But many details still have to be filled in. So there is work to be done; keep to the grindstone. What happened to vision and enthusiasm? Is the present situation not almost a repetition of that of the turn of the century? Have not just recently some "sacred" invariance principles, namely, parity and time reversal, been proven not to be obeyed by nature in analogy to the violation of Galileo invariance of yore, and have not the incomprehensible energy sources, the quasi-stellar objects, made their appearance, the counterpart to the then incomprehensible energy generation in Becquerel's radiation? Are we not right at this moment witnessing the first manifestations of an as yet unknown invariance principle, the analogy of the Lorentz invariance, which will explain the breaking of the symmetries?

These faults of the book are real enough. They are, however, outweighed by a factor of about 500 by the positive aspects. Claims to the contrary notwithstanding, this is not a college textbook for science majors. It is an informative book to be read and enjoyed and perhaps struggled with. As a matter of fact, beginning with a level corresponding to high school, I know of nobody who would not profit from reading Gamow's book. A physicist could improve his teaching skills, a member of the other professions, including that of physicist's wife, could overcome Snow's famous gap between the diverse cultures, and, finally, Gamow himself could eliminate the few remaining faults of the book in anticipation of the next edition. The book is fully worth its price and, in fact, can make an ideal gift, even for physics graduate students.

Introduction à l'Emploi de Rayonnements en Chimie physique. Vol. 1, Cheminement des Particules chargées. By Yvette Cauchois and Yvonne Heno. 271 pp. Gauthier-Villars, Paris, 1964. Paper 52 F.
Reviewed by L. Marton, National Bureau of Standards.

This interesting monograph on the scattering of charged particles forms the first volume of an introduction to the use of radiations in physical chemistry. A brief enumeration of the chapters may give a good idea of the contents. In the first, introductory, chapter are some remarks on the sources of charged particles. A short review is given of the interaction of charged particles with matter, including Cerenkov effect and the effects of annihilation. The second chapter is a good presentation of the different types of collisions, such as elastic, inelastic, and nuclear. The third is devoted to a treatment of bremsstrahlung and is followed by a fourth chapter on total energy losses, straggling, and mean free path. The last third of the book is taken up by appendices, and I would like to single out the excellent treatment of synchrotron radiation although it is extraneous to the main object of the book. In over thirty pages the existing theoretical and experimental material on this type of radiation is reviewed, and it is, as far as I know, the best review of its kind.

I have not previously seen any French book treating electron interaction with matter, and I think it is a definite gain for the French scientific literature to have this book appear. Cauchois and Heno have done a good job in assembling the material and presenting it in a concise manner. Maybe the manner is too concise, and a serious reader will have to go quite extensively to the original literature for more information. Parts of the book reflect the incompleteness of French scientific libraries, by referring to review articles rather than to the original papers.

As usual, there are some items that I would like to submit as possible corrections if there is a second edition. One reason for my complaint is the very long list of errata, which is added as a loose leaf to the volume, containing over forty items, that is, about one correction for every sixth page. I am also inclined to disagree with certain statements, such as, for instance, the remarks about the electron microscope and the x-ray microscope contained in the foreword: "The electron microscope and, in principle, the x-ray and proton microscopes provide a direct view of the morphology of molecules and of other atomic groupings." I think this statement is too optimistic. An added defect of this interesting book is that there is no index. All these are relatively minor defects, and they can be easily improved in a second edition.

The book is written in good style and offers easy reading. For the use of students it would have been preferable to present it between hard covers, rather than as a paperback.

Magnetism. George T. Rado and Harry Suhl, eds. Academic, New York, 1963 and 1965. Vol. 1, 688 pp., $19.00; Vol. 2 part A, 443 pp., $15.00; Vol. 3, 623 pp., $18.00.
Reviewed by R. P. Hudson, National Bureau of Standards.

In times of million-dollar research programs and papers jointly authored by as many names as filled the attendance roster at an olden-days conference, it is perhaps not surprising that a detailed review of the present understanding of magnetism should be undertaken only by enlisting the expository talents of some 50 experts. In a phrase, collective phenomena collectively treated. . . .

Understandably, then, the work takes on the aspect of an encyclopedia rather than the "treatise" claimed by the editors and publishers. Not that the product necessarily suffers thereby as a didactic or reference aid, but it perforce abandons almost all hope of genuinely aesthetic appeal, of furnishing *reading pleasure*, and of easing the reviewer's task!

This "treatise on modern theory and materials" was conceived as a trilogy, but, now that a third volume has appeared after a two-year delay, a fourth volume (in preparation) will be needed to do the subject justice. (This will cover the topic of magnetism and superconductivity, among others.) The style of the individual articles is less varied than one might have expected; the exposition is generally far from leisurely, which is not surprising in view of the encyclopedic coverage and understandable limitations of space.

