Books

Nuclear Reactions, Vol. 1. Edited by P. M. Endt and M. Demeur. 502 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1959. $12.50. *Reviewed by Herman Feshbach, Massachusetts Institute of Technology.*

BY comparing it with the standard texts in nuclear physics the need for a volume such as this can readily be appreciated. Although there is considerable overlap, the amount of material which one finds in *Nuclear Reactions* and which is completely absent from these books (or just touched upon) is remarkable especially when one recalls that the time lapse is considerably less than a decade. And this is only the first volume of a projected two-volume work!

The first chapter on the theory of the nucleus as a many-body system by R. J. Eden is an example. Eden discusses essentially the Brueckner method, relating it to the shell model, the optical model, and finally high-energy nuclear reactions. The second chapter by J. P. Elliot is on shell theory. This theory now contains many refinements leading to the intermediate coupling version which take it well past the simple single-particle theory first formulated. Indeed even rotational properties are found to emerge if configuration interactions are considered but of course with considerable labor since the shell model is hardly the most convenient zeroth approximation. Nuclear rotational motion is discussed by A. K. Kerman in Chap. 10. Again this is a completely new subject developed in the past few years by A. Bohr and B. Mottelson. In this chapter we find a wide variety of predictions on energy spectra, electromagnetic and β transitions made by the strong coupling version of the theory. We find also considerations which are concerned with the justification of the model, and the eventual calculation of the parameters such as the moment of inertia.

So far this material furnishes essentially background material for the main subject of this book. Eden does discuss the optical model and Kerman does consider the scattering of low-energy neutrons by rotating nuclei, but nuclear reactions are not involved in their main theme. The remaining chapters are concerned with nuclear reactions. Certainly the most novel is contained in the chapter by J. H. Fremlin on heavy-ion reactions produced when the more complicated nuclei are employed as projectiles. Material which would have been familiar to the reader of say Blatt and Weisskopf's book is found in the chapters on "Angular Correlation and Polarization" by L. J. B Goldfarb, "Resonance Reactions, Theoretical" by E. Vogt, "Resonance Reactions, Experimental" by H. E. Gove, "The Statistical Model" by K. J. LeCouteur, "Neutron Resonances in Heavy Nuclei" by D. J. Hughes and R. L. Zimmerman, and finally the chapter by P. C. Gugelot on medium-energy nucleon and alpha-particle scattering. There of course have been a great many new developments. Gugelot, for example, is mainly concerned with the "direct interaction". Hughes and Zimmerman discuss the strength function and scattering length for thermal neutrons and, very importantly, the statistical properties of level spacings and widths which give a new insight into the statistical model. Angular correlations and polarization measurements have become major instruments in the determination of the properties of nuclear levels. Nuclear reactions are just a possible example of angular correlation and the methods of Racah and Wigner and Eisenbud can be employed to codify and classify the possible phenomena. The pertinent formulas are given in the article by Goldfarb. Vogt's, Gove's, and LeCouteur's articles are closer in spirit to Blatt and Weisskopf. Vogt describes the Wigner theory of resonances reactions. The new element he includes is the intermediate coupling model of giant resonances. Gove's article contains a detailed discussion of possible resonance reactions, with particular emphasis on the methods by which various properties of the target or compound nucleus can be extracted from the data.

Needless to say, these authors know their subject and the articles reflect that fact. Of course in the short space allotted it is not possible for them to transmit their understanding in all its subtlety and depth. Nevertheless it is remarkable how clear and informative most of the articles are.

A Compendium of Mathematics and Physics. By Dorothy S. Meyler and O. G. Sutton. 384 pp. D. Van Nostrand Co., Inc., Princeton, N. J., 1958. $5.00. *Reviewed by J. Gillis, The Weizmann Institute of Science.*

THIS book is an impressive demonstration of how much can, by orderly arrangement, be compressed into a modest space. About two thirds of it is devoted to formulae of pure mathematics and the remainder to physics. Any student familiar with all the results in the book, and also with the underlying theories and proofs which are not in the book, can reasonably claim to have a large part of a good education. To illustrate its range one might mention that it includes algebra (from elementary algebra through matrices to algebraic forms and elementary group theory); plane and spherical trigonometry; analytical geometry (plane and solid); plane projective geometry; differential geometry; material of a US college course in "advanced calculus"; vector analysis, differential equations, and several minor items (including Bernoulli's and Euler's numbers). And the range of formulae is well up to good university level. The scope of the physics section is similarly