts please neither one.

A little less than the first half of the book is devoted to elementary atomic physics, crystallography, crystal types, polymorphism, and crystal imperfections. This last subject includes such diverse topics as freezing of metals, dislocations, Hume-Rothery rules, and ordering. A brief chapter on magnetic and electrical properties completes the first section. The organization and method of presentation are neither bad nor distinguished; in essence, the author has boiled down the well-known books of Seitz, Cottrell, and Barrett. The coverage of topics is broad rather than deep, and tends to vary in emphasis. Four pages are devoted to the amorphous "Beilby layer," and somewhat less space is given to dislocations, although the latter are subsequently reintroduced. Dislocations, lineage, and mosaic structure are treated successively with no attempt at interrelation.

The greater part of the book concerns deformation of metals, effects of deformation and temperature, and fracture. The subjects are treated in a rather loosely knit fashion. Descriptions of the various properties are usually general with occasional references to specific alloy systems. Little use is made of the theories developed in the first half of the book. Although about 20 pages are devoted to creep, experimental work and theory of the last 10 years are largely ignored.

A great many (apparent) statements of fact are open to question; for instance, Smith states that second-stage and third-stage creep do not occur in compression, although it is well known that they do. In another example, he states that mechanical polishing of copper results in mechanical twinning. Unfortunately, there are very few references, so that one cannot trace some of the author's unusual conclusions to their sources.

Attempting to educate the engineering metallurgist, as the author intends, is a worthy and much-needed endeavor, but in a book of this size it is difficult to give more than superficial coverage of many important topics; the author has done no more. Furthermore, the lack of references and the use of books for most references (thereby causing much material to be out of date) decrease the usefulness of the book if it should whet the interest of the reader.

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Structural Geology for Petroleum Geologists. William L. Russell. McGraw-Hill, New York, 1955. x + 427 pp. Illus. $7.50.

Russell's new textbook on *Structural Geology for Petroleum Geologists* has been prepared with an objective that, to my knowledge, is new, original, and so worthy that I wonder why it had not been thought of before. As the title indicates, it is neither a textbook on petroleum geology nor a textbook on structural geology, although it includes and combines subject matter ordinarily treated in each of these, omitting parts of the other subjects that do not bear on the new objective.

In the subject of petroleum geology, it thus omits such matters as chemistry of hydrocarbons, the hydrology of petroleum deposits, and the origin, migration, and accumulation of petroleum; in the subject of structural geology, it omits structural features of metamorphic and igneous rocks, neither of which ordinarily contains petroleum deposits. The text is, however, not merely a treatment of the structure of known oil and gas reservoirs, for the petroleum geologist is less a developer of proved deposits than he is an explorer for deposits yet un-