
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} cm²) 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