

The writing of a book requires a great deal of time and labor. To write one on a subject which is poorly understood and which is changing rapidly can only be construed as the act of a brave man, and we should all be grateful to Professor Brout for having provided us with the text in question.

Lectures on General Relativity. Summer School Proc. (Brandeis U., 1964). By A. Trautman, et al. 459 pp. Prentice-Hall, Englewood Cliffs, N. J., 1965. Paper \$5.00. Reviewed by Jacques E. Romain, Centre de Recherches Routières, Sterrebeek, Belgium.

The proceedings of the 1964 Brandeis Summer Institute of Theoretical Physics consist of two parts, devoted respectively to general relativity and to quantum field theory. This first volume is made up of three lectures by outstanding specialists. Pains have been taken to integrate the contributions and to provide cross-references among them.

A. Trautman's "Foundations and Current Problems of General Relativity", which takes over half the space, is a full book in itself. It constitutes a self-contained and up-to-date course covering the essential aspects of general relativity. It is written at a high level and contains brief expositions of the required mathematical tools. The approach is decidedly geometric. Trautman's exposition is one of the best available introductions to the new formalism which has recently invaded the field and which may obscure the physics behind the theory unless the physical interpretations of the mathematical concepts are clearly grasped. The author's profound remarks will be a great help in this respect. In order to take full profit from this presentation, the reader should have a reasonable advance knowledge of standard general relativity.

F.A.E. Pirani contributes a sizable and authoritative introduction to gravitational wave theory. Again the theoretical level is high. The author begins with physical aspects, then introduces spinors and bases the bulk of his exposition on spinor formalism.

Under the title "Some Special Solutions of the Einstein Equations", H.

Bondi presents not a complete and systematic exposition, but a beautiful, crystal-clear, and humorous discussion of the principles of both special and general relativity, followed by an analysis of problems principally related to gravitation-wave emitters and receivers. His purpose is to make the reader feel the physics behind the formalism, and to conjure away the "black magic" feeling. The approach is stimulating and illuminated by a lot of cleverly presented thought experiments. This essay is very good reading for anyone, including the seasoned specialists.

It is good fortune that such a unique and consistently excellent book is available at a moderate price. It must not be absent from the bookshelf of any relativist, even though it is, quite unfortunately, not provided with a subject index.

Progress in Optics, Volume 4. E. Wolf, ed. 327 pp. (North-Holland, Amsterdam) John Wiley, New York, 1965. \$13.50. Reviewed by H. E. J. Neugebauer, Xerox Corporation, Brussels.

Many are the branches of optics. This is evidenced by every new volume of *Progress in Optics*. Its editor does not seem to forget a single one. Volume 4 offers articles ranging from abstract theory to experimental studies almost falling into the field of chemistry. A critical remark may be in place: The volume would certainly have gained if the editor had had the time to rewrite two or three of the articles. He has demonstrated in his book and many scientific publications how lucid a writer he is.

Focke's clear and concise review of higher-order aberration theory can be recommended as summary for the experts and as introduction for the reader less familiar with this branch of optics. It is a welcome supplement to M. Herzberger's publications on the subject. Bryngdahl's "Applications of Shearing Interferometry" reflects the author's mastery of the subject, both experimentally and theoretically. Many people might think that surface deterioration of optical glass by chemical reactions is hardly a field of optics. Yet, Kinoshita's article should be read by everybody concerned with the design and use of optical systems. It

is also proof that a less known field may be represented in a way arousing the interest of an uninitiated reader. The article on optical constants of thin films by Rouard and Bousquet is remarkable for drawing a clear line between older determinations of optical constants based on erroneous assumptions and incomplete theories as opposed to more recent work. Much of the older work is relegated to that of historical interest. The reader obtains a vivid impression of how much must still be done after the older work has lost some of its value. Wedford's "Aberration Theory of Gratings and Grating Mountings" leaves the reader with the impression that this is one of the simplest chapters of optics. Yet, nothing of importance seems to be omitted.

Two articles are concerned with diffraction theory. Both authors, Rubinowicz on the Miyamoto-Wolf diffraction wave and Kottler on diffraction at a black screen, are given to reminiscing. Rubinowicz renders a good account of the modern theory of the diffraction wave in scalar, electromagnetic, and quantum field theory. Unfortunately, his melancholy statement that an ingenious theory sometimes produces little effect in related branches of physics may prove correct. Kottler confines himself to older scalar theories. It is hoped that the promised second part will include all the modern developments, both, in theory and experiment.

Studies in Penetration of Charged Particles in Matter. 388 pp. National Academy of Sciences—National Research Council, Washington, D. C., 1964. Paper \$7.00. Reviewed by J. E. Mansfield, Harvard University.

Often a program of preparing a state-of-the-art report so stimulates research that it is nearly impossible to produce a timely report. The fast pace of developments has brought about such a situation since a subcommittee of the NRC Nuclear Science Committee undertook to unify the extremely varied recent results in one of the pioneer branches of modern physics. The result is this collection of twelve reports in considerably greater detail than is usual in the literature. Fano's reprinted review of the theory of

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This is the first in a series of advertisements featuring art by students in the Los Alamos school system. This painting is by Cherri Wenslay, a twelfth grade student at Los Alamos High School.

