# Books

**Group Theory:** and its Application to the Quantum Mechanics of Atomic Spectra (Revised Edition). By Eugene P. Wigner. Translated from German by J. J. Griffin. 372 pp. Academic Press Inc., New York, 1959. $8.80. *Reviewed by Herman Feshbach, Massachusetts Institute of Technology.*

THE fine qualities of this superb book are surely well known to the readers of this journal. Although it was first published in 1931, almost three decades ago, it is remarkably modern in its approach and of great value to the theoretical physicist of today. This phenomenon must of course be a consequence of the clarity and cogency of the presentation. But it also follows from the now universal recognition of the role of symmetry in all of physics. Once the symmetry structure of a phenomenon is known one can state which processes are allowed, which are forbidden, and which are related. Or vice versa, as the recent history of the study of "strange" particles shows very clearly, by determining experimentally the allowed and forbidden transitions one can be led to the determination of the symmetries involved. As a corollary, knowledge of the symmetry of a problem and application of group theoretical methods permit the inclusion of all the effects of symmetry ab initio, reducing the complexity of the theory and revealing the relevance of various elements entering into it.

Because of this relatively recent renaissance a number of books on the application of group theoretical methods have appeared in recent years. However most of these have been monographs and rather specialized in their orientation. But before these can be of value to any but the cognoscenti a book giving the necessary background and emphasizing the conceptual basis, rather than the mechanics of these methods, was needed. This is provided by the present volume in which group theory is applied to the quantum of atomic spectra. The first three chapters give the basic elements of linear vector theory. Chapters four through six provide an introduction into quantum mechanics. Chapters seven through sixteen deal with group theory. The author starts this section with the elementary definitions and properties of groups but is soon involved with the general theory of representations and with continuous groups. Separate chapters are devoted to the symmetric group, the rotation groups, and the three-dimensional pure rotation group. Chapter sixteen on the representation of the direct product is of course essential for the application to atomic spectra which is discussed in Chapters 17 through 25. This section includes a chapter on Racah coefficients not present in the German edition. Both Chapters 26 and 27 are also new. Chapter 26 on time inversion is a very welcome addition since Wigner's original work on this subject was not readily available. Chapter 27 is on the physical interpretation and classical limit of the $3j$ and $6j$ coefficients. The book concludes with a short list of conventions and a list of formulas provided by the translator. Those who know the German edition will be cheered to learn that in this book a right-handed rather than a left-handed coordinate system is used. References have been brought up to date and there has been some revision of the original material.

It is probably not necessary to add that the discussion of these varied topics is perspicuous throughout. The neophyte should have little difficulty, while the more informed will find this book will broaden his understanding of the important concepts and methods.

**The Theory of Elementary Particles.** By J. Hamilton. 482 pp. Oxford U. Press, New York, 1959. $12.00. *Reviewed by J. C. Polkinghorne, University of Cambridge.*

IN their efforts to understand the behavior of elementary particles physicists employ two principal methods. One is the crude phenomenology which seeks to extract by intuitive hook or crook the essence of a physical situation. Its voice is sometimes somewhat oracular—it is not always entirely clear what we know when we have fitted the data with an optical model potential. The other method is that of quantum field theory. Its intellectual content is clear, but though its approach is both powerful and elegant its elegance does not always satisfy the mathematician any more than its power is yet sufficient for the physicist. Each method is the complement of the other and both are necessary in the study of elementary particles.

Dr. Hamilton has included much more phenomenology than is usually found in books of this kind. There is a lot of discussion of angular correlations and a long chapter on polarization. This is all to the good. Indeed this part might have stood alone as a slimmer and cheaper volume without the simple treatment of field theory up to dispersion relations that is added to it. The author's aim throughout has been to stick as close as possible to physics. However, for this a price must be paid. Physics is an untidy subject and its structure is not linear like a book, from one end to the other. Its parts have much more complicated interrelations. In consequence the topics discussed in this book change at times with a rapidity that the beginner may find bewildering. A little more artificial separation and streamlining might have been an advantage.

It is a pity that the Oxford physical monographs are not more pleasant to look at. The Clarendon Press has a curious reluctance to number footnotes and, since many references are given in this book, the foot of each page looks like a collection of expletives from a comic strip.