

BOOK REVIEWS

Classical Electrodynamics. By John David Jackson. 641 pp. John Wiley & Sons, Inc., New York, 1962. \$13.00. College edition \$10.75. *Reviewed by L. C. Levitt, Boeing Scientific Research Labs.*

PROFESSOR Jackson has produced a sort of pedagogic masterpiece in this splendid new book, which is eminently suitable for instruction and reference alike. Thoroughly modern, lucid, and remarkably complete and self-contained, it deserves to become a popular classic, accessible even to capable undergraduate students.

In seventeen well-integrated chapters the reader is taken, at a steady easy pace, from Coulomb's law through self-fields and radiative reaction . . . with remarkably little of basic importance left out in between. The discussion is lively and physically motivated throughout, and the physics is everywhere kept in the forefront. Each chapter is supplied with a list of useful and instructive problems involving worthwhile extensions of the text material, and the reader's curiosity is challenged by well-chosen references, many of them to still-evolving applications of the subject.

Conventional "elementary" topics, from basic potential theory through the introduction of Maxwell's equations and applications to waveguides and cavity resonators, are given a clear and ample discussion, with an exposition of orthogonal expansions and Green's functions nicely interwoven. Highlights from among the more "advanced" topics include a treatment of diffraction emphasizing a vector form of Kirchhoff theory, a clear and concise survey of magnetohydrodynamics and plasma physics, two chapters offering a self-contained treatment of special-relativity kinematics and dynamics and the relativistic formulation of electrodynamics, and very clear discussions of particle orbits, radiation by moving and colliding charges, Thomas precession stopping power, Cerenkov radiation, scattering by quasi-free charges, the method of virtual quanta, an extensive development of multipole fields, and a final chapter on radiation damping, self-fields, equations of motion of charges, and the absorption of radiation by bound systems. The book concludes with a useful appendix on units and dimensions.

Even a search for criticism would turn up little in this fine book. Had the author planned on a larger work, various topics could, naturally, have usefully been given more extensive treatment. With some sacrifice of completeness, topics such as special relativity and the theory of waveguides and cavity resonators, which are well treated in so many other places, could

have been omitted in favor of the inclusion, say, of chapters on the electrodynamics of media with spatial dispersion, and on the scattering of radiation in bulk matter. Discussion of these matters with the clarity of treatment of the other topics would have been a welcome bonus indeed for the more advanced readers. Nevertheless, the author has done a superb job within his plan for the book, and it should join Landau and Lifshitz's *Electrodynamics of Continuous Media* to form the pre-eminent (and mutually complementing) pair of modern physical treatments of the subject. Professor Jackson has shown again, albeit here within the compass of a well-worked-out subject, the extent to which clear thinking and clear writing can transform the difficult into the easy, and the obscure into the beautifully lucid. One but wishes that such skill and care might be more evident in the muddily-written *research* literature of today!

Methods of Mathematical Physics. By R. Courant and D. Hilbert. Vol. 2, Partial Differential Equations, by R. Courant. 830 pp. Interscience Publishers, a division of John Wiley & Sons, Inc., New York, 1962. \$17.50. *Reviewed by T. Teichmann, General Atomic Division, General Dynamics Corp.*

THE two volumes of *Methoden der Mathematischen Physik* by Courant and Hilbert have long been classics and their study indispensable to those interested in applications as well as those concerned with mathematical researches. Indeed, long before the English translation of Volume 1 appeared some nine years ago, its tone, and to a great extent its contents, had become a well-established part of the English-language literature in its field. The contents of Volume 2, despite their importance, have not, however, been similarly assimilated (though they have stimulated much mathematical research), and this translation and expansion therefore fills an important gap in the English literature.

With the exception of the omission of a chapter on the existence of solutions of elliptic equations, using variational methods, the book covers much the same ground as the earlier German version, but in a greatly extended and modernized way. The treatment is more general, abstract, and deeper, and relies heavily on functional analysis (including fixed-point theorems) in the existence proofs. Of necessity, some of this increased generality and depth is accompanied by references to the literature rather than by complete ex-

positions, but, on the other hand, there is an increase in the number and type of examples, particularly from the field of physics, which are used to illustrate and illuminate the methods of solution.

