

typos, missing symbols in equations and a notation for vectors that is virtually undetectable.

Molecular Biophysics might be used as a text, but only for sophisticated students. A mastery of elementary statistical mechanics and quantum mechanics would be required and a familiarity with biochemistry is needed in many sections. But the presentation is authoritative and unique and the book should be seriously considered by anyone concerned with theoretical and physical aspects of molecular biology.

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Introduction to Group Theory with Applications

G. Burns

Academic, New York, 1977. \$18.50

Ever since the mid-1920's, when Eugene P. Wigner, John von Neumann and others begin to apply group-theory methods in physics, many people have realized that great beauty and great simplicity can emerge from the collaboration of group theory and physics. In many branches of physics the use of group theory can reveal unifying underlying principles that may be obscured in a welter of special results. This is the case in solid-state, atomic and molecular, and nuclear physics, to give a few examples. In other branches of physics, where "exact" calculations are not reliable owing to some lack of knowledge of the coupling constants or other aspects of the dynamics, "symmetry reigns" as the major tool. Despite this long and successful record of usefulness, there does exist, even now, among some physicists a certain discomfort with "the group pest." For some people the group-theoretic, or algebraic, approach to the analysis of physics problems requires overcoming a certain barrier or "activation energy" before one can conceptualize and solve problems using group-theory formalism.

In his *Introduction to Group Theory with Applications*, which is primarily directed toward an audience of condensed-matter scientists, Gerald Burns has attempted to provide assistance in overcoming this barrier. As he puts it, his "goal is to provide a 'feel' for the subject." I think he has succeeded rather well. At the outset I should emphasize that this is not a mathematical, formal or rigorous treatise. It is, however, of a genre of il-

lustrative texts that serve an important pedagogical function—namely, to supplement the rigorous treatments and to give numerous examples (including pedestrian and very specific ones), and to motivate the reader to press on, by emphasizing the rewards for persistence.

In 13 chapters the book touches on many important aspects of group theory of interest to the atomic, molecular and solid-state scientist:

▶ as a mathematical tool—selected abstract definitions and properties of groups and their finite-dimensional (unitary) irreducible representations;

▶ as a means by which the physical eigenstates of systems can be classified into irreducible representation—that is species of molecular and crystal vibrations; atomic, molecular and crystal eigenstates including molecular-orbital and energy-band symmetry labels; and

▶ as a calculational procedure—by which some simple selection rules can be found.

Burns provides nice illustrations on symmetry of molecular vibrations in simple molecules, crystal-field splitting, and selection rules including such rules for infra-red and Raman vibrational processes. It would be easy to criticize this book for its omissions. Burns does not discuss the Jahn-Teller effect (which lends itself to very pretty illustrations of just the introductory type I have always found useful to a student), or "accidental" degeneracy (defined on page 132) as a possible concomitant of higher symmetry (for example, in the hydrogen atom, where the relevant group is $O(4)$ and not $SU(2)$ (or $O(3)$), to explain the Balmer series). Burns gives an extremely sketchy treatment of continuous groups and mentions not at all Lie algebra (or groups) in connection with angular momentum and many novel applications in atomic and molecular physics. In view of Burns's general success in achieving his goal of conveying a "feel," such criticism should be understood rather as expressing some of my own prejudices and favorite topics.

On the other hand, one could expect more care in proofreading. Tanabe's name should not have been misspelled in the table of contents (page xi). In the discussion on time reversal (page 337) the statement "terms like $(C_2)^2 = E$ and not E " should have been corrected or omitted entirely, and in discussing the rotation group (page 352) the equation $D^2 \times D^2 = D^1 + D^1 + D^0$ should have been correctly given. The students who use this text are I assume very likely to be confused by these misprints and others, which ought to be eliminated in future printings.

All in all, Burns (a well known physicist and staff member of the T. J. Watson Research Laboratory of IBM), who has made notable contributions to our understanding of ferroelectrics, has written

a useful book. I can recommend it, in conjunction with one or another more thorough and rigorous texts, such as Wigner's *Group Theory & Its Application to the Quantum Mechanics of Atomic Spectra* (Academic, 1959) or Morton Hamermesh's *Group Theory & Its Application to Physical Problems* (Addison-Wesley, 1962).

