Books

Mesons and Fields. Volume II: Mesons. By Hans A. Bethe and Frederic de Hoffmann. 434 pp. Row, Peterson and Co., Evanston, Ill., 1955. $8.00. *Reviewed by Freeman J. Dyson, Institute for Advanced Study.*

In two volumes the authors are giving us an exposition of the meson field theory and of the attempts which have been made with this theory to understand meson experiments. Volume 2 comes out first and describes the experimental results with theoretical analysis and commentary. Volume 1 will follow in a month or two and will contain the mathematical development of the theory from its abstract foundations. The division is made in such a way that Volume 2 is self-contained and can be used by experimental physicists, while Volume 1 is for theoretical people only. Both volumes are designed as text-books for graduate students, and they grew out of courses in high-energy physics which Bethe gave to the third-year graduate students at Cornell. Volume 2 represents what every Ph.D. in high-energy physics at Cornell, either experimental or theoretical, is expected to know. Volume 1 is what the theoretical students are expected to know in addition.

Before discussing the book in detail, some general remarks are in order. Volume 2 is an important historical phenomenon. It represents in a nutshell the American philosophy in the training of physicists, the idea that there should be a wide range of common ground with which experimental and theoretical people should both be thoroughly familiar. This philosophy, much more than the availability of money and equipment, is the reason why so much good physics is done nowadays in America. The lack of this philosophy was the prime cause of the decline of the Cavendish Laboratory after Rutherford's death. When I was a student in Cambridge, an experimental physicist was considered good if he knew how to build good equipment, a theorist was considered good if he knew how to handle his mathematics. It was not generally understood that a creative experimenter is one who thinks about what he will discover with his equipment, and a creative theorist is one who thinks about what he will do with his mathematics. Things have improved in Cambridge since those days, and they will improve a lot more when Bethe goes there next fall.

So the substance of this Volume 2 is the meaning of the results of the precise experiments which have been done with mesons. Nothing is said about experimental equipment and techniques, which the experimental student is expected to know anyway. Nothing is done with high-powered mathematics, which the theoretical student will find in Volume 1 when he needs it. Specifically, the main part of the book is concerned with the scattering of pi-mesons by protons and with the photoproduction of mesons by photons colliding with protons. These are the processes for which rather complete experimental data now exist, and for which detailed comparisons with various theoretical models are meaningful.

The book has one major fault, which is hardly to be avoided in any book written about a rapidly growing subject. It tries too hard to be up-to-date. The reviewer wishes in this connection to enunciate a theorem: if a book is to be published at a time T, and if it is supposed to be up-to-date to a time $T - t$, then it will inevitably be out-of-date at the time $T + t$. This principle will be recognized by experts as having some analogy to the "spin-echo" phenomenon in nuclear induction. The principle is based on the observation that a physical theory which has survived for a time t has, statistically speaking, a further expectation of life equal to t. An equivalent statement is the inverse-cube law of survival of ideas: the *a priori* probability that an idea shall be disproved or abandoned at a time t after it is proposed is proportional to t^{-3}. The proof of equivalence is left as an exercise to the reader.

The question many people will ask is, why try to write a book about meson theories now, when the problem of obsolescence of ideas is so particularly acute? To this Bethe would probably reply, the purpose of such a book is to be useful, not to be immortal. And I believe he is right. The book is particularly badly needed now, just because the situation is confused. Students and researchers are bombarded with a weekly barrage of papers and reports, each claiming to interpret this or that item of experimental information with this or that theoretical model. There is no time for most people to read all this literature, let alone to understand it, and people had until now no text-book in which the important parts of it were extracted and arranged in orderly fashion.

That is what this volume does, and does very well.

High-Energy Accelerators. By M. Stanley Livingston. 157 pp. Interscience Publishers, Inc., New York, 1954. $3.25. *Reviewed by A. H. Snell, Oak Ridge National Laboratory.*