Several new features are particularly worthy of note. There is an expanded treatment of characteristics, both from the purely mathematical point of view and in relation to propagation phenomena. This is the only place in the literature, English or German, in which such a complete and satisfying account can be found. The theory of distributions is used to generalize the solution theory of linear hyperbolic equations, and an appendix gives a concise but perspicuous introduction to and survey of distribution theory. The relation between conservation laws and differential equations is also discussed with special reference to discontinuous solutions. The treatment of transient effects in linear systems and Heaviside's calculus is given in a way that makes possible an easy transition to the generalized operational calculus recently developed by Mikusinski. Finally, there is a bibliography of 20 pages.

It is most satisfying to welcome this work as an essential and readable reference and text for anyone interested in the theory of partial differential equations and their applications.

An Introduction to the Physics of Vibrations and Waves. By Norman Feather. 330 pp. Edinburgh U. Press, Edinburgh, 1961. \$6.00. *Reviewed by Walter G. Mayer, Michigan State University.*

THIS book is intended to familiarize the "beginning specialist" with the classical concepts of waves and mechanical vibrations. Starting with a chapter on stretched strings, Professor Feather introduces the reader to the fundamentals of wave propagation, damping, pulses, and spectral analysis. The next sections discuss coupled vibrations, elastic vibrations of rods, and vibrations of air columns. The book also contains chapters on plane waves in an infinite medium, water waves, and interference and diffraction. Although the book is concerned mostly with mechanical vibrations, it also contains a long chapter on the wave-particle duality in which the author discusses briefly the origins of electricity and magnetism.

The treatment of the various topics is rather extensive, possibly a little too extensive for some second-year undergraduate students. The interested student, however, will find the style and presentation very refreshing, particularly the clarity and simplicity with which the author describes the physical meaning of equations and derivations he uses—not primarily as statements of self-explanatory facts but more as illustrations of discussions in the text. There are no numerical examples, problems, and answers; instead one finds a great number of quotations by old and modern scientists, biographical details, and a good deal of historical information. Nevertheless, the author does give all the mathematical details necessary for the develop-

ment of the various topics without losing sight of his ultimate goal: to make the reader understand and appreciate the unity of the subject.

Particle Accelerators. By M. Stanley Livingston and John P. Blewett. 666 pp. McGraw-Hill Book Co., Inc., New York, 1962. \$17.50. *Reviewed by D. Keefe, Lawrence Radiation Laboratory.*

THE very rapid growth in the field of accelerator physics in the last decade has created an urgent need for some comprehensive textbook treatment of the subject. Both the authors of this volume have been actively concerned in machine development for many years, and have produced a valuable source book on the history, present status, and immediate future of particle accelerators.

This book and Livingood's recent *Cyclic Particle Accelerators*, reviewed in these pages (*Physics Today*, May 1962, p. 57), together should form an excellent and rather thorough introduction to this branch of physics. Actually, these two books are in a sense complementary; where Livingood has concentrated largely on the development of the basic theory of machines in a useful mathematical way, Livingston and Blewett have centered each chapter about specific accelerators and have managed to include a large amount of descriptive detail with a virtual minimum of mathematics.

The descriptions of specific types of accelerators include chapters on low-voltage and electrostatic generators, cyclotrons, betatrons, and weak- and strong-focusing synchrotrons. Other more general chapters are devoted to ion sources, particle motion, phase stability, and shielding. There is an abundance of illustrations and the references are good. The wealth of descriptive detail, albeit suffering from wordiness in many places, makes it a useful reference for anyone associated with the accelerator field. Although the level of understanding required is not high, it is probably likely to be less useful to the student than a more basic and less special text.

It is stimulating to find in the pages of a physics text an occasional heightening of the rhythm of presentation by certain personal embellishments and individualistic touches—mainly to the credit of the senior author (MSL).

Inelastic Scattering of Neutrons in Solids and Liquids. Symp. Proc. (Vienna, Oct. 1960). 651 pp. Internat'l Atomic Energy Agency, Vienna, 1961. Distr. in US by Internat'l Publications, Inc., New York. Paperbound \$12.00. *Reviewed by A. A. Maradudin, Westinghouse Research Laboratories.*

ONE of the most powerful tools for the experimental study of the details of atomic motions in solids and liquids is the inelastic scattering of low-energy neutrons from solids and liquids. The suggestion that neutron-scattering experiments could be used