As mentioned above, the choice of material for a condensation, while often being a matter of taste, seems to be mostly felicitous. Objection may be raised toward the arrangement of some parts. For instance: β-ray spectrographs are applications of electron optical principles. Nevertheless, their presentation is divided into three fragments: lens spectrometers are discussed in the chapter devoted to electronic aberrations; some "prismatic" spectrometers are to be found in the chapter dealing with deflecting fields; and the final chapter on applications has a generalized discussion of these devices. While there is some justification for discussing the principles underlying these devices in Chapters VII and XI, if a description of the instruments was shifted to the final chapter it would help those who like their information neatly gathered.

This brings us to the question: for whom was the book written? Condensations are mostly utilized by research workers engaged in other fields needing a concise introduction and by teachers. The second edition of Klemperer's *Electron Optics* fulfills the needs of the research worker remarkably well, principally because of its excellent bibliography. Some reservations will have to be made, however, on using the volume as a textbook. While it may be excellent as a guide for outlining a graduate course in electron optics, it will have to be supplemented by material contained in other books and/or periodicals. This is particularly evident in the presentation of the theoretical material: almost all equations are presented without derivation or other proofs.

Printing and binding are excellent. The price, while rather high, is perhaps not entirely out of line with the prevailing high prices of books. **L. Marton**
National Bureau of Standards

Mathematical Aspects of the Quantum Theory of Fields. By K. O. Friedrichs. 272 pp. Interscience Publishers, Inc., New York, 1953. Paperbound $5.00.

In this book five papers which have previously appeared in the communications on Pure and Applied Mathematics are reprinted. A successful attempt is made to present some of the aspects of the quantum theory of fields in consistent mathematical language in a manner useful for mathematicians. The treatment is limited to linear interactions although current physical interest is centered on nonlinear fields. By representing states by functions and operators by functional operators, many of the field relations involving Dirac-functions are rigorized using the methods of L. Schwartz. The particle representation seems to be the most suitable in dealing with fields extending over infinite space.

The problems of a quantized boson field interacting with a given source distribution is treated in a Lorentz invariant form and a scattering operator is introduced. The notion of myriatic fields which possess no particle representations, even if enclosed in a box, is presented and discussed in conjunction with occupation number representations. A construct similar to Dirac's sea of negative energy electrons can be derived from the for-

malism. The problem of boson and fermian fields under the action of a source distribution linear and homogeneous in the field variable is solved in certain special cases and a Lorentz invariant treatment of the boson fields by B. Zumino is presented.

While the methods introduced do, indeed, rigorize many of the formalistic aspects of the quantum theory of fields, they do not seem to suggest physically useful extensions of present ideas. **I. Oppenheim**
National Bureau of Standards

Experimental Nuclear Physics. Edited by E. Segrè. John Wiley and Sons, Inc., New York, 1953. Vol. 1, 789 pp., $15.00. Vol. II, 600 pp., $12.00.

Nuclear Moments. By Norman F. Ramsey. John Wiley and Sons., Inc., New York, 1953. 169 pp., $5.00.

For several years now there has been an increasing need for "a book which would bring the experimentalist up to date in experimental techniques, point out to him significant facts and data, and indicate the broad lines of theoretical interpretation". No individual physicist could hope to perform so ambitious a task by himself, nor is the random, uncorrelated publication of textbooks and monographs likely to give a complete picture of modern experimental physics either. A compendium of separate articles, each written by an authority, and the whole under the guidance of an experienced physicist is probably the best solution— the celebrated *Handbuch der Physik* originated in just such a cooperative effort. *Experimental Nuclear Physics* is an attempt at the same kind of synthesis in its own field, and before going any further it must be said that the attempt is a distinct success.

Of the three projected volumes of *Experimental Nuclear Physics* the first two have already appeared and the third is still in preparation. The closing dates for the material included in Volumes I and II were all toward the end of 1951 with the exception of Staub's paper, which was closed in December 1950. Each contribution is in the form of a self-sufficient monograph with its own bibliography.

Part I, Detection Methods (165 pp.) by Hans H. Staub, opens with a discussion of the motion of ions and electrons in gases. This leads naturally into the principles of operation of ionization chambers and proportional and Geiger counters, which are treated clearly and concisely. Crystal and scintillation counters unfortunately receive less than three pages each, doubtless because the material was prepared over three years ago. A more extensive section on cloud chambers follows, and nuclear emulsions and Cerenkov counters are also covered. Part I concludes with an account of the electronic instrumentation used with counters and construction and operational details of counters and cloud chambers.