Do you know the difference between a betatron oscillation and a synchrotron oscillation? Can you distinguish between a synchrotron and a synchro-cyclotron in the dusk with a light behind them? Can you tell a λ-particle from a necktie diagram? If not, draw an easy chair up to the fire and open this little book. It takes you clearly and logically from the introductory chapter on the whys of the large, high-energy accelerators (those bothersome new particles, you know!) through a chapter on the stability of orbits, to descriptions of electron synchrotrons, synchro-cyclotrons, linear accelerators and proton synchrotrons, and it ends with the de-

sign dreams for the alternating-gradient monsters now contemplated by men with their eyes on the horizon. It's a nice book because it emphasizes principles. You are told the requirements of orbital and phase stability, and you see how these requirements are individually satisfied in the various types of machines, and how acceleration is applied at the same time. It deals also in a descriptive way with the engineering of the accelerators, but here again it is the engineering *principles* that are discussed rather than the length of this or that member or the placing of nuts and bolts. For example, a chapter is devoted to the Brookhaven cosmotron, and in it the requirement of varying the frequency of the accelerating voltage over a wide range is made clear; this then leads to an engineering discussion of how the requirement of a broadly tuned, high-impedance cavity of the right resonant frequency was met through the use of ferrite. It may be a pity that the extensive discussion of the East-Coast cosmotron has practically crowded the West-Coast bevatron out of the book, but one feels in the writing the author's having lived through the creation of the cosmotron and one senses his intimacy with the very sophisticated electrical engineering applied by the Brookhaven group to their machine. The book is very readable; simple differential equations are used as required, and explanations are helped by analogy in such spots as the discussion of phase stability (loaded pendulum analogy) and in the description of alternating-gradient focusing (optical analogy). Sometimes two or three ways of looking at a point are presented. The more classical accelerators such as direct-current machines, betatrons, microtrons, and ordinary cyclotrons are not discussed, but within its defined limitation of subject material, the book presents an enjoyable exposition.

The Compleat Strategyst. By J. D. Williams. 234 pp. McGraw-Hill Book Company, Inc., New York, 1954. $4.75. *Reviewed by Ernest A. Lynton, Rutgers University.*

In the preface to this delightful book the author states that ". . . it was felt to be worth while to try to bridge the gap between the priestly mathematical activity of the professional scientist and the necessarily blind reaction of the intelligent layman who happens not to have acquired a mathematical vocabulary". In this he has succeeded admirably, producing a thoroughly enjoyable and highly instructive primer on the theory of games of strategy.

After an introductory discussion of the aims, methods, and limitations of game theory, the reader is taken gently but firmly through a successive treatment of two-, three-, and four-strategy, zero-sum games. Each of these sections consists of a series of amusing and delightfully illustrated examples, followed by a general discussion of the pertinent methods, and concluded with a group of problems left to the reader, with solutions given at the back of the book.

This sounds rather like a textbook, and the book is in a way just that. It requires from its reader (supposedly an intelligent layman) much concentration and a good deal of work, and is most definitely not one of those insultingly sophomoric popularizations which purport to "teach effortlessly". But this book is written (and illustrated) with so much wit and charm that it quite lacks the soporific effect of so many otherwise truly instructive treatises.

An equally remarkable characteristic of the book is that from the beginning to the very end it never lets the reader forget that it is no more than a primer. There is no pretension to completeness, none of the "you too can be an expert" attitude. Instead the approach is rather: "You can have fun reading this and doing some work, and then you'll at least know what game theoreticians are talking about."

Indeed a laudable aim, which makes this book a wonderful acquisition or gift for any outsider to the field. And if any scientist buys this book for a friend, let him be sure to read it himself before rewrapping it carefully.

Textbook of Physics. Edited by R. Kronig. 855 pp. Interscience Publishers, Inc., New York, 1954. $10.50. *Reviewed by M. L. Stitch, Varian Associates.*

This textbook by a distinguished group of Dutch scientists under the editorship of R. Kronig represents in many ways a new departure in undergraduate texts available in this country.

It is novel to have a textbook, and especially an undergraduate textbook written in the "Handbuch" manner, with different authors for different chapters. It is unusual to find a chapter on medical physics and a section of biographical notes. The last has some puzzling qualifications for its choices. (Thus one, Dominique François Jean Arago, is mentioned. And while Lawrence and Millikan are included, Gibbs and Oppenheimer are ignored.) The really extraordinary thing is that despite such esoteric topics as good derivations of Debeye's theory of specific heat of solids or of Van der Waals' law, and a fairly extensive treatment of modern physics, this is essentially a text of physics at the phenomenological level which is unusually detailed and diverse, and which is suitable for sophomores and juniors with a grounding in differential and integral calculus.

Useful pedagogical devices are employed such as specially marked sections for topics of specialized interest, fine print sections for topics requiring more sophisticated mathematics, and distinguishing print for verbal formulations of important principles. There are many illustrations, and the printing and format are better than average.

Although there are no problems, the number and choice of practical examples are unusual. Thus one finds several examples of practical kinematical constraints, an automatic urinal flush ilustrated as an example of a nonharmonic relaxation oscillator, three-phase currents and rotating fields, and a discussion of spectacles.