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Book Reviews

Relativistic Theory of Reactions. By J. Werle. J. Wiley and Sons (1966). 457 pp. $17.50.

Theoretical physicists bemoan the sad state of our understanding of elementary particles and their interactions. There is no satisfactory theory for treating problems of interaction and decay. Despite this, there has been a great deal of progress in elementary physics during the past ten years. The reason for this seemingly contradictory situation is that one can make many deductions about the relations of quantities without being able to calculate their individual numerical values.

The requirement of relativistic invariance of physical theories severely limits the kinds of model theories one is permitted to try. In addition, any assumption about symmetry of a theory will impose further restrictions on it.

The natural way to formulate problems involving symmetry is to use the language (and some of the tools) of group theory, which provides a formal method for examining the consequences of an assumed invariance.

Professor Werle's book begins with a self-contained introduction to group theory. The presentation is fairly brief, but well done. He then shows how invariance principles influence the choice of suitable basis functions for the description of one-, two-, and many-particle states. Here one sees how the chirality description is introduced in a straightforward way. This is followed by a discussion of the symmetry properties of S matrix elements and the associated selection rules and correlations between cross sections. There is a good introduction to the unitary groups that have helped in the classification of strange particles and a thorough treatment of the discrete operations (space inversion, time reversal, and charge conjugation).

This book assumes that the reader comes to it with a good knowledge of quantum mechanics. It provides a useful source of detailed information about the basic tools of the theory of elementary particles.

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About the Reviewer: Professor Hamermesh is now head of the School of Physics and Astronomy in the Institute of Technology of The University of Minnesota, to which he came in 1963 after an extended stay at the Argonne National Laboratory. At Argonne he was Director of the Physics Division and an Associate Director of the Laboratory. His specialty is theoretical nuclear physics with particular interest in elementary particles, group theory, and the interaction of neutrons with matter. Following formal academic work at the College of the City of New York and at New York University, Professor Hamermesh did post-doctoral research at Stanford and at Harvard.

Introduction to Nuclear Reactor Theory. By John R. Lamarsh. Addison-Wesley Publishing Company (1966). 585 pp. $15.00.

This recently published book promises to be very useful as an up-to-date text book for a first course in reactor theory. The book contains 15 chapters, presenting most of the important material that can be discussed by the use of elementary diffusion theory.

The first chapter is a very brief review of nuclear physics, which is followed by a good semi-qualitative presentation of the interaction of neutrons with matter. This chapter, contrary to the author's statement that a knowledge of quantum mechanics is not assumed, will be most useful *only* to those students who have had quantum mechanics and nuclear physics. The fission process is treated separately in Chap. 3 and contains the important basic data. This is followed by a brief chapter on neutron chain reacting systems—a more comprehensive discussion than given would be helpful.

The next four chapters develop the basic material in neutron transport using the elementary diffusion approximation. The material is organized along the lines of earlier texts, and the notation is that established by Glasstone and Edlund. The presentation of resonance absorption is very good. The NR and NRIM approximations are developed with Doppler broadening. The temperature dependence of resonance absorption, and measurements of resonance integrals are discussed. The student is introduced to the rather complex problem of thermal-neutron spectra by a discussion of the scattering kernel for a free gas. The figure on page 243, for example, showing the scattering kernel as a function of the ratio of the neutron energy-to-kT, is very instructive and is representative of the many fine figures used to illustrate the material throughout the book.

The next three chapters discuss criticality calculations using the Fermi theory, the multigroup diffusion theory, and specialized techniques for treating lattice-cell heterogeneities. There are many illustrative examples and a profusion of problems on which the student can test his understanding.

The next chapter gives an elementary discussion of reactor kinetics without feedback. Some discussion of reactor dynamics with temperature feedback probably should be included at this point in an elementary course. Chapter 13 discusses the slow changes in reactivity, including the change of reactivity with fuel burnup and the production of plutonium. This is followed by a chapter on control rods, in which the material is that developed during the early days of the Manhattan project. This is not of very great value today, and the reviewer feels the author should have expanded his brief discussion of A. F. Henry's method for calculating cruciform control rods such as are used in water reactors. A presentation of the area-absorption technique proposed by Hurwitz would also prove useful.