

by a long chapter on the speed of light and its measurement, a topic not usually found in texts on mechanics.

Much emphasis is placed on the conservation principles. Newton's third law is found lacking and hence the recommended derivation of the principle of conservation of momentum is based on the generalized principle of the conservation of energy, an interesting procedure. There is a good chapter on harmonic oscillations with stress on the analogy with electrical oscillations. Nonlinear effects are discussed. The short chapter on rigid dynamics (26 pages) is recommended for omission on first reading of the volume: the modern physicist's interest in the rigid body is minimal.

In the numerous examples of dynamical systems most attention is paid to motions of charged particles and astronomical bodies. There is, for example, no reference to mechanical oscillations as sources of acoustic radiation. Waves in the mechanical sense are not mentioned, being presumably postponed to a later volume in the series. The book is profusely illustrated with clear and well-drawn figures, though the plan of reproducing them on a gray background raises some questions about maximum legibility. Numerous well chosen historical notes, with actual quotations from original sources, enliven the text.

The book should have great appeal to the intelligent, well prepared, enthusiastic and conscientious student of elementary physics, but the reviewer fears that the average physics major will find the going very difficult. It is probably churlish to criticize such an interesting venture into the pedagogy of physics, but in view of the authors' stated intentions to emphasize vigorously "the foundations of physics" in their series, it seems a pity that more efforts along this line are not apparent in the text of this first volume. Thus there is no careful definition of a physical law and no discussion of the relation between law and theory in physics. Moreover it seems distinctly unsafe to assume that the student acquires adequate definitions of the fundamental concepts of mass and force in his secondary-school course. No attempt is made in this text to define these concepts, which are basic for mechanics

and indeed for all of science. Mechanical energy is handled more adequately, but justice is scarcely done to the generalized form of the principle of the conservation of energy needed to meet the existence of mechanical dissipation. However, the student must learn early in his career that no book is perfect, and that he must broaden his perspective by wide reading and deep meditation if he is ultimately to understand what physics is all about.

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'Round and 'round and 'round go the deuterons

THEORY OF CYCLIC ACCELERATORS. By A. A. Kolomensky, A. N. Lebedev. Trans. from Russian by M. Barbier. 403 pp. Wiley, New York, 1966. \$15.50

by Denis Keefe

This is an outstanding addition to the literature on accelerator theory. The original work was published in Russian in 1962 and the English-reading scientific world should be indebted to M. Barbier for his clear translation.

Compared with some other branches of physics, major advances in accelerator physics take a relatively long time to become realized in practice. Thus to some it may appear as a comparatively slowly moving field. In fact, impressive quantities of theoretical and experimental material have been amassed over the last few decades and continue to be produced. It is, therefore, somewhat surprising that there are very few comprehensive texts that do justice to most of this work. To obtain an understanding of, or to teach a course on accelerators, the linear approximations of particle orbits in magnet systems or the more simplified treatment of phase stability that can be found, for example, in the texts by J. J. Livingood and by M. S. Livingston and J. P. Blewett, are completely adequate. The accelerator physicist today is, however, faced with the more difficult problems concerning passage through resonances, negotiation of transition, distortions of the equilibrium closed orbit, nonlinear resonances and the many coupling problems that can occur in circular accelerators.

It is more than four years since the

The Analytic S Matrix

A Basis for Nuclear Democracy

Geoffrey F. Chew,

University of California, Berkeley.

115 Pages (1966).

Code #1900.

This text-monograph comprises a systematic presentation of strong interaction dynamics on the basis of the *S* matrix, without appeal to field theoretical notions. The emphasis is on fundamental principles suitable for graduate students approaching the subject of high-energy nuclear physics for the first time. The central point of the book is "maximal analyticity of the second degree," which is equivalent to the concept of nuclear democracy and which forms the basis for bootstrap dynamics. The general level assumes familiarity with the principles of nonrelativistic quantum mechanics (including scattering theory) as well as with the Lorentz group, but no background in quantum field theory is required.

CONTENTS:

Analyticity as a Fundamental Principle in Physics. General *S* Matrix Principles, Excluding Unitarity. Unitarity and Discontinuities. Maximal Analyticity of the First Degree: Landau Singularities. The Four-Line Connected Part with One Channel Invariant Fixed. Angular Momentum Decomposition. Analytic Continuation in Angular Momentum and Asymptotic Behavior. Maximal Analyticity of the Second Degree, Bootstrap Dynamics. The Nonrelativistic Potential Scattering Model. The Strip Model of the Four-Line Connected Part. Dynamical Equations for the Strip Model. Regge Pole Approximation to the Strip Model. The Nuclear Bootstrap: General Discussion, Continued. Conclusion. Index.

