Books

The Physical Theory of Neutron Chain Reactors. By Alvin M. Weinberg and Eugene P. Wigner. 801 pp. U. of Chicago Press, Chicago, Ill., 1958. $15.00. *Reviewed by E. Richard Cohen, Atomics International.*

Nuclear reactor theory has been an important branch of applied physics for more than fifteen years, yet the first reasonably comprehensive text on the subject has only now appeared. The reasons for this are many; security restrictions and wartime censorship cannot be blamed exclusively. Radar developed at about the same time and under almost as stringent secrecy; yet the past ten years have seen numerous textbooks in ultra-high-frequency techniques, and engineering schools throughout the country responded almost immediately with courses and curricula. This is perhaps the major difference. In reactor theory there was no structure upon which to build. Whereas radar represented only a tremendous extension of traditional disciplines, atomic energy thrust upon physics a burden which it was not prepared to carry.

For several years Alvin Weinberg has been calling for the establishment of the "scholarly tradition" in reactor technology. We cannot say that this book, per se, fully establishes that tradition, for tradition cannot be so easily achieved; but it can be said that this is the first book in reactor theory which displays the spirit of scholarship which has been for so long lacking in the field. To so classify Weinberg and Wigner's book is not to disparage Davison or Kourganoff, both of whom have produced excellent volumes on the solution of the equations of neutron transport, but these books are to be considered as applied mathematics (a field which already has an established tradition), and do not pretend to cover the somewhat different field of reactor physics. The same exception can be made to the books by Hughes, by Wirtz and Beckhurts, and others, which discuss neutron physics as a part of modern nuclear physics in which reactors are a tool and not the end product.

The Physical Theory of Neutron Chain Reactors devotes one quarter of its 800 pages to nuclear physics, in particular to the theory of low-energy (less than 1 Mev) neutron cross sections. As such, Part 1 represents an excellent review of the subject in which Professor Wigner's fine hand is evident. Part 2 treats the transport theory of neutrons in general terms, and includes an excellent summary of the solution of the Boltzmann equation by the spherical harmonic method. The last half of the book covers homogeneous and heterogeneous reactors. Throughout this discussion the emphasis is on general aspects and basic formulations rather than on specific calculations or numerical examples. Examples are not lacking, however, and results from the literature are used extensively to illustrate theory, although not with the numerical detail of Murray or Glasstone and Edlund. The discussion of heterogeneous reactor cores and the calculation of the flux distribution in a lattice cell is perhaps the most complete treatment I have seen, some of the material having been resurrected from unpublished wartime papers.

Throughout the entire book physical insight is stressed, and the authors continually take time out following a section on details for a mental step back to look at the entire structure. The book is, therefore, a gentle blend of mathematical physics and reactor technology.

There is one jarring note, however, which is the authors' attempt to introduce the Fermi (symbol, F, equal to 10^{-24} cm^2) as a cross-section unit. Enrico Fermi certainly deserves to be honored in some manner in the field of reactor technology but the "barn" appears to be so firmly entrenched as the name of this unit that only a strong advertising campaign could sell the change. There is in addition the fact that "fermi" already denotes a length, 10^{-13} cm, which has received almost universal adoption in nuclear structure work. The authors recognize this but dismiss the use as "arcane". It will be most interesting to see how battle between "Fermi" and "fermi" is resolved; in the meantime the book will serve as the basis for a scholarly tradition in reactor theory even if it adds nothing to the scholarly tradition in semantics.

The Physics of Elementary Particles. By J. D. Jackson. 135 pp. Princeton U. Press, Princeton, N. J., 1958. $4.50. *Reviewed by M. E. Rose, Oak Ridge National Laboratory.*

This book is based on a series of lectures on elementary particle physics delivered by the author at the Summer Seminar of the Theoretical Physics Division of the Canadian Association of Physicists, in Edmonton, Alberta, during the summer of 1957. This material originally appeared in a paper-backed edition. The present version has been brought up to date, or as up to date as is possible in a field which is developing with such rapidity. The author, of course, is aware of this enormous "obsolescence" rate and expresses the hope that this little book will nevertheless serve as a useful introduction to the field. It is just that and a rather good one.

Actually there is very little in the book which, at this writing, would be described as obsolescent. The contents represent a reasonably complete if highly compact description of the state of our knowledge in the spring of 1958. Since that time a number of advances have been made. For the most part these represent a resolution of apparent discrepancies between theory and observation. For example, the difficulty concerning π-e decay no longer exists. Nevertheless, the fact that

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THEORY OF ELASTICITY (Vol. 7)

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This Volume 7 deals with the theory of elasticity. Since it is written primarily for physicists, it includes not only the ordinary theory of the deformation of solids, but also some topics not usually found in textbooks on the subject, such as thermal conduction and viscosity in solids, and various problems in the theory of elastic vibrations and waves. However, the authors have discussed only very briefly certain topics such as complex mathematical methods in the theory of elasticity and the theory of shells.

To be published June 1959—price to be announced

FLUID MECHANICS (Vol. 6)

Translated from the Russian by J. B. Sykes and W. H. Reid

Volume 6 treats the theory of the motion of liquids and gases. A distinctive feature of the book is its description of fluid mechanics as a branch of theoretical physics. The aim of the authors has been to develop as fully as possible all matters of physical interest, and to do so in such a way as to give the clearest possible picture of the phenomena and their interrelation. Consequently, they do not discuss either approximate methods of calculation in fluid mechanics or empirical theories devoid of physical significance. On the other hand, the volume treats topics not usually found in textbooks on this subject, such as the theory of heat transfer and diffusion in fluids, acoustics, the theory of combustion, the dynamics of superfluids, and relativistic fluid dynamics.

