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 intended 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

should also be prepared by an introductory course in thermodynamics and statistical mechanics. Mathematically, they should be at home with vector calculus (the book has an excellent appendix) and familiar with Fourier transforms and elementary concepts of tensor notation. Familiarity with contour integration and Green's function solutions to differential equations would be helpful. The author places his book at a slightly lower level than David Jackson's *Classical Electrodynamics*, which seems about right, although comparison is difficult because of the two books' orthogonal coverage of electromagnetism. I would not assign this book as a principal text because many important topics, such as radiation, interference, diffraction and electrodynamics, are not included; unfortunately, the price seems rather high for a supplementary book.

The book's role in the field appears clear—it provides an excellent bridge between the usual junior-level course in electricity and magnetism and such advanced texts as the Landau–Lifshitz series. Robinson's sensitivity to the conceptual and logical difficulties that might trouble a probing student and his terse style make a book that a student could profitably read on his own. Numerical illustrations are used to maintain contact with the physical world, and each chapter is followed by a set of problems, which frequently require numerical calculations.

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The Practitioner's Shell Model

G. F. Bertsch
206 pp., Elsevier, New York,
1972. $11.95

Many potential readers may be put off by the title of this book, which suggests a work on the intricate details of large-scale, mixed-configuration calculations done on a digital computer. That this is not the case is immediately apparent from the fact that a chief ingredient of such calculations, the coefficients of fractional parentage of the antisymmetrized wave functions of shell-model configurations, is not even mentioned. Instead, the subject is one of widespread and pressing interest to the general practitioner of nuclear physics, namely an explanation of the "qualitative effect of configuration mixing on the physical observables" in terms of the properties of the nucleon–nucleon interaction.

This main topic is subdivided into (1) correlations between two "valence" nucleons (two particles, two holes, or one particle and one hole), (2) coherent correlations among many valence nucleons and (3) weak "polarizations" of the core by valence nucleons. These are treated separately in chapters 5–7, preceded by four introductory chapters, and followed by one concerning the information on nuclear structure to be gained from direct, nucleon-transfer reactions. A number of interesting problems and their solutions are provided for each chapter.

Most of the novelty in the book seems to be contained in chapters 5 and 7. In the former, an extensive table reproduces two-particle or two-hole wave functions taken from the literature for fifteen nuclei. These were obtained by relatively simple diagonalizations of shell-model Hamiltonians appropriate to the various nuclei. The author, G. F. Bertsch points out that the mixed j–j coupled configurations often correspond to nearly pure LS coupling configurations, in which two-particle correlations are maximized. These correlations are examined by a plot of the pair correlation as a function of the distance between the nucleons and by a formula for the pair correlation as a function of the angle between the position vectors. Turning to one-particle–one-hole (1p–1h) states, the author defines "multipole states" and explains their large correlations. He then examines whether the energy eigenstates are correlated and consequently whether the multipole strengths are concentrated or fractionated among the eigenstates. This discussion involves the expansion of the particle–hole-coupled matrix elements of the residual interaction in terms of the corresponding particle–particle-coupled ones.

Deformations of the core by valence nucleons are discussed by means of second-order perturbation theory. This involves virtual "core polarization" processes (analogous to vacuum polarization in quantum electrodynamics) in which a particle–hole pair is created and destroyed. Bertsch is well qualified to describe this field, as he was involved in the earliest work on nuclear core polarization in association with G. E. Brown at Princeton in the mid-1960's.

It is stated in the preface that the book grew out of lectures at Michigan State. Unfortunately, insufficient care was devoted to putting the material in book form. There are very many misprints and faulty references to equations. Few concessions are made to the beginning reader: Little attention was given to eliminating confusing imprecisions in terminology or to pedagogical care in presenting derivations. Much of the physics in this book depends on the signs of quantities, yet crucial ambiguities, lacunae and typographical errors intervene. No references to more