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a minimum of mathematics. Illustrations are mainly chosen from the physics of the human body and are clearly explained. A considerable amount of attention is also paid to electronics and related devices useful in physical medicine.

The second half deals specifically with applications including the physiological effects of electricity and its use for stimulating and heating the body, diathermy, the biological effects of electromagnetic radiation, electromyography (measurement of body potentials), and ultrasonic therapy. The last named topic is given a very brief and cursory treatment, with no mention of the recently developed diagnostic uses of ultrasonics. There is curiously enough no discussion of x rays or of radiation by radioactive materials. These omissions render the book less valuable than it otherwise might be.

Introduction to Quantum Field Theory. By F. Mandl. 202 pp. Interscience Publishers, Inc., New York, 1959. \$6.00. *Reviewed by H. Mendlowitz, National Bureau of Standards.*

IN writing a textbook, especially an introductory text, two of the most important problems confronting an author are the choice of topics and their treatment. In my opinion the author has chosen his topics very judiciously and wisely. He tried to give the uninitiated a good foundation in field theory and avoided for the most part the finer points and newer problems in field theoretic investigations. In about one hundred and sixty pages, the author has twenty-two chapters, each dealing with a different subject. These include such topics as the Gupta-Bleuler formalism for photons, S-matrix, Feynman graphs, radiative corrections, self-energy, vacuum polarization, and renormalization. An additional thirty-five pages are devoted to exercises and hints for their solutions as well as an appendix on Dirac theory. If one were to master the ground covered in this book, he would have a good grasp of basic field theory including the great advances which were made up to the early fifties. I feel that the omission of a treatment of dispersion relations, special models, and similar current topics does not detract from the book in any way because they are outside the limited scope of this text.

Although I agree with the author that great bulk and a large number of pages do not necessarily make a good text, one can also err in the opposite direction. The one major criticism that I have is that the book is not self-contained. It is necessary to go elsewhere to complete the topics chosen by the author. For instance, in the case of the Wick T -product, the author states: "For the case of 'unequal times' . . . Wick proves the following . . .," and lists the reference to Wick's paper. The last few chapters which include such topics as vacuum polarization, vertex modification, anomalous moment of the electron, and renormalization are treated almost in the barest outline form; and in order to really understand the "solutions" to these problems, I feel that one must get aid elsewhere. An increase in the size

Basic Research For Industry

In discussions about industrial research activities, the above phrase usually reads "Basic Research In Industry," and most observers agree that it must and does exist. In this we concur, adding only that contract research for industry by an independent laboratory may oftentimes be more efficient than fundamental studies undertaken within industrial organizations. The reason is that the staff scientists of a not-for-profit independent research laboratory, such as the Physics Division of the Armour Research Foundation, can pursue research of their own interest under sponsorship by any one or several industrial organizations or government agencies. In basic research, self-motivation of the scientist is a major factor which can best be cultivated by an atmosphere in which research for its own sake is possible. In addition, cross fertilization between research programs in different branches of physics can most readily occur when a wide variety of research activities exists in the same laboratory. Furthermore, fundamentally new scientific discoveries made on research programs can be immediately followed up and expanded along lines of interest to either government or industry when both types of sponsorship exist concurrently in the same laboratory. To take maximum advantage of these possibilities, the staff scientists of an independent contract research laboratory must be alert to developing research areas and capable of expanding their own activities to meet the challenge of new ideas. They must have a well-developed sense of scientific self-interest in order to suggest and carry through research programs which can be supported by any of the many possible industrial and government sponsors. The self-satisfaction and financial rewards to the individual scientists of the ARF Physics Division are outstanding. In addition, liberal fringe benefits and four week vacations are provided. We will be pleased to discuss all of these features with senior level research physicists who feel their professional future will blossom in the environment of our Physics Division.

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PHYSICS: FOUNDATIONS AND FRONTIERS

by **GEORGE GAMOW** and **JOHN CLEVELAND**, both of University of Colorado

Serving as an introduction to general physics and emphasizing modern physics, this text requires only high school algebra as a prerequisite.

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of this book by about 20 to 30 percent would have greatly enhanced its attractiveness as a text. An important asset of this text is the well-chosen list of problems and the hints for their solutions. These both complement and supplement the text.

Semiconductors. By R. A. Smith. 494 pp. Cambridge U. Press, New York, 1959. \$12.50. *Reviewed by Robert L. Sproull, Cornell University.*

SUBSTANTIAL changes have taken place in the field of semiconductor physics since the excellent books of Shockley and later of Spenke. As Shockley predicted, the discovery of minority carrier processes, the elucidation of the $p-n$ junction, and the existence of a semiconductor technology have opened whole fields of investigation to physicists. It is primarily to such physicists, rather than to transistor engineers, that Dr. Smith's book is addressed. But the advanced transistor engineer would be well advised to study it too, since its breadth may open his mind to phenomena and processes which will be important to him in the years ahead.

Breadth of coverage is the distinguishing feature of this book. It is in no way restricted to the areas of present application of semiconductors, although these are given quite adequate treatment. There are welcome chapters on imperfections, thermal effects, and optical processes not usually found in a book of this kind. There is an especially valuable and readable chapter on the methods of determining the characteristic properties of semiconductors. A long chapter on compound semiconductors is not confined to III-V compounds, nor is it distorted toward the lead salts that have been a primary interest at Dr. Smith's laboratory (Royal Radar Establishment, Malvern). Incidentally, the section on lead salts demonstrates the complete lack of bias of the author, since the work of Brebrick and Scanlon at NOL and other important contributions are accorded at least "equal time".

Many examples could be cited of the author's care in explaining the physics of semiconductors. A small section, for example, gives a comparison of the magnitudes of the various thermomagnetic effects with the Hall and Seebeck voltages of a typical semiconductor specimen under typical conditions. Such attention to the necessities of the process of explanation helps assure this book an important place in the literature of semiconductor physics.

An Introduction to Mathematical Statistics. By H. D. Brunk. 403 pp. Ginn & Co., Boston, Mass., 1960. \$7.00. *Reviewed by T. Teichmann, General Atomic.*

THE development of modern statistics, and its extensive application to varieties of problems considerably more complex and subtle than those considered in its early days, have made it highly desirable, if not mandatory, to relate intimately the underlying notions of the theory of probability and the techniques used in treating practical examples. For a time it