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Tokyo Summer Lectures in Theoretical Physics

MANY-BODY THEORY, Part I.
Ryogo Kubo, Editor.

168 Pages (1966). Regular Price: \$7.75 Cloth. Prepaid Price: \$6.20 Cloth.*

HIGH ENERGY PHYSICS, Part II.
Gyo Takeda, Editor.

128 Pages (1966). Regular Price: \$6.75 Cloth. Prepaid Price: \$5.40 Cloth.*

The first Tokyo Summer Institute of Theoretical Physics, held for two weeks during September 1965, brought together physicists from all over the world for lectures and discussions on many-body theory and high energy physics. The twenty lectures presented in these volumes represent the most important papers delivered at the Institute during the week devoted to many-body theory and the week devoted to high energy physics. Much of this material is published here for the first time.

CONTRIBUTORS:

Many-Body Theory, Part I: Ryogo Kubo, Hazime Mori, David Pines, Keith A. Brueckner, W. Kohn, J. M. Luttinger, J. Robert Schrieffer, P. G. de Gennes.

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two American texts mentioned have appeared. This year the literature has been expanded by the addition of two notable books, in French, *Accélérateurs Circulaires de Particules* by H. Bruck, and the other, the English translation of the work by Kolomensky and Lebedev that is the subject of the present review.

Kolomensky and Lebedev succeed in making an extremely elegant and rigorous presentation of accelerator theory. They adhere strongly to the Hamiltonian formulation and insist on great generality before proceeding to specific cases. In overall structure, the main body of the book is devoted to quite general treatments and in the final chapter particular examples of accelerators are examined. This is in contrast with more standard presentations wherein the reader is steered first through some simple examples and then is subjected to successively greater complexities relating to the realities of current accelerator problems. Within each chapter the general treatment is often briefly illustrated by specific examples while more complicated and special cases are offset in smaller print to indicate that they may be skipped in a superficial reading.

This exposition of accelerator theory achieves a remarkable fluidity in the steady and orderly progress of equations and ideas. Frequently the passage from one equation to the next is far from obvious but the authors consistently follow up each of the more difficult expressions with a paragraph highlighting the basic physical content and sign-posting those terms that turn out to be most important. Thus the reader is led in a compelling and, indeed, almost narrative fashion, through the development of the fundamental concepts.

The initial chapter provides an excellent introduction to the basic variety of cyclic accelerators. The following two chapters describe the behavior of particles in ideal and in nonideal magnetic fields: first, an excellent description is included of the closed orbit problem and the general case of stability criteria; second, the complications encountered in the real case, are discussed, namely closed-orbit deviations and nonlinearities. Chapter 4 is devoted to a treatment of synchrotron oscillations and contains a splendid treat-

ment of the coupling between the betatron and synchrotron oscillations and of the passage through the transition energy. The special problems of radiation effects and quantum fluctuations are treated in chapter 5. Gas scattering and beam loss are examined in the succeeding chapter. The last chapter, also the longest one, is devoted to specific applications of the general theory to the peculiarities of accelerators of different types.

In the logic and elegance of their development, the authors succeed remarkably well, yet there are several topics that an accelerator physicist today would wish to see included, such as a discussion of long straight sections, beam extraction, space-charge effects, collective instabilities and alternative injection systems. Most of these, however, are quite recent developments and their omission can be blamed, not on the authors, but on the passage of time since their edition in Russian first appeared.

Barbier is to be congratulated on his translation. It contains some minor imperfections, but in general adds a certain color that is in keeping with the descriptive flow of the authors' style. If one worries about the need for more frequent use of the definite article or is stopped for longer than a moment by reference to "Hirshaw's" theorem, he is being pedantic. At all times, the translation meets the fundamental criterion of clarity.

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Denis Keefe is an experimentalist in elementary-particle physics at the Lawrence Radiation Laboratory at Berkeley. During the last three years he has been involved with design problems of the future 200 GeV accelerator.

Unsolved problems, undeveloped theory

THEORY OF THERMALLY INDUCED GAS PHASE REACTIONS. By E. E. Nikitin. Trans. from Russian by Scripta Technica, Inc. 155 pp. Indiana University Press, Bloomington, Indiana, 1966. \$5.00

by Kurt E. Shuler

E. E. Nikitin, who is a member of the Institute of Chemical Physics of the Academy of Sciences of the USSR in Moscow, has been an active worker in