Newton's scientific work was published under the Royal Society auspices and with the great help of his younger colleagues, Edmund Halley, Roger Cotes and others. These included the second and third editions of the *Principia*, the works on optics, on fluxions and other mathematical achievements. This book presents an engaging picture of the process by which these great masterpieces were at last published.

Until prodded by his fellow scientists, Newton always appeared reluctant to publish his discoveries for fear of controversy; yet once challenged on priority he spared no exertion in asserting his own rights and in refuting and discrediting all others who dared claim even a small share of his achievements. Here the book shows Newton as his most formidable self, bent to crush and humiliate his opponents, but also showing the kindest regard for the group of brilliant younger disciples who aided him.

It is now probably of little concern if Leibnitz deserves more credit for the calculus than merely his improved notation. But when Newton felt this rivalry from the accomplished intriguer, he loosed all his skill through the agency of his scientific friends to refute and ridicule the claims so successfully that Leibnitz died soon afterwards. It has often puzzled students of Newton's optics why he did not use the wave theory of light to explain the phenomenon of Newton's rings; the reason may well be in his abiding resentment and hostility towards Huygens for his support of Leibnitz. Newton never sought help, and he never forgave.

Physicists will be grateful that Frank E. Manuel does not often intrude to explain Newton's profound and complex nature from the viewpoint of his professional field of philosophical history. On the occasions that he does the conclusions and the relationships often are unconvincing to the physical scientist. He is more assured when he lets the impressive historical material speak for itself.

I will not comment in depth on Manuel's detailed discussion of Newton's alchemical experiments, on which he lavished such great effort but that led to so little. His chronology of the ancient kingdoms is another major story that the author treats well.

This book is exceptionally well printed and is illustrated in a most appropriate manner. Although written in a rather involved style, it should appeal to physicists, mathematicians, astronomers and all those interested in the history of science.

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Axiomatic thermodynamics

THERMAL PHYSICS. By Edward A. Desloge. 363 pp. Holt, Rinehart and Winston, New York, 1968. $9.95

by GARRISON SPOSITO

Edward A. Desloge has produced in this book a companion volume to his earlier work, *Statistical Physics*. The present tome is a relatively complete introduction to thermodynamics for advanced undergraduates, which has been heavily influenced by the axiomatic school of Laszlo Tisza and Herbert Callen. Readers who favor this view will not be disappointed to find themselves once again in the friendly milieu of energy and entropy postulates, partial Legendre transforms, mnemonic diagrams and Jacobians.

Moreover, they will not find that *Thermal Physics* is just a condensed "Callen," for its author has gone to great lengths to motivate empirically and justify the postulates he presents. In a very real sense Desloge has attempted to synthesize the laws and the axioms of thermodynamics by showing, in 73 pages of fundamental discussion, that law and axiom are but two faces of the same distillation from experience.

On the pedagogical side, the book has a number of valuable attributes. Its chapters are short, averaging about nine pages a piece, and are well endowed with worked examples and rel-

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evant problems. Besides this, the ordering of chapters, proceeding from principles (axioms and laws) to methods (potentials and Maxwell relations) and to consequences and applications, should make the book an excellent instrument for self-study. The applications, incidentally, take up half the total number of chapters and range from the ubiquitous ideal gas to the less expected elastic and magnetic systems and systems not in equilibrium.

The discussion in these chapters is not all what one might wish, however, because of its general tendency to describe only ideal systems and to relegate any description of real systems—real gases, real liquids, real paramagnets—either to problems or to tables in the back of the book. The effect of this segregation is to lend an abstract character to the discussion that the general undergraduate reader may find unpalatable and conducive to the suspicion that thermodynamics is more an exercise in model building than a consensus of experience. In this respect, those who are cool to the axiomatic approach would appear to have a valid point of contention.

In summary, *Thermal Physics* can be recommended as a textbook for a one-term course on thermodynamics at the junior or senior level, provided that the course is of a somewhat theoretical bent and that the applications in lecture are more than geometric illustrations of the equations developed.

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Graphite and neutron irradiation

PHYSICAL PROPERTIES OF GRAPHITE. By W. N. Reynolds. 193 pp. Elsevier, New York, 1968. $11.00

by GEORGE MONTET

Much effort, both experimental and theoretical, has been expended to understand the ways in which the physical and chemical properties of graphite are affected by irradiation. In addition, the rigorous specifications for nuclear graphite have required precise determinations of unirradiated graphite properties.

A more recent stimulus for the study of the properties of graphite has been interest in its anisotropy; the availability of large specimens of well annealed pyrolytic graphite makes possible the investigation of anisotropy in a great variety of properties. This short book by William Reynolds is limited to those properties of graphite that are related to these modern aspects of graphite technology; nevertheless, it is of interest to scientists and engineers associated with the older technology based on graphite electrodes, brushes and resistors.

Reynolds's monograph presents a concise account of the physical properties of well graphitized materials, such as single crystal, pyrolytic and high-purity polycrystalline graphites. The discussion is based on the idealized hexagonal structure of graphite. The relationships between the real structures and the ideal structure is treated in the first chapter. The accounts of microscopic and x-ray examinations of the various forms of graphite are particularly good.

The second chapter features illuminating summaries on the fundamental mechanical properties of both single crystal and polycrystalline graphite, but little is said of the technologically important properties of friction and wear. Dealing with thermal, electrical, and optical properties, the next two chapters form an excellent introduction to the theory of these properties for anisotropic substances such as graphite. The resulting anisotropy is competently described, but certain difficulties attending conduction along the c-axis are ignored. The brief chapter on surface and physicochemical properties does not maintain the high level of the rest of the book; yet it can be recommended as a useful compendium of results.

The author has made substantial contributions to the investigation of point defects and radiation effects in graphite, and the end of the book is devoted to these topics. Here the discussion is particularly good and the presentation is authoritative and well documented. It is interesting to observe that, despite the great amount of work on determining the values, there remain serious discrepancies among the various activation energies assigned to point defects in graphite. The chapter on neutron damage to graphite is limited to the physical effects and contains a lucid account of the relatively recent observations by transmission-electron microscopy.

The book is highly recommended as a source of well presented, easily digested information for all who are interested in the physical properties of graphite and the effects of neutron irradiation.

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Nuclear astrophysics

PRINCIPLES OF STELLAR EVOLUTION AND NUCLEOSYNTHESIS. By Donald D. Clayton. 612 pp. McGraw-Hill, New York, 1968. $22.50

by R. A. JAMES

Apart from its considerable intrinsic interest, the field of stellar evolution has important connections with other branches of physics. One example is the fruitful interaction with the study of galactic structure and evolution. Another comes from the identification of nuclear transmutations in stellar interiors as the main source of stellar energy. This has led to important developments in nuclear physics, and is vital to the problem of explaining the origin of the chemical elements.

Newcomers are frequently bewildered by the complexity and variety of the physical processes involved. Unfortunately this complexity is all too faithfully reflected in the literature. Progress has been so rapid that suitable and up-to-date texts have not been available. Donald Clayton is an old student of William Fowler, and has made a number of original contributions to nuclear astrophysics. Students and teachers will be grateful to him for writing this book.

He begins by outlining our observational knowledge of the stars and the conclusions drawn from simple physical arguments. The next two chapters consider the thermodynamic state of stellar material and the mechanisms of energy transport. The discussion of nuclear-energy generation is split between two chapters. One considers the basic physics underlying all nuclear reactions, and the other describes the reactions that are important in stellar interiors. Following these are the methods most used in calculating stellar models, and a summary of the characteristics of the main phases of a star's life. He makes no attempt to give a complete account of