of investigation". The active role of the scientist in nature is generalized into a doctrine that man now "confronts himself alone". There is no longer even a given universe, independent from himself, which man can explore. "Thus even in science the object of research is no longer nature itself, but man's investigation of nature." And, Heisenberg does not flinch from quoting with approval the well-known statement by Eddington, to the effect that scientists in studying nature are like those who are trying to account for a strange footprint on the shore, and then, lo, find it to be their own.

Professor Heisenberg's discussions in the first essay raise many questions. For example, if science is concerned not with nature, but with our relationships with nature, then what is the domain with which we have relationships, and how do we explore that domain? There is an unsatisfactory sense of being left suspended, of science being an operator function that has no argument on which to operate. The author could perhaps have in mind something like the "latent observable" interpretation of quantum-mechanical observation, but actually he gives no clue to how he would solve this problem. And surely some distinctions or reservations are wanted in his generalizations about the extent to which science has become part of nature; the effects of observation, for example, on an electron that is observed by its mark on a photographic emulsion are far different in kind from the effects on the planet Jupiter when we make a photographic observation of it.

The second essay gives an account of how quantum mechanics has brought indeterminism into physics. In the third essay we are given a fine defense of the values of a classical education. Teachers who have misgivings about curricula which are planned with first priority on bringing the student up to the latest work in science will here find welcome counterarguments. Professor Heisenberg states, for example, that from the Greeks one learns in every field how to pose questions of principle. Two instances which he gives of the value of his own Greek studies could well be added to the classicists' permanent stock of *apologia* for their subject. He tells that at the age of 18 he found a first clear idea of the atomic theory in Plato's *Timaeus* and gained the conviction that one could hardly make progress in modern atomic physics without a knowledge of Greek natural philosophy. Further, he writes that when in his work on quantum theory he asked himself whether an experiment could possibly show atoms to be bound by hooks and eyes, as illustrated in a physics textbook, the education he had received in Greek philosophy made him wary of unproved solutions.

The series of historical selections and accompanying discussions make up a good three-fifths of this book. All of the quoted writings are of the highest interest in their own intrinsic content, but also, Heisenberg uses them to illustrate several theses about the history of physics. Among his historical propositions, there is the notable one that physicists are today returning in one important sense to a conception of their science that was held by Galileo. In contrast to Kepler, and generally to the late mediaeval tradition of science, Galileo strongly expressed the notion that science must be limited in its aims, and that it must not expect to elucidate the final nature or ultimate essence of anything, much less of the entire sum of things. This view was eminently practiced by Galileo in his own work, and likewise by Newton and his contemporaries. But during the 18th Century the attitude began to grow that science, with the great success of its mechanistic-materialistic assumptions, was perceiving the true nature of the universe. In the 19th Century this view flourished as a new and "inherently uncritical" philosophy, which gave the scientist warranty for believing that his findings were direct contributions to the ultimate truth about the universe. However, in our own day, Professor Heisenberg tells us, physics remembers ". . . once more that a natural science is one whose propositions on limited domains of nature can have only a correspondingly limited validity; and that science is not a philosophy developing a world-view of nature as a whole or about the essence of things."

We find in this thesis an argument against those philosophers who tell us that effectively they have no work to do, except to point out that it is in science and not in philosophy that truth is gained. Rather, Heisenberg tells us, science preserves its philosophic significance only if it imposes a self-limitation with respect to the properties of phenomena of nature. Great discoveries about the properties of phenomena are possible, he writes, only if the nature of the phenomena is not generalized a priori into an ultimate essence. It is only with such a limitation that physics may reach an understanding of the properties of phenomena—and with that understanding, Heisenberg concludes, the philosopher may gain his more universal insights.

The Algebra of Electronics. By Chester H. Page. 258 pp. D. Van Nostrand Co., Inc., Princeton, N. J., 1958. $8.75. *Reviewed by W. T. Wintringham, Bell Telephone Laboratories.*

THE scope of *The Algebra of Electronics* is indicated by this quotation from the dust-jacket:

> A definitive guide to a basic and practical understanding of electronic circuits, equations that can be derived, and more than 100 problems with methods and answers.

The intended audience is suggested by these paragraphs from the preface:

> In recent years, there has been a renaissance of our forefathers' do-it-yourself philosophy. Fortunately, this trend is found in the intellectual realm, as well as in craftwork. Thousands of persons have learned algebra and calculus by home study of suitable texts. . . .
>
> This book is addressed to these people, with their healthy intellectual curiosity. It is addressed equally to electronic technicians and TV and radio servicemen, who have a practical knowledge of circuits and wish to acquire understanding.