To be published July 1959—price to be announced

ALREADY PUBLISHED

QUANTUM MECHANICS Nonrelativistic Theory (Vol. 3)

Translated from the Russian by J. B. Sykes and J. S. Bell

From a review in *Physics Today:*

"A magnificent contribution to the pedagogy of physics."

515 pp, 51 illus, 1958—$12.50

STATISTICAL PHYSICS (Vol. 5)

Translated from the Russian by E. Peierls and R. F. Peierls

496 pp, 1958—$12.50

THE CLASSICAL THEORY OF FIELDS (Vol. 2)

Translated from the Russian by Morton Hamermesh

The authors are now at work on a revised Russian edition, which will be published in about two years in a format uniform with that of the four volumes listed above. Pending publication of this second edition, Addison-Wesley continues to offer this original translation which has met with such wide acceptance.

354 pp, 12 illus, 1951—$10.00

ALL VOLUMES AVAILABLE IN THE U.S.A. AND CANADA FROM

ADDISON-WESLEY PUBLISHING COMPANY, INC., Reading, Massachusetts, U.S.A.

these recent developments could not be included does not appreciably mar the book or impair its usefulness.

The subject matter is divided into three parts of roughly equal prominence: low-energy pion physics, K-mesons and hyperons, and weak interactions. The emphasis in the latter section is on nuclear beta decay. The treatment, of course, is phenomenological with emphasis throughout on physical ideas and results and little detail of calculation is presented. In general, the style is reminiscent of *The Physical Review* or similar journals with a generous sprinkling of footnotes and references on almost every page. While it is true that there is a school of thought which decries this manner of writing, especially in the form of a book, it does seem appropriate in the present context. Any particular topic is sufficiently well documented as to permit the reader interested in further details to find them in the literature with no undue difficulty.

In the natural course of events, as time goes on and the field of elementary particle physics matures, there will certainly be further books on the subject. In the meantime this book does provide a well-written, handy compendium of experimental facts and theory and should prove to be quite useful.

Quantum Electrodynamics: Selected Papers. Edited by Julian Schwinger. 424 pp. Dover Publications, Inc., New York, 1958. Paperbound $2.45. *Reviewed by J. C. Polkinghorne, University of Cambridge.*

Thirty-four original papers are reprinted, covering four hundred and twenty-four pages of often minute type, and all for $2.45. The book starts with Dirac's original paper applying quantum mechanics to radiation problems, shows how the theory was elucidated during the thirties, and finally records the consummation of the wonderfully fertile postwar years when the troublesome infinities were spirited away by renormalization theory and unambiguous correct numerical predictions obtained for such subtle phenomena as the Lamb shift and the anomalous magnetic moment of the electron.

No anthologist can please all his readers. This reviewer would have liked to have seen the account of renormalization rounded off by the reprinting of Salam's work on the isolation of divergencies and the elegant, if somewhat elliptic, papers of Ward. Perhaps the editor thought Källén's paper proving that at least one of the renormalization constants is infinite a sufficiently gloomy ending, but reference could also have been made to the questions of the convergence of the perturbation series and the possible existence of "ghost states".

Despite these omissions the book contains a great deal of material for its price, but for what purpose? Original expositions are seldom the most transparent so that it can hardly be intended as a means of learning the subject. Luther spoke of the relief with which he turned to Paul from his interpreters and it is no doubt good at times to study the masters. However, except for a few items, such as Solvay Conference reports, all these papers are readily at hand in any scientific library. We are told that in this volume the history of quantum electrodynamics is "dramatically unfolded through the original words of its creators". Yet without some further guidance the reader who is not already an expert will find the drama as fashionably enigmatic as a play by Samuel Beckett. Unfortunately, we mostly cannot take our history raw but need it predigested. Schwinger has written a seventeen-page skeletal preface briefly indicating the contexts of the printed items. It is a pity that we have not been treated to a fuller interpretative and critical analysis from the pen of one who has played so distinguished a part in these fascinating developments.

An Introduction to Combinatorial Analysis. By John Riordan. 244 pp. John Wiley & Sons, Inc., New York, 1958. $8.50. *Reviewed by T. Teichmann, Lockheed Missile Systems Division.*

Combinatorial analysis has a long and respected history going back to the work of Pascal, though it was first formalized by Leibniz. Its origin was in problems of probability though it has subsequently become important in algebra, topology, and number theory. It has, however, seemed to fall by the wayside in the growth of modern mathematics because of its intrinsically numerical nature and its unadaptability to the intense abstraction which has become so popular. Lately it has regained a more respected place, owing partly to pressure of applications and partly to consideration of highly complex systems in which determination of number of paths alone was of real value.

The present volume gives an account of this important topic in the light of the newer problems to which it is applied. The treatment given centers around generating functions and their applications to the variety of problems in which combinatorial analysis is important. The discussion ranges from comparatively simple permutations and combinations through some aspects of substitutional analysis, distribution analysis, and partitions to more profound topics of trees and graphs. These major topics are accompanied by substantial lists of references and by long sets of problems which complement the text and serve to test the understanding of the reader. The style is generally clear and the author has not hesitated to carry out the details of calculations in the text where it seemed to illuminate the argument. Nevertheless, the book does not make easy reading, at least for a newcomer, for the author manages to communicate a sense of sophistication which is not easy for an inexperienced reader to absorb even when all the details of the argument seem to be present. This work should probably be read in conjunction with or subsequent to the study of Netto's *Kombinatorik* in which case it will serve to give the reader an excellent command of the subject, both from the point of view of understanding and problem solving.