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Crystallography and its Applications

L. S. D. Glasser

224 pp. Van Nostrand Reinhold, New York, 1977. \$24.95 clothbound, \$12.50 paperback

The steadily increasing importance of crystallography, in fields ranging from solid-state physics to molecular biology, ensures a steady flow of texts on the subject; *Crystallography and its Applications*, by Lesley S. Dent Glasser, is one of the latest. It differs from most of the others in that Glasser did not intend to provide a complete account of crystal-structure determination, and she describes a variety of other crystallographic techniques in enough detail to show at least their range of usefulness. The book is for advanced undergraduate students and research workers who occasionally need to use crystallographic methods and read crystallographic reports. Glasser, a lecturer in chemistry at the University of Aberdeen, is a card-carrying crystallographer in the fine British tradition.

After an introduction to the basic concepts of lattices and symmetry, Glasser turns to studies of optical properties of crystals by use of the polarizing microscope. She argues that a modest investment of time in learning this art is well repaid by quick results in identifying materials, determining if more than one phase is present, determining symmetry and orientation, and even in estimating the density of crystals. The presentation is refreshingly clear, and Glasser suggests a few experiments to encourage the beginner.

The major part of the book is a description of x-ray diffraction: the production of x rays, the geometry of diffraction (by way of the reciprocal lattice), single-crystal diffraction photographs, the determination of structure and the assessment of the accuracy of the results. Glasser gives briefer treatment to diffraction from powders and to neutron and electron diffraction from crystals. A final brief chapter indicates the advantages and limitations of various techniques, and includes suggestions for what material to learn and what equipment to buy, de-

pending on the interests of the research worker.

The reader will find here a fresh, cheerful, concise account of major crystallographic techniques, together with lots of sound and intensely practical advice. Concerning the use of a polarizing microscope, Glasser notes:

There are two golden rules: never use a polarizing microscope without permission and never make an adjustment to it unless you are quite sure you know what you are doing. Neglect of these two simple rules can result in quite extraordinary amounts of ill-will.

Glasser emphasizes the physical or geometrical basis for each technique, and rarely provides a formal derivation of a result. The drawings are numerous and clear, the freedom from typographical errors is commendable, and I noted only one factual error: a wrong identification of the transition giving rise to the $K\alpha_2$ line in the x-ray spectrum of an element.

Glasser omits or merely mentions many topics that we might expect to find. She provides only a handful of problems, hidden in the captions to figures. Almost no reference is made to work published since 1970. Glasser allots only a few scattered paragraphs to single-crystal diffractometers and omits entirely modern direct methods of structure determination. In consequence, this book could have been written perhaps twenty years ago with only slight differences. An extensive bibliography that includes most of the better-known monographs partly remedies these omissions. Glasser's book is thus a splendid introduction, but only that.

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**Electromagnetic Vibrations,
Waves, and Radiation**

G. Bekefi, A. H. Barrett
664 pp. MIT, Cambridge, 1977. \$17.50

In one sense, George Bekefi and Alan Barrett's *Electromagnetic Vibrations, Waves, and Radiation* is a luxury, like an enticing appetizer or dessert. I cannot agree more with the authors on the prerequisite for this text—a sound course in the principles of electricity and magnetism. The strength of this book lies in the wealth and fascination of modern applications of electromagnetic theory. The weakness lies in the lack of solid fundamentals.

The main emphasis of the book is on "the oscillatory aspects of the electromagnetic field." So, Bekefi and Barrett treat generalities about oscillatory motion in the first two chapters. They devote the rest (six chapters) to the many facets of

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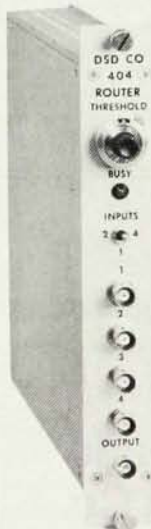
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