Part II, Passage of Radiations Through Matter (191 pp.) by Hans A. Bethe and Julius Ashkin, is superb. Heavy charged particles, beta and gamma rays are covered in considerable detail, and much practical as

well as theoretical information is given. Such topics as the energy loss of charged particles, bremsstrahlung, multiple scattering, Compton scattering, and pair production receive comprehensive, lucid treatment, and the large bibliography should prove useful. It might be mentioned that S. K. Allison and S. D. Warshaw have an article in the October 1953 *Reviews of Modern Physics* designed to supplement the Bethe-Ashkin work and to "bring the experimental picture more up to date".

Part III, Nuclear Moments and Statistics (109 pp.) by Norman F. Ramsey, is an able presentation of this field that fills a definite gap in the literature. Theory, experimental methods, and the results of the various measurements that have been made are given in that order. A table of nuclear magnetic moments complete to January 1, 1952 is included, along with tables of magnetic shielding corrections, nuclear moment ratios, and hyperfine structure separations.

The contents of Part III have been reprinted in *Nuclear Moments*, a separate book, together with additional material on the application of nuclear moments to chemistry and to solid-state physics. Information on the nature of molecular bonds, chemical exchange, crystal structure, electron distributions in metals, and allied subjects can be obtained from studies of nuclear resonance spectra, and Ramsey deals with the interpretation of such data in the new section. The result is a comprehensive monograph of interest to a somewhat different audience from that of *Experimental Nuclear Physics*.

Part IV, Nuclear Two-Body Problems and Elements of Nuclear Structure (90 pp.), also by Ramsey, covers just that. First nucleons and nuclear forces are introduced, followed by a thorough discussion of two-body problems: the deuteron and its photodisintegration, neutron-proton scattering, neutron-proton capture, proton-proton scattering. Meson theories of nuclear forces are described, with another section devoted to nuclear three- and four-body problems and various aspects of the theory of the heavier nuclei. The author has a flair for integrating theoretical, experimental, and intuitive material, so that the resulting presentation is instructive and illuminating.

Part V, Charged Particle Dynamics and Optics, Relative Isotopic Abundances of the Elements, Atomic Masses (207 pp.) by K. T. Bainbridge, is essentially an exposition of the mass spectrograph and its applications. Extensive tables of known relative isotopic abundances, experimental upper limits of isotopic abundances for the more scarce isotopes, mass spectrograph doublet measurements, nuclear reaction Q values (24 pages of them), and isotopic weights supplement the text.

Part VI, A Survey of Nuclear Reactions (207 pp.) by Philip Morrison, is one of the two sections that make up Volume II. Starting with the conservation laws and progressing through nuclear models, the statistical and dispersion theories of nuclear reactions, radiative processes, fission, and high-energy reactions, this monograph gives a comprehensive picture of its complicated subject. Morrison is another author who is very much concerned with the physical meaning of theory, and his contribution should make a good introduction to more advanced works and to the original papers.

Part VII, The Neutron (374 pp.) by Bernard T. Feld, completes Volume II. An immense amount of experimental information has been collected in numerous tables and graphs, with the whole organized and provided with a running commentary and interpretation. The fundamental properties and interactions of the neutron are first discussed, then neutron sources and detectors, neutron interactions with matter in bulk, and coherent scattering phenomena. The adjectives clear, complete, and useful again apply.

The present two volumes of *Experimental Nuclear Physics* and Ramsey's *Nuclear Moments* are beautifully styled and printed. When completed, the *Experimental Nuclear Physics* series seems likely to become as standard an item in laboratories devoted to this field as a slide rule or an oscilloscope; it is to be hoped that frequent revisions will enable it to maintain this position.

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Space Travel

Space Travel, by Kenneth W. Gatland and Anthony M. Kunesch (205 pp.; Philosophical Library; New York, 1953; $4.75), is a popular book on the technical aspects of space travel. It starts with a historical survey of ancient work with rockets, and carries this through the German and American work of the last quarter of a century. The problems that will have to be faced in establishing a satellite vehicle, and in the subsequent escape from the earth's gravitational field, are considered realistically in all the detail that is possible in a nonmathematical work. The book is illustrated and contains a short and useful bibliography.

Mathematics

Elementary Mathematics From An Advanced Standpoint, Vol. I, *Arithmetic, Algebra, Analysis*, by Felix Klein, is a reprinting of the English translation of the third (1924) German edition. The able translation achieves passing on to the reader the inspiring style of Felix Klein—mathematician, lecturer, and teacher who more than any other influenced the teaching of elementary mathematics in modern times. The presentation is a mixture of historical and logical development of the fundamental operations and notions underlying arithmetic, algebra, and analysis. These comprise three of the four sections of the book—the fourth being a supplement containing some remarks on the theory of assemblages and complete proofs of the transcendence of e and 11. (Translated from the third German edition by E. R. Hedrick and C. A. Noble; 274 pp.; Dover Publications, Inc., New York, 1953; clothbound $3.25, paperbound $1.50.)