

BOOK REVIEWS

Collision Theory. By Marvin L. Goldberger and Kenneth M. Watson. 919 pp. Wiley, New York, 1964. \$19.95.
Reviewed by George Weiss, The Rockefeller Institute.

Modern developments in collision theory have changed it enormously since Mott and Massey's volume became the authoritative work on the subject. Although there are several books which include recent research on the subject, none is nearly as comprehensive as the present volume. The qualifications of the authors to undertake such an encyclopedic account can hardly be questioned, since they have themselves made substantial contributions to the field. One of the outstanding features of the book is the fact that mathematical developments are always supplemented by a discussion of the physics of scattering problems. In the face of some of the heavier calculations, this is always a desirable feature since one otherwise tends to get lost in abstractions.

The authors begin the main section of the book with an account of symmetry operations on the Schrödinger equation, followed by a careful description of the different phases of a scattering process. A particularly good part of this description is the analysis of the change in time of wave packets. This lends considerable insight into succeeding mathematical results. The authors then develop scattering theory in terms of the Lippmann-Schwinger formalism and the S-matrix. Since the book is slanted towards applications in nuclear physics, the authors give their results for the most general many-channel reaction. A discussion is given of scattering both by central and noncentral forces. Aside from a presentation of the various approximations to solutions of scattering equations, some of the recent work on justification for these approximations is set out for the reader. While most of the story on rigorous justification for approximate solutions is yet to be written, the reader will certainly get a good idea of current research on the subject. One of the subjects which might also have been

useful in this volume is the recent work by Gel'fand and others on the calculation of the potential from solutions of scattering equations.

Other topics included are the lifetime and decay of virtual states, an introduction to dispersion theory, and scattering by systems of bound particles. All of these are treated in some detail, but omissions are inevitable. The book does not contain any of the latest material on Regge poles, but does introduce the reader to the Mandelstam representation. In the days when physics was studied at a more leisurely pace, it would have been possible to predict that *Collision Theory* would be the classic treatise for many years to come. Ideas change too freely for this prediction to be made lightly, but the book is certainly to be recommended as a thorough introduction to the modern theory of collisions.

Introduction to Statistical Optics. By Edward L. O'Neill. 179 pp. Addison-Wesley, Reading, Mass., 1963. \$6.95.
Reviewed by L. Muldrew, Temple University.

This book develops its theme logically and is remarkable in its economy of presentation without omission of the physical picture or of practical implications. It is really difficult, however, to know the contents of the book from its title; we would have to read the preface and table of contents first. We are told in the preface that the adjective "classical" should have been included in the title and that the first two-thirds of the book could have used the title *Communication Theory and Image Formation Optics*. In the author's words the purpose was to "apply the concepts of filter theory . . . developed for the most part in electrical communication theory to the theory of optical image formation . . . to consider image forming optical systems as filters of spatial frequencies".

To achieve this aim the author has described some recent developments in optics, some of the chapters being self-contained. The first six chapters

are needed for the concise presentation of the purely statistical optics sections which are to be found mainly in the last three chapters. Chapters 1 and 2 and two appendixes give the mathematical basis for this treatment covering Green's function applications, differences between spatial and time filters, Fourier-Bessel series, probability and entropy theory. (We may be surprised to find entropy related to optics but there is a reference to some work of von Laue in 1907 developing the superposition of partially coherent light by means of entropy). Chapter 3 introduces geometrical optics with matrix methods, a fairly recent development. The next three chapters cover the effects of aberration on image formation from geometrical theory and from diffraction theory. Finally come the chapters on statistical methods, matrix and coherence theory, and the theory of partial polarization, using Jones and Mueller matrices.

This is a text written for seniors and graduate students. There are no problems but there are excellent references at the end of each chapter. It is clearly written with each chapter properly introduced. The material and presentation are modern and should certainly be of value to students of optics.

Progress in Nuclear Physics, Volume 9. O. R. Frisch, ed. 310 pp. (Pergamon, Oxford) Macmillan, New York, 1964. \$15.00.
Reviewed by F. W. K. Firk, AERE, Harwell.

