

well within the current state of the art.

In another chapter, we read of the less celebrated observer William F. Denning (1848-1931) who "remained a life-long bachelor in order to devote the maximum possible time to his observational work." Thus, Denning was spared the anguish felt by another comet enthusiast, who missed a new comet due to the death of his wife.

Six of the seventeen chapters are devoted to meteors, meteoroids and meteorites (the author's definitions of these terms are, however, not the accepted ones). The presentation is rather interesting, although several important topics, such as luminous efficiency, are not discussed, or are only briefly mentioned. In the latter category it is particularly regrettable that while radioactive dating is described, the implications of such studies of meteorites for the general understanding of solar system evolution is not brought out.

P. L. Brown, who is an experienced amateur astronomer and author, also discusses the prices paid for meteorites. Many astronomers have had some fleeting contact with this subject and each may have his own story to add to the list. I recall correspondence with a midwestern farmer in the early 1960's who had ploughed up a stone and needed to know whether museums paid more for a single big meteorite or several smaller ones.

This book will interest the general reader, although it is not really much more up-to-date than similar volumes written a decade or more ago. It would have benefitted a great deal from a pre-publication review by a scientist working in the fields discussed. Also lacking

is careful attention by the manuscript editor. On one page, for example, "Clairaut" is misspelled six times, and on another page, "Bennett" is also multiply misspelled, although both words are done correctly elsewhere in the book. The index is excellent.

Although flawed, this book will be a useful addition to many libraries at a time of wide public interest in comets. Perhaps somewhere a young reader will be inspired to join the hunt, for, the author tells us, even in the 1970's, "Medals and immortal glory are still to be won."

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The Dynamics of Atoms in Crystals

W. Cochran
145 pp. Crane, Russak, New York.
1973. \$13.95 hardcover, \$6.95 paperback

The most truly characteristic aspects that distinguish solid-state physics from the other branches result from the periodicity of a crystalline solid. In demonstrating the various concepts that follow from translational symmetry (for example, collective elementary excitations and their interactions) one can scarcely choose better elementary examples than those encountered in lattice dynamics. One is thus not surprised to find that a projected series of student texts entitled, "The Structure and Properties of Solids," should include an early volume on lattice dynamics. An advantage of a series of relatively short texts over the traditional single comprehensive volume is that authors with genuine expertise in their various subfields can be induced to contribute. The present series sets a high standard with the choice of William Cochran of the University of Edinburgh. Cochran's work has strongly influenced the development of modern lattice-dynamical theory, and he has been instrumental in unifying recent developments with a series of timely reviews of the subject during the past decade.

This text could hardly be other than accurate and authoritative in its treatment of topics. These topics include chapters on the dynamics of both one- and three-dimensional lattices, elementary diffraction theory, experimental methods of determining phonon dispersion relations, as well as chapters on thermal, optical and transport properties of crystals at least insofar as they are concerned with vibrational excitations. Cochran also includes two further topics, anharmonicity and the role of lattice dynamical instabilities in



Comet Burnham 1960 II with its "wagging tail" was recorded at Lowell Observatory.



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By John S. Blakemore, *Florida Atlantic University, Boca Raton.*
506 pages, 265 illustrations. \$16.95. May 1974. Order code 1701.

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By Carl R. Nave, *Georgia State University*, and Brenda C. Nave (RN), *Georgia Baptist Hospital.*

About 285 pp., 170 illus. Soft cover. Ready January.
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phase transformations, which are either ignored or given short shrift in most elementary treatments.

The text is generally clearly written and amply illustrated, often with actual experimental data. The level is truly introductory; the active practitioner in the field will find little of interest. I should imagine that the researcher or graduate student in the material sciences or physical chemistry who requires a quick and not too painful encounter with the fundamentals of lattice dynamics will appreciate this book. I have certain reservations about the suitability of the book as an undergraduate text, however. One stems from the inevitable problem, particularly acute in an early volume of a series of this sort, of deciding what to include in order to make the work reasonably self-contained. This problem surfaces several times here. To quote a single example, the statement that a certain wave function is of the form required by Bloch's theorem must be less than comforting to a reader unencumbered by any knowledge of the content of the theorem, and possibility that it will be discussed in a later volume of the series will provide little reassurance. Although the mathematical developments are elementary and rather complete, there are no problems to test the depth of the student's understanding. Moreover, in scrupulously avoiding the "frontiers" of any of the topics discussed, the book generates little feeling as to what, if any, interesting unsolved problems remain. This is admittedly never easy to achieve in a student text, but it is always worth attempting.

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Macroscopic Electromagnetism

F. N. H. Robinson

246 pp. Pergamon, New York,
1973. \$18.00

If physics is to continue to be the professional activity of a large number of scientists, it seems that we should train our students to apply the profession's best experimental and theoretical tools, as well as its unique approach to problems, not only to the fundamental questions of high-energy physics, but also to frontier problems in condensed-matter physics, chemistry and the life sciences. This requires training with more emphasis on the "traditional" disciplines, such as thermodynamics and statistical mechanics. I hope that F. N. H. Robinson's book will help this to come about.

Macroscopic Electromagnetism is in-

tended as a text for upper-level undergraduate or beginning graduate courses, and it fills a vacancy left by the currently popular texts. Several of the latter provide excellent coverage of electrodynamics in vacuum, but gloss over the electromagnetic properties of matter with heuristic arguments designed to make the introduction of some phenomenological parameters acceptable. Robinson has thought deeply about how to relate the atomic and quantum-mechanical nature of matter to the phenomenological continuum approach we meet in Landau and Lifshitz's *Electrodynamics of Continuous Media*. He carefully leads his reader to see some of the inconsistencies that arise with too cavalier an attempt by improperly carried out "averages." He formally bridges the gap between the microscopic and macroscopic by the introduction of a truncation process to eliminate the higher wave-vector spatial Fourier components that contain information unnecessary for the length scales of interest. This avoids unwanted difficulties and leads to the desired results in a physically reasonable and plausible way. Robinson's particular demonstration that macroscopic continuum electrodynamics is a physically reasonable and logical result of Maxwell's equations applied to the atomic nature of matter is the book's strongest point and its greatest contribution.

In addition to four chapters devoted to the discussion just mentioned, Robinson provides introductory ones devoted to a concise treatment of the field equations, potentials and multipole moments. He then goes on to applications of the basic material. These include plane-wave propagation, energy, power and stress in media. Both macroscopic aspects (causality and the Kramers-Kronig relations, as well as anisotropic behavior) and microscopic aspects (including Onsager and Lorentz local-field calculations) of the constitutive relations are discussed. The author also includes chapters on thermodynamics and statistical mechanics of the electromagnetic properties of materials, including a chapter on noise and fluctuations. All of these discussions are brief, as one expects for such a range of topics in a book of some 240 pages, but are not usually superficial. For example, the treatment of nonlinear optics includes the concept of phase matching, and Robinson usually points out difficulties that remain for each topic and leaves his reader with the feeling that there is much more to it; references are usually given to the original literature.

Finally, I should turn to the precise role of *Macroscopic Electromagnetism* as a textbook. Students who use it must have had a sound introductory course in electricity and magnetism through Maxwell's equations. They

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