This book is a fairly elementary text covering many

(and possibly too many) topics between its covers. Passive direct- and alternating-current circuits are treated from a relatively elementary point of view, with a limited discussion of modern network topology. Such active circuit elements as solid-state and thermionic diodes, transistors, and vacuum tubes are discussed; and finally the author treats noise in electrical circuits and the principles of modulation.

This is a sort of in-between text. Since an elementary knowledge of the calculus is required for its understanding, it is not suitable for high-school nor for many technical institute graduates. On the other hand, it is by no means sufficiently meaty for use even in a first-year college course; but it should be ideal for the true amateur (in the fundamental meaning of that word).

There are a number of typographical errors in the first printing of *The Algebra of Electronics*. This reviewer understands that there have been extensive corrections in the second printing. Consequently, there seems to be little point in discussing this aspect of the book.

Soviet Research in Fused Salts, 1956. Part 1, Systems; 146 pp.; paperbound $30.00. Part 2, Electrochemistry; 268 pp.; paperbound $20.00. Translated and published by Consultants Bureau, Inc., New York, 1958. 2-vol. set $40.00. **Transactions of the First Conference on the Spectroscopy of Light-Scattering Media** (Moscow, Mar. 1956). 77 pp. Translated from the Bull. Acad. Sci. USSR, Physical Series, Vol. 21, No. 11 by Columbia Technical Translations, White Plains, N. Y., 1958. Paperbound $20.00. *Reviewed by Stuart A. Rice, University of Chicago.*

THERE is little that can be said for or about the first two translations listed above. The cross section of papers represented in these volumes is, on the average, neither better nor worse than a random sampling of similar American or European literature. Most of the studies are of phase equilibria and of interest only to a few specialists. The more general questions of the theory of molten salts, solutions of metals in salts, equation of state, etc., are unrepresented. It appears to the reviewer that in the general hysteria to translate "anything Russian" insufficient selectivity has been used. There is little justification for this compilation. Moreover, since the articles come from previously translated journals, there seems very little argument for the very high price.

In contrast, the last translation listed, the proceedings of a conference, is a welcome addition to the English literature since it deals with a subject rarely represented in American journals. There is little point in listing the titles of the contributions. Suffice it to say that there is discussion of both theory and experiment with particular application to photographic emulsions. Although the articles are short, the literature references will be helpful in tracking down the previous Russian work on scattering from inhomogeneous media.

Physics for Engineers and Scientists. By Richard G. Fowler and Donald I. Meyer. 546 pp. Allyn and Bacon, Inc. Boston, Mass., 1958. $8.00. *Reviewed by Lawrence H. Bennett, National Bureau of Standards.*

THE title of this book might lead one to expect that it is intended for engineers and scientists. In fact, it is an introductory textbook in physics for science and engineering *students*. Its 30 chapters cover much of the traditional material of freshman or sophomore physics such as resolution of vectors, heat, electricity, and mechanics. In addition are included topics in modern physics not found in all elementary texts, e.g., electron spin, elementary particles, and special relativity. The modern work is not simply "tacked-on", however, but forms an integral part of the text. Room was made for the newer material by a skillful reduction of the older.

Each chapter has problems, graded according to difficulty. Answers to some of the problems are included. The book is replete with clear illustrations, averaging one every other page. Calculus notation is used, but the text is readable if these are omitted.

Among the minor objections to the textbook may be cited the use of *centigrade* temperature, without even passing reference to *Celsius* temperature, although it has been ten years since the newer terminology was adopted by international agreement.

The symbol B is used for magnetic induction and magnetic field intensity interchangeably and no mention of H or the unit oersted is made.

Fast Reactions in Solids. By F. P. Bowden and A. D. Yoffe. 164 pp. (Butterworths, England) Academic Press Inc., New York, 1958. $7.00. *Reviewed by Paul W. Levy, Brookhaven National Laboratory.*

BY "fast reactions" Bowden and Yoffe mean the various "chemical" and "physicochemical" processes involved in the explosions of solids. Considering that explosive technology is relatively "old", that it has obvious military applications, and that it has application to propellants, which depend on "slow" fast reactions, it is surprising how little is really understood in this field. The initiation and eventual detonation of an explosive may be roughly divided into three steps: first, the initiation of a reaction, second, the growth of this reaction to a steady state, and third, the steady-state propagation of the detonation through the remaining explosive. The steady-state propagation, which can be described by the thermohydrodynamic theory, is the best understood step. It is the first two steps which are the primary concern of *Fast Reactions in Solids*.

Although not arranged in the following order the subjects discussed include:

(a) The physical and chemical properties of materials which can explode.

(b) The conditions necessary to initiate an explosive with emphasis on "hot spots".