BOOK REVIEWS

Newtonian Algebra

The Mathematical Papers of Isaac Newton. Edited by D. T. Whiteside. Volume 5. 1683–1685. With the assistance of H. A. Hoskin and A. Prag. Pp. xxii+627+4 plates. (Cambridge University: London, July 1972.) £20; \$65.

THE present volume of Dr Whiteside's magnificent edition of Newton's mathematical papers is concerned with the history of the work that was later to be published as the *Arithmetica universalis*. In probably the first half of 1684 Newton, to comply with the statutes, deposited in the archives of Cambridge University a volume that purported to contain lectures on algebra delivered by him between 1673 and 1683. As Whiteside convincingly shows, the document can in no way represent a transcript of the lectures that Newton actually gave, and for at least one "lecture" Newton was not even in Cambridge at the stated time. The document in fact had been heavily rewritten and divided somewhat arbitrarily into separate lectures; Newton's intent is clearly shown where at one point he inadvertently addresses himself to the "reader". But it seems that the work actually had few readers before it was published in 1707 by William Whiston, Newton's successor in the Lucasian Chair. In 1722 a new edition was brought out which incorporated some revisions by Newton. In neither of these editions did Newton's name appear on the title page, although the authorship would have been obvious. The first edition was very favourably reviewed by Leibniz, but Whiteside finds that the work seems to have been little used until after Newton's death in 1727. It then had a certain vogue with further editions appearing, but was fairly soon to be superseded by other textbooks.

The main bulk of this volume comprises an edition and translation of the deposited "lectures", but Whiteside also includes various preliminary drafts and intended revisions. As with the previous volumes this one is greatly enriched by copious annotations, which give us the benefit of Whiteside's vast knowledge of seventeenth-century mathematical works, and he shows clearly how Newton incorporated various parts of his earlier work in this treatise—for example, notes that he had written for inclusion in the intended publication of Nicholas Mercator's Latin translation of a Dutch algebraic work by Gerard Kinckhuysen. (The translation and Newton's notes were published in Whiteside's volume 2.) My only regret is that the exigencies of producing the

volume could not have allowed a rather easier system of cross-referencing. In particular it is not always clear where information about changes made by Whiston for the 1707 edition or by Newton for the 1722 one will be found. Thus the reader who notices an apparent lack of correspondence between some of the problems in this edition and those in the 1722 edition may well miss the fact that this is discussed on page 184 note 216.

The treatise moves from elementary arithmetical operations to the algebraic treatment of quite complex problems. But from the beginning Newton treats operations on numbers in close conjunction with those on "species" or letters denoting unknown or indeterminately treated quantities. A central concern is the reduction of various problems to equations, which Newton explicitly regards as involving a translation from ordinary language to "algebraic language". Numerous problems are worked through as examples, and Newton pays particular attention to the use of algebra in the solution of geometrical problems. Considerable space is naturally also given to techniques for solving equations, and Newton enunciates various rules for identifying characteristics of roots of equations and the limits between which they will fall. The last section of the work as it stands (Newton did not regard it as complete) treats of finding first approximations for numerical solutions of equations by mechanical geometrical constructions. Here he reveals some doubts about the desirability of completely algebraicizing geometry, and maintains that "it is not the equation but the description that produces a geometrical curve" (page 424).

The nature of the material means that this volume brings to light less that is dramatically new about Newton than some of its companions. The meticulous scholarship that Whiteside has brought to it, however, helps to prepare for a fuller appreciation of Newton's algebraic work and reveals much concerning seventeenth-century approaches to this subject. A. G. MOLLAND

Weisskopf on Physics

Physics in the Twentieth Century: Selected Essays. By Victor F. Weisskopf. Pp. xv+368. (MIT: Cambridge, Massachusetts and London, 1972.) \$7.95.

It was a good idea to collect in book form the most characteristic of

Weisskopf's essays on topical problems of physics and the social issues that its unprecedented expansion has raised: a source of renewed delight to his friends and pupils who already know its contents, this book provides to all enquiring minds and especially to the younger generation an introduction into the fundamental aspects of modern physics combining to a rare degree mastery of the subject with lucid simplicity of exposition. Indeed, the refined quality of these essays and the charm of their style would have deserved a less shabby production. The volume, introduced by a foreword (written by H. Bethe with warm feeling and deep understanding) and a delightful autobiography, is divided into four parts, respectively dealing with the basic conceptual framework of quantum theory, the main problems of the constitution of atomic nuclei and of the still more "elementary" constituents of matter, more special issues connected with the same topics, and finally some philosophical and social questions. On the latter the author discourses with his usual common sense, straightforwardness and generosity, but perhaps less pointedly than he used to do in our Copenhagen conversations with Placzek in the thirties. Although it is going too far to describe Weisskopf (as Bethe does) as "an American with European background", it is undeniable that the American environment has left its mark on his European outlook. There is one essay I sorely miss in this book: it is the one Weisskopf has never written about the epistemological breakthrough brought about by quantum theory—a theme he is so well armed to treat with persuasive brilliance. Confronted with the débâcle of epistemological thinking in the country of William James, why did he choose to shun the clamours of the Boeotians? L. ROSENFELD

Nonscience

Cults of Unreason. By Christopher Evans. Pp. 264. (George G. Harrap: London, July 1973.) £3 net.

THERE can be few who read this book who have not at one time or another had at least a mild brush with one of the cults or organizations whose history Dr Evans tells; scientology, flying saucers, blackboxery (particularly of the De La Warr variety) and eastern mysticism from Gurdjieff to Hare Krishna. Dr Evans's thesis is straightforward and fairly familiar; the rationality of science