In voting favorably on the international nuclear test ban treaty, the Senate Armed Forces Committee insisted that four safeguards be maintained. These safeguards, in which Los Alamos Scientific Laboratory has a major role, were stated as follows:

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penetration and stopping power is given as an appendix; actually it is the introduction, since most of the reports use his notation and expand on his topics.

The title is a bit misleading: "charged particle" means one heavier than the proton, and "penetration" is concerned only with range and stopping power. Considerable stress is given to the passage of heavy ions. As a result, one is concerned with shell corrections, small-angle multiple scattering, and similar topics that are germane to massive-particle problems but not so much to electron scattering. Electron penetration, in fact, is represented only in the extensive range-energy tables of Berger and Seltzer. They contribute also range-energy tables for mesons, and a tabulation of the Vavilov distribution.

Fano, the subcommittee chairman, contributes several good things besides his appendix/introduction. He and Turner treat inner-shell corrections to the stopping-power formula, ending with some remarks toward a generalized equipartition theorem such as obtains in the electron gas. His other paper is a short discussion of open problems in the field.

State-of-the-art reports are by nature rather strictly circumscribed by the interests of the reporters. Hence one is usually annoyed not to find a treatment of a pet problem. Here I would say more weight could be given to electron problems, especially plural-scattering effects, spin transport, and the like.

Studies in Statistical Mechanics, Volume 3. By J. de Boer and G. E. Uhlenbeck. 388 pp. (North-Holland, Amsterdam) Interscience, New York, 1965, \$14.75. Reviewed by Kurt E. Shuler, National Bureau of Standards.

Probably the most concise and precise way to describe this volume is to quote here in toto the Editors' Preface to Volume 3.

This third volume of the Studies contains in the first place a monograph by Dr. Bloch on the diagram or "graphological" techniques in quantum statistical mechanics. It complements the article of Dr. Huang in Volume II which was written more from the physical point of view, while Dr. Bloch emphasizes and treats in detail the formal methods which were developed in the

last ten years, mainly inspired by the quantum field theory. It is well known that the application of field theoretical ideas and methods has produced a whole flood of articles in which all kinds of diagram expansions were used. We are grateful to Dr. Bloch for having given a systematic treatment of this difficult subject and it seems to us that a student can learn from this chapter what has been accomplished. And although the ratio of the amount of physical insight to the amount of formal machinery is perhaps smaller than one hoped for, there is no doubt that any serious student of statistical mechanics should learn these methods. It seems to us also very valuable that Dr. Bloch always shows carefully how the classical theory is contained in the quantum theoretical formalism, so that his article also complements the article on graphological methods in classical statistical mechanics which appeared in Volume I.

The second article by one of the editors on the so called second quantization method is mainly intended as a preparation for the modern quantum mechanical treatment of systems of a large number of interacting identical particles. The student should perhaps be advised to study this article before starting with the articles of Dr. Bloch and Dr. Huang.

The third article is a reprint of the dissertation of Dr. Boris Kahn on the theory of condensation. It follows our policy to make available older monographs for which there is still demand. We refer to the foreword written by one of us for further comments.

There is no question that the articles by Bloch and de Boer are clear, authoritative, and well written and that they serve a most useful didactical purpose. In particular, the paper by Bloch on "Diagram Expansions in Quantum Statistical Mechanics" which is some 200-odd pages is a most valuable broad review and commentary on "graphology" as applied to equilibrium quantum statistical mechanics. Professor de Boer's paper on "Construction Operator Formalisms in Many Particle Systems" is rather specialized and concerned primarily with the use of annihilation and creation operators in the construction of eigenvectors in many-particle systems of identical particles. B. Kahn's 1938 dissertation "On the Theory of the Equation of State", to which Professor Uhlenbeck has written a very moving personal foreword, still forms, as indicated in Uhlenbeck's foreword, a good introduction to the modern

statistical theory of the nonideal gas. When read in conjunction with Bloch's and de Boer's papers it also forms an interesting commentary on the difference of approach to problems in statistical mechanics then and now.

It is to this last point that the reviewer wishes to address himself briefly even at the danger of being considered a reactionary prehistoric fossil. There is no question that new and powerful mathematical techniques need to be developed for the solution of some of the complex modern problems in statistical mechanics, particularly in the fields of many-particle problems (both classical and quantal) and in nonequilibrium statistical mechanics. The history of science is replete with examples where the development of new mathematical techniques or the extension and application of hitherto esoteric and "pure" mathematics has led to decisive advances in physics and chemistry. The proof of the pudding is, however, in the eating. To those of us interested in statistical mechanics as a discipline which describes, interprets, and predicts chemical and physical phenomena, a mathematical technique is a tool and not an end in itself. The development and refinement of such tools are necessary; it is undoubtedly lots of fun and great mental stimulation for its practitioners, but is it *statistical mechanics*?

The Habitable Earth. By Ronald Fraser. 155 pp. Basic Books, New York, 1965. \$4.50.

Reviewed by Alan G. Henney, Naval Ordnance Laboratory.

Present knowledge of the physical properties of and forces acting on the earth are discussed in a clear and concise manner. Liberal use is made of diagrams and photographs. The composition and influence of the earth's core and mantle on the surface features and magnetic field are treated. Periods of mountain formation are analyzed.

A separate chapter is devoted to the ocean floor. The theory of continental drift is strongly supported with evidence obtained from a number of independent sources. Finally, the ocean and air currents are considered.