calculations: the OPW or orthogonalized-plane-wave method; the closely related pseudopotential method, applied particularly to the NFR or nearly free-electron case; the KKR or Korringa-Kohn-Rostocker method; and the APW or augmented-plane-wave method, most closely related to the KKR method. The OPW and pseudopotential methods have been most useful for the so-called "simple crystals," metals such as sodium, magnesium and aluminum, and semiconductors such as silicon and germanium.

The APW method, on the contrary, is the best one for crystals containing transition elements, and containing heavy atoms. The applications described in this book are to metallic crystals with only one atom in the unit cell, but the method has been applied as well to more complicated elements, and to many compounds. The book contains a good bibliography, and information about all the crystals that have been treated by the method. Too recent for inclusion are some papers, some not yet published, on the application of the method to ferromagnetic and antiferromagnetic crystals. For problems of this latter type, the method and the closely related KKR method are practically required, since they are the only ones capable of handling the transition elements in an a priori fashion.

The part of the theory to which Loucks has made the most significant contribution is the adaption of the method to atoms heavy enough to require relativistic treatment. This means at least the latter half of the periodic table. There is a good discussion of all the points connected with setting up the relativistic calculation, a method that remarkably enough is not much more difficult than the nonrelativistic version.

After the textual material, there are nearly 50 pages devoted to details of computer programs for making calculations. This is particularly useful, for the method so far has been used, as was indicated in an earlier paragraph, almost entirely by the students of the reviewer, who got their training at MIT. Loucks worked up his programs by himself, and this volume should help others to do the same. Many workers in other institutions who have been using the pseudopotential and other methods, feeling that they were simpler, might well be inspired by this book to learn the more powerful methods of the APW technique.

Finally, as was mentioned earlier, there are facsimile reproductions of 17 of the leading papers that have so far appeared, dealing either with the techniques of the method or with energy-band calculations made by use of it. These are well chosen and furnish a very valuable supplement to the material presented in the earlier part of the text.

It is only fair to say that this text does not cover all aspects of the APW method. For one thing, the matter of symmetry and of the application of group theory to the study of energy bands in crystals is almost completely omitted. For the very simple crystals under discussion by Loucks, this is not unreasonable; the simplification of the problem that can be brought about by use of group-theoretical methods is not necessary in order to get useful results. But as one goes to more complicated crystals, with many atoms in the unit cell (not treated in this volume), group theory becomes increasingly necessary to bring the problem within the range that can be handled with present computers. It may be appropriate to point out that an extensive review article on the method, now under preparation by L. F. Mattheiss, J. H. Wood, and A. C. Switendick, will provide a great deal of additional material, and when it is published, it should provide a useful supplement to the present book.

There are advantages, however, in simplicity, and the opinion of the reviewer is that the book of Loucks contains just about the amount of detail that should be found in a text intended to give the reader a first acquaintance with the method.

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John C. Slater is Institute Professor Emeritus at MIT and graduate research professor of physics and chemistry at the University of Florida.

Subtle and eclectic history

THE ROLE OF MATHEMATICS IN THE RISE OF SCIENCE. By Salomon Bochner. 386 pp. Princeton U. Press, Princeton, N. J., 1966. $9.00

by Eugene P. Wigner

This is not an easy book to read or review. Its purpose is, if we believe its title, to describe the role that mathematics plays in the sciences, and it describes much of this. However, it does much more—it gives a history of mathematics as seen by the author, and this is a delightful history. Almost every page has some subtle observa-

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tion, either on mathematics or on mathematicians or on scientists in general or, at least to this reader's surprise, on the history of science as an independent science. Some of these observations may be controversial—as are most subtle observations—but they are invariably illuminating and, as a rule, penetrating.

The history of mathematics contained in the book is far from being a complete history of mathematics or even a systematic review of the role that mathematics played in the sciences. It is a very eclectic story. The book ends with about 150 biographical sketches including that of Euripides, the tragedian, but not including that of Euclid. It deals with the subjects to which the author could contribute some interesting remark or original opinion. However, this reader, at least, marvelled at the number of such subjects and at the author's intimate knowledge of the original monumental contributions to science, such as those of Plato, Aristotle and Newton. He was equally surprised by the author's familiarity with scores of treatises on the history of mathematics and of the sciences.

Finally, it was a pleasure to read a book on mathematics, written by a mathematician with deep understanding of his subject, and free of the jarring misunderstandings that one encounters in many books on the history of science.

* * *

The reviewer was awarded the 1963 Nobel Prize "for systematically improving and extending the methods of quantum mechanics and applying them widely."

Nothing impious about it

ATOMISM IN ENGLAND FROM HARIOT TO NEWTON. By Robert H. Kargon. 168 pp. Oxford U. Press, London, 1967. $6.75

by L. Marton

I must confess my profound embarrassment in receiving R. H. Kargon's book for review and not knowing who Hariot was. A few days later, however, I started feeling better. I have shown the book to one of my friends, who was educated in England, has a Cambridge University degree and taught there. He never heard of Hariot either. It just goes to show that either the book is about some obscure scientists or that our education is incomplete.

BACON

DESCARTES

BOYLE

Before describing the book I would like to give my answer to the above query. Indeed Kargon's book relates the contributions to atomic theory of some of the lesser-known natural philosophers of the times around the 17th century, which is a very praiseworthy undertaking. I am a firm believer in the view that no scientific creation is entirely due to a single genius. In most cases it is possible to trace back the elements of a new thought to the contributions of several minor scientists. The "giants" accomplish most often a synthesis, either by adding some missing elements or by fusing together several apparently unrelated components that were needed to complete the edifice. I believe therefore that the present book accomplishes a very useful purpose by bringing to our knowledge the succession of events and ideas that allowed the atomic consideration of matter to triumph over the previous vague conceptions.

The early, Epicurean conception of atomism was based on considerations requiring a purely materialistic buildup of the universe. In absence of experimental proofs, practically all arguments for or against were of philosophical nature and thus subject to theological interpretation. One of the great stumbling blocks for the advancement of atomism was that it carried the stigma of atheism and many people condemned it just on that basis alone.

Kargon's book brings out the struggle in 17th-century England by listing the men, their accomplishments and the arguments used. It starts out with a description of the scientific circle gathered around Henry Percy, the ninth Earl of Northumberland, who was one of the most gifted amateurs of his time. Thomas Hariot was the leading scientist in their circle and was a staunch supporter of the atomic hypothesis.

Unfortunately, Hariot never pub-