The range of subject matter can best be conveyed by citing the official list of contents: Volume I—Magnetic Ions in Insulators: Their Interactions, Resonances and Optical Properties. Volume II—Statistical Models, Magnetic Symmetry, Hyperfine Interactions, and Metals. Volume III—Spin Arrangements and Crystal Structure,

Domains, and Micromagnetics. Individual articles (twelve each in Volumes I and III, seven in Volume II, A) run the gamut from statistical mechanics to the structure and switching of permalloy films and include excellent discussions of exchange, anisotropy energy, ferro- and antiferromagnetism, spin waves, resonance and relaxation, optical properties, domains, spin arrangements and neutron diffraction, hyperfine interactions, crystal structure and symmetry considerations, annealing, crystal preparation, permanent magnet materials, and microwave devices.

Magnetism, equally with any other branch of modern physics, is a rapidly expanding field of study and bedevilled by the "information explosion". Thus, regrettably, some parts of the presentation will be significantly out of date before the final volume becomes available. This very defect underscores, of course, the magnitude of the task that the editors set themselves, and it would be churlish to be other than most grateful to them and their contributors for this massive and highly valuable work of reference. A word of warning to the casual title reader and purchaser (if such exists): this is *not* an exhaustive review of magnetism; it is a review of magnetically ordered materials, and paramagnetism is all but totally excluded.

The Theory of Magnetism. An introduction to the Study of Cooperative Phenomena. By Daniel C. Mattis. 303 pp. Harper and Row, New York, 1965. $11.50. *Reviewed by Daniel B. Butrymowicz, National Bureau of Standards.*

The increasing volume of published literature on magnetism and other cooperative phenomena reflects the great activity and complexity in this field of theoretical physics. Giant strides are being made in the understanding of cooperative phenomena in systems of large numbers of interacting particles. Here is a book that presents most of the material likely to aid in the solution of those problems that limit our understanding.

The introductory chapter is an excellent historical summary of theory of magnetism, beginning with the ancient Greeks and ending with the developments of the past few years. Chapter 2 is devoted to obtaining a qualitative understanding of the meaning of exchange and its importance for a theoretical interpretation of magnetism. An introduction to the quantum theory of angular momentum follows. In Chapter 4 the author shows how intra-atomic exchange (Hund's rule), as put forward by J. C. Slater in the late 1920's, is necessary for understanding the magnetic properties of the ferromagnetic transition metals.

Three chapters deal with the statics and dynamics of magnetism. Included is a brief but adequate treatment of the equations of motion of spin waves. The author's discussion of the quantum theory of spin waves in insulators makes use of the semiclassical theory as a guide in the development of some of the well-known approximate theories. Another chapter deals with theory of magnetism and magnons in metals; it begins with a review of band theory in the one-electron approximation (emphasizing tight binding), continues with the reasons for strong magnetic properties, and ends with the derivation of the theory of magnons in metals for several models.

Chapter 8 introduces the reader to some of the problems of elementary statistical mechanics, as well as the elementary theory of thermodynamics in magnetism.

A final chapter details the two-dimensional Ising model. The principal properties of the model are derived by using only elementary properties of spins one-half and their transformation to fermions. Although the main results are for the two-dimensional net, many of the formulas can be extended to three dimensions.

The book is by no means a comprehensive treatise, nor was it intended to be. In choosing the subject matter, the author has emphasized strong interactions among two or more particles, especially where collective phenomena are involved. He has omitted all time-dependent or irreversible phenomena, spin-orbit coupling (and other causes of magnetic anisotropy), the theory of the Landé g factor in solids, and experimental and technical properties. Such omissions are taken care of in a bibliography, which consists mainly of annotated references to the omitted material; this in effect extends the scope of the book considerably. Material covered in the text is referred to in footnotes.

Several problems are included since the book was written primarily for the beginning student in solid-state physics. Solution of these will require a knowledge of principles rather than skill in numerical computation. To comprehend the more theoretical subject matter of theories of magnetism in metals, the Ising model, and spin waves, it will be of benefit for the reader to have had an introductory course in quantum mechanics. Some familiarity with statistical mechanics will also help, but it is not essential.

The volume can certainly be recommended as a textbook, since it is clearly written with unity and continuity throughout. The specialist working in this area of physics will find it highly useful since the author has reviewed each of the topics sufficiently in depth to give a coherent picture of the advances made to date. Finally, it will be of value to other scientists interested in learning of the progress being made in our understanding of magnetism as a cooperative phenomenon.

Boolean Algebras (2nd ed.). By Roman Sikorski. 237 pp. (Springer-Verlag, Berlin) Academic, New York, 1964. $9.50. *Reviewed by Dagmar Renate Henney, The George Washington University.*

It is rumored that one of the members of his examining committee at the University of Warsaw had jested that because of the number of papers that had already been published by Sikorski they would have to award the doctor's degree to him. But he added that if he published another set like it, they would have to take back his degree.

Of course he was passed with flying colors, and the second edition of his book indicates Sikorski's success as a noted mathematician and author. Of the two possible approaches to the theory of Boolean algebras, that is the algebraic or the set-theoretical, the author chooses the set-theoretical aspect for his book. The book consists of two chapters and an appendix.