Books

Molecular Beams. By Norman F. Ramsey. 466 pp. Oxford U. Press, New York, 1956. $12.00. *Reviewed by R. W. Hellwarth, Hughes Research Laboratories.*

The contributions of research employing directed thermal beams of neutral particles have been many and fundamental. It is therefore somewhat surprising that no full-length book has been devoted to the subject until the present volume. However, it is all the more gratifying that this first major coverage of molecular beams should be such a comprehensive and authoritative work. From the early experiments in gas kinetics to recent measurements of the anomalous gyromagnetic ratio of the electron, there seems to be nothing of consequence in beam research that is not discussed here. The topics extend from early deflection experiments on the wave and quantum nature of matter to the many sophisticated high-resolution rf resonance techniques and are emphasized in fair proportion to their importance and to the detail required for clarity.

Although the content of over 700 catalogued references is discussed, the book is much more than a collection of past work; it contains many thoughtful essays in which Professor Ramsey's contribution is evident. Coupled with the breadth of subject matter is a depth of treatment that makes the book useful to anyone connected with the subject, from the shop technician to the theoretician. One may find electrical wiring diagrams, vacuum equipment plans, a five-page list of design parameters for a typical molecular apparatus, analyses of apparatus defects on results, as well as a comprehensive theoretical development of atomic and molecular interactions, transition probabilities, and line shapes. The theory is presented without explicitly invoking the more elegant mathematical tools but may be the more understandable to many for that. The inclusion of many graphs and tables of results and data adds further to the already impressive scope of the book.

A Textbook of Sound (Third Revised Edition). By A. B. Wood. 610 pp. The Macmillan Co., New York, 1955. $6.75. *Reviewed by R. B. Lindsay, Brown University.*

The first edition of this well-known text appeared in 1930 and the second in 1941. The author now presents a revised and somewhat enlarged version to take account of the recent advances in a rapidly developing field. With its fundamental virtues unimpaired, the book remains probably the best one-volume text on the physics of sound both basic and applied. Its strength consists largely in the judicious coverage in a limited space of the most significant features of the subject with emphasis on the phenomenological point of view, but with sufficient reference to the associated theory to enable the reader to find his way to the more theoretical treatments.

Among the more recent developments for which the author has added supplementary material in this edition are shock waves, cavitation, relaxation effects in fluids, and the growing practical applications of ultrasonics. Up-to-date references to many other topics have been included. It is a pleasure to recommend this useful and well-written work to the scientific public.

Elementary Nuclear Theory (2nd Revised Edition). By Hans A. Bethe and Philip Morrison. 274 pp. John Wiley & Sons, Inc., New York, 1956. $6.25. *Reviewed by H. Primakoff, Washington University.*

The present volume is a second edition of a book of the same title published by Bethe in 1947. It constitutes a valuable, albeit somewhat sketchy, introduction to theoretical nuclear physics, suitable as a text in beginning courses on the subject. A reasonable familiarity with nonrelativistic quantum mechanics is demanded of the reader.

In this book Bethe and Morrison place particular emphasis on the problem of the determination of the nuclear forces both from the point of view of a semi-quantitative and physically vivid treatment of meson theory and of a phenomenological analysis of the nuclear two-particle problem (deuteron binding energy and quadrupole moment, interaction of deuteron with radiation, proton-proton and proton-neutron scattering both at low and at high energy and including polarization effects). General features of the nuclear forces, charge independence and saturation, are also discussed. A fairly complete outline is given of the various models involved in the interpretation of the properties of complex nuclei (liquid drop, Fermi gas, spin orbit shell, collective) though little attempt is made to correlate their underlying assumptions with the known properties of the nuclear forces. The book opens with a largely qualitative description of the basic features of nuclear structure (binding energies, size, spin and statistics, types of nuclear disintegration, properties of free nucleons, leptons, pions, muons) and closes with chapters on nuclear reactions, including γ-ray absorption and emission, and on beta decay. A table of nuclear species containing data on stability, mass defects, and spins is provided in an appendix. In general, relatively few references to the original literature are given.

In some places the book bears the mark of hasty composition and is occasionally even marred by ambiguities and errors, for example on page 232 . . . "the general theory of elementary particles does not demand a distinction between particle and antiparticle if they are electrically neutral" . . . and, one should add, if they also have no magnetic moments. As regards omissions, several topics useful in the analysis of the nuclear force problem, i.e. the properties of the nuclear 3 and 4 particle systems, are not treated and no mention is made of recent L-S and intermediate coupling attempts to describe the ground and low excited states of nuclei with Z between 3 and 10. In addition, some questions of interest in connection with the nuclear models, e.g., the bearing of the analysis of deuteron stripping reactions on the shell model, are not treated. Nor are certain fundamental matters associated in particular with the heavier nuclei discussed in any detail; thus only occasional remarks are made regarding the possible extent to which the properties of a single nucleon or the interaction between two nucleons are modified by the proximity of other nucleons, or, regarding the possible reasons for the general success of the shell model.

The above list of what the reviewer feels are the book's shortcomings should not however be permitted to throw the picture out of focus. On the whole, the presentation is clear and authoritative and contains many elegant physico-mathematical derivations and discussions; the four chapters on nucleon-nucleon scattering, the chapter on polarization of nucleons and the chapter on noncentral forces are especially lucid and informative. The book's friendly and unassuming style should make a strong appeal to readers engaged in studies preliminary to theoretical or experimental research or engaged in preparation for examinations.

Quantum Field Theory. H. Umezawa. 364 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1956. $9.75. *Reviewed by J. C. Polkinghorne, University of Edinburgh.*

In his preface Professor Rosenfeld explains how this book came to be written. In 1953 Dr. Umezawa arrived at Manchester with a small Japanese book that he had written. His colleagues were able to deduce from the formulae that it dealt with quantum electrodynamics. The present volume is in part a translation and in part a revision of that work. Its English style at times betrays its origin but in general it is lucid and readable.

The first twelve chapters deal with relativistic field equations and their quantization. A feature of this part of the book is its generality. The particular formalisms used to describe particles with spins 0, ½, and 1 are treated as examples of the general theory that is first developed. We are told on the dust cover that this procedure has been adopted because thus we can best "examine the inner homogeneity and consistency of quantum field theory by describing its scheme in a form independent of specialized cases of fields". However it seems to this reviewer that our difficulties in quantum field theory do not arise from an inadequate understanding of the formalism but from uncertainties about when these formal quantities make sense. If this is so our need is surely for the discovery and exploitation of specialized theories sufficiently complicated to be thought typical but not so complicated that they cannot be solved. The Lee model is a case in point. The gen-