Books

Multipole Fields. By M. E. Rose. 99 pp. John Wiley and Sons, Inc., New York, 1955. $4.95. *Reviewed by R. B. Lindsay, Brown University.*

The multipole field is a standard technique in classical electromagnetic radiation theory, whereby the vector and scalar potentials (or alternatively the Hertz vector) descriptive of a field can be expressed as summations in which the various terms correspond respectively to the contributions of a single charge, dipole, quadrupole, and so on to the higher orders of multipoles. In the present volume the author introduces a unified treatment of the quantum theory of radiation by means of multipole fields of the type represented by irreducible tensors. Thus the potentials of a 2^L pole field are given in terms of irreducible tensors of rank L. This ties the definition of a multipole field to transformation properties under rotation and therefore provides a close relation to the quantum mechanics of angular momentum eigenfunctions.

After discussing the construction and properties of the multipole fields of the type indicated the author applies them to the theoretical description of gamma radiation from nuclei as well as to the internal conversion associated with the de-excitation of nuclear states.

The treatment is straightforward though condensed and will appeal primarily to theoretically-minded persons with a good grasp of both radiation theory and quantum mechanics.

Einführung in die Quantenelektrodynamik. By Walter Thirring. 122 pp. Franz Deuticke, Vienna, Austria, 1955. DM 17.50. *Reviewed by Freeman J. Dyson, Institute for Advanced Study.*

This book stands in the same class with the Handbuch article of Pauli on The General Principles of Wave Mechanics. It presents quantum electrodynamics in the same style and spirit in which Pauli presented wave mechanics. To say this is high praise, for Pauli's book has been correctly described as "the only adult presentation of quantum mechanics". On the other hand, the very adultness and breadth of Pauli's approach make his article unsuitable as a text-book for average students, and Thirring's book is similarly unsuitable. A student will be well advised to work through a standard textbook such as Heitler's *Quantum Theory of Radiation* before embarking on Thirring. In this sense the title of the book is misleading; it had better been called "The General Principles of Quantum Electrodynamics".

With conciseness and clarity, Thirring develops the mathematical formalism of quantum electrodynamics from its logical foundations. He carries the theory far enough to calculate the Schwinger correction to the magnetic moment of the electron. A general description of the ideas of mass and charge renormalization is included. There is no discussion of the historical development of the subject, nor of the experimental facts from which it originated.

The great merit of the book is the emphasis on physical principles. In all other "highbrow" expositions of quantum electrodynamics, the mathematics dominates and usually obscures the physics. In this book the mathematics is kept firmly in control, and the physical meaning of the formalism is at the center of attention. A valuable and original feature is the opening chapter which gives a survey of the orders of magnitude of the various phenomena described by the theory.

In elegance of style and presentation, Thirring is even better than Pauli. Pauli included a wider field and went more thoroughly into details. Still, the mere fact that the two books are comparable means that Thirring has written a classic. Thirring's book will remain a standard reference for serious workers in quantum field theory, long after the contemporary student textbooks become obsolete.

Finally, it may be worth remarking that Walter Thirring is not identical with Hans Thirring, but is his son. Walter Thirring is approximately as young as Pauli was when he wrote the Handbuch article.

Shell Theory of the Nucleus. By Eugene Feenberg. 211 pp. Princeton University Press, Princeton, New Jersey, 1955. $4.00. *Reviewed by Bernard T. Feld, Massachusetts Institute of Technology.*

The revival and fruitful exploitation of the nuclear shell model represents the outstanding development in low-energy nuclear physics of the past decade. This development began with the rediscovery, on the basis of various empirical evidences, of the "magic numbers" and their explanation, through the introduction of spin-orbit coupling into a single particle model, by Mayer and Jensen.

Although the extreme single particle model was enormously successful in correlating a vast amount of nuclear information, it was soon evident that a more sophisticated approach would be required to achieve a detailed and quantitative fitting of the data. In particular, it soon became clear that while, to a first approximation, each nucleon can be regarded as moving, independently, under the influence of an average potential, the interactions between nucleons cannot be neglected. The important interactions are of two types: (1) interactions between particles outside of closed shells, and (2) coupling between particles outside closed shells and the core of closed shells, leading to distortion of the core and collective motions of all the nucleons.

This volume is primarily concerned with the first of the above-mentioned types of interactions. The author carefully collates and discusses the available information on nuclear moments, isomerism, and β-decay, developing the theoretical consequences of a number of different coupling schemes and comparing them with the data. In this discussion abundant use is made of the techniques and results of supermultiplet analysis, developed by Wigner and collaborators (of which the author was one of the foremost) in the thirties, for the understanding of the properties of light nuclei. Unfortunately, the general conclusion, that the coupling scheme is intermediate between L-S and j-j, portends a vast amount of detailed and laborious calculation.

In a lucid chapter on collective motions, the author develops the theory of the coupling of a single odd nucleon with the core. This is an excellent introduction to the present-day work on collective motions in heavy nuclei. The final chapter deals with the general (unsolved) problems of understanding the shell model in terms of a theory of nuclear forces.

While mainly intended for advanced students of nuclear physics, this volume will prove very useful as a reference, owing to its excellent survey and compilation of experimental data and theoretical results. It is amply documented and indexed.

Nuclear Physics. By Irving Kaplan. 609 pp. Addison-Wesley Publishing Co., Inc., Cambridge, Massachusetts, 1955. $10.00. *Reviewed by T. Teichmann, Lockheed Aircraft Corporation.*

The author of this book has set himself the rather difficult task of writing an elementary but complete and practically applicable account of nuclear physics, particularly aimed at nuclear engineers. In this he has been very largely successful, and the minor defects that occur must be attributed to the nature of the requirements rather than to a faulty exposition.

Among the many excellent features are comprehensive references relating to both general and specific topics, at the end of each chapter, and also numerical problems based on the material of each chapter. The latter seem particularly adopted to teach the reader how to make use of the results presented. A possible failing is that, of necessity, the use of quantum mechanical ideas is severely limited. Schrödinger's equation, and wave functions are mentioned very sketchily, and thereafter results depending on application of these must be taken on faith. Though these results are discussed qualitatively as far as possible, this reviewer feels that they may prove hard going for the uninitiated reader.

The book is also distinguished by an effective choice of material. It opens with a section on atomic physics, giving a logical and understandable summary, and including neat and clear derivations. The second (and main) section deals with nuclear physics, and gives a