The high standard of review articles characteristic of this series is maintained in Volume 9. The first two articles are devoted to experimental techniques. The interesting developments in the design and application of spark chambers are reviewed by Rutherglen, and the remarkable development and uses of semiconductor counters in studies of nuclear reactions are discussed by Dearnaley. Both these articles suffer from the fact that they were completed several years ago (latest references 1961) so that a number of up-to-date technical

advances and important applications are not covered. It would obviously help in a series of this kind if the writing of these shorter technical articles could be delayed relative to those of a more extensive and permanent nature. An important topic which receives little publicity—namely the theoretical problems of handling high-energy beams—is covered in detail (King). The volume is dominated by an extensive and illuminating review of the interaction of strange particles with nuclei (Burhop, Davis, and Zakrzewski). The majority of results discussed are obtained using emulsion techniques: this is clearly an opportune moment to review such work prior to the large output of data to be expected from bubble chambers and spark chambers. The popular subject of dispersion relations in theoretical nuclear physics is discussed by Eden. Finally, the many ingenious experiments carried out in establishing the electromagnetic properties of the muon are covered by Farley. Apart from the technical article on semiconductor counters, the present volume is devoted to high-energy physics. This, no doubt, reflects the current trend; nevertheless, it is to be hoped that progress in both theoretical and experimental nuclear physics below about 50 MeV will not be too overshadowed in future volumes.

The Dawn of a New Age. Reflections on Science and Human Affairs. By Eugene Rabinowitch. 332 pp. University of Chicago Press, Chicago, 1963. \$6.95.

Reviewed by Bruce H. Billings, Aerospace Corporation.

One of the striking phenomena of our times has been the involvement and interest of scientists in public affairs. With the advance of technology to the point where science can literally destroy the globe, there has come a belief on the part of many scientists that they should shoulder more of the responsibility for political relationships and governmental problems. Dr. Rabinowitch, who is one of the world's foremost experts in photosynthesis, is one of those who has been politically inspired. In 1945, he and some of his friends founded the *Bulletin of the Atomic Scientists*. Since then, un-

der his editorship, the *Bulletin* has been the spokesman for those who have felt an urgent sense that governmental and national relationships have not kept pace with progress in physics, chemistry, and mathematics. *The Dawn of a New Age* is a collection of essays by Dr. Rabinowitch, most of which have been published over the years in the *Bulletin*. These essays are important both because of the message they carry and because of the insight they give into the characteristics of a politically inspired scientist. The essays cover several themes with variations. In the main theme Dr. Rabinowitch points out that the world has made political progress since World War II, that more progress must be made in order to avoid nuclear holocaust, and that meaningful disarmament should be preceded by political progress. The tone of the message is well said by the preface, which is the author's exhortation at the 1962 Pugwash Conference. He called for a rebellion of mankind against a system which sets part of it against each other. He says, "A man cannot be asked to become a perpetrator or conniver in a million fold murder of innocent men, women and children." It is certainly appropriate that an engineer working on the Atlas Guidance System or the Polaris Propulsion System or their Soviet equivalents, understand and ponder this main theme. Dr. Rabinowitch leaves it up to him to decide whether he is a perpetrator or a conniver and furthermore what he should do about it.

For those who remember FDR as "that man," part of the second theme of the essays may come as a bit of a shock. This theme has to do with the ability of the scientist to see world events as analogs to physical phenomena and thereby use analogs to physical laws to predict future events. Two of the essays in this vein are in the nature of prophesies, one written in 1939 and 1940 describing the probable course of World War II, the other in 1962 describing the probable events in the next 25 years. The '39 prediction is remarkable in its accuracy and requires that the '62 forecast be taken quite seriously. The important prediction here is that the probability of nuclear war is low.

However, Dr. Rabinowitch says, "The dark future . . . for the capitalist countries has been averted . . . by the breakthrough of the New Deal in the United States, by the creation of the welfare state in Scandinavia and in Great Britain. . . ."

It is difficult to end a discussion of these essays without one last quote. "It is as abnormal for the armed forces to finance research outside their own laboratories (such as NRL and Aberdeen) as it would be for the military to take over continuous responsibility for American colleges other than West Point and Annapolis." This is a real jolt to Route 128.

Although there are quite a few scientists today who are spending time thinking about the problems of social relationships, this number is far too small. *The Dawn of a New Age* is a good book for the physicist who is conscious that there is more to life than the mu meson. In addition, the book is good fun, although perhaps it was not intended as such by Professor Rabinowitch.

Continued Fractions. By A. Ya. Khinchin. 94 pp. University of Chicago Press, Chicago, 1964. Cloth \$5.00, paper \$1.95.

Reviewed by T. Teichmann, General Atomic Division, General Dynamics Corporation.

Continued fractions provide an elegant and simple representation of the intrinsic properties of numbers, i.e., a representation independent of any ordinary fractional or "n"-ary system used. (For example, irrational numbers are represented by infinite continued fractions and vice versa.) They also enable a direct and accurate approximation to be made to the numbers they represent, but since they are particularly ill adapted to computational uses, their main application has been in mathematical problems of approximation, and of the measure theory of numbers. In recent years, however, the approximative techniques, generalized in some cases to functions, have found physical applications in problems of circuit synthesis (to mention only one example). This little book by Khinchin is written with the author's characteristic directness, perspicuity, and insight, and serves as an ideal intro-