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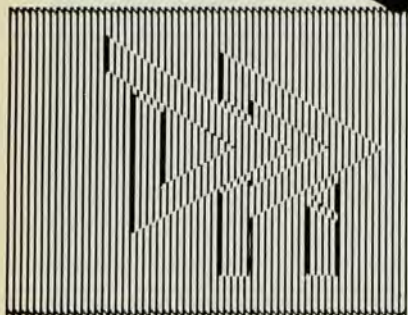
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and multilayers. The third section includes a detailed treatment of the effects of electromagnetic retardation on the interaction potentials of spheres, cylinders and half spaces. Finally, the fourth section describes the semiclassical Schrödinger formulation and the fully quantized treatment of van der Waals forces, providing partial clarification of the more heuristic approaches given in preceding chapters.

Physicists, chemists, biologists, and other workers in the area of macroscopic van der Waals forces will find Langbein's monograph a useful reference. It will not be particularly suitable for students attempting to enter the field, however. The material is quite difficult, and the manner in which it is presented does not particularly aid in its mastery. Even so, the modern research library will want to acquire this recent addition to the distinguished series of Springer tracts in modern physics.

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Electronic States and Optical Transitions in Solids

F. Bassani, G. P. Parravicini (R. A. Ballinger, ed.)
300 pp. Pergamon, New York, 1975.
\$23.50

In the fifteen years since the invention of the laser, crystal optics has become one of the largest specialties in solid state physics, and subspecialties of crystal optics have in turn become major activities. The present monograph is intended to give a self-contained treatment of electronic structure of crystals and related optical properties, with emphasis on the role of space-group symmetry as an essential and unifying theme. In the reviewer's opinion, Franco Bassani, of the University of Rome, who is a well known and prolific contributor to the field, and his collaborator G. Pastore Parravicini, have achieved a measure of success in their endeavor.

About half this book is concerned with basic group theory and with the basic theory of electronic energy bands in crystals; the remainder utilizes this work in the analysis of optical properties of crystals.

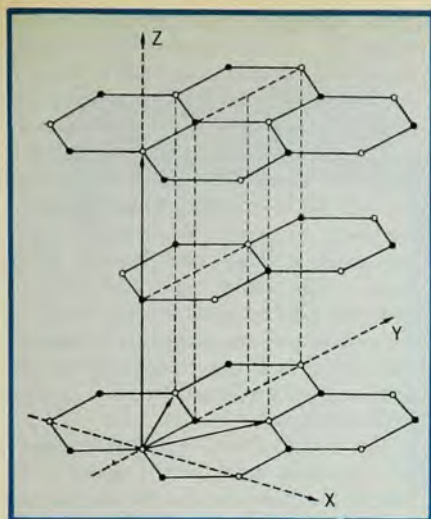
The section on basic group theory is a nice survey—with examples—of the important theorems, none of which are proven. A very useful pedagogical feature throughout is the inclusion of tables that summarize various options and alternatives. For example, Table 1-23 shows the effects of time reversal symmetry for particles of integer or

half-integer spin; Table 5-1 deals with the joint density of states near critical points, and others appear in various places in the text.

While summaries of conventional material are rather good, the presentation of general theory is a bit sketchy: one example is the calculation of selection rules connecting different wave vectors, in which the authors focus on cases where simple point group theory suffices. Thus in diamond only the rules $L_j \times L_j = \Gamma_k$ are given but no account is taken of rules such as $L_j \times L_j = X_l$, which involves a deeper analysis and which is needed for investigation of non-trivial phonon-assisted processes. Ray-representation theory is not explicitly mentioned despite the complete discussion, among other things, of representations at X in diamond; actually the "representation group" is introduced de facto as a "new" group in a sudden manner which, after reflection, appears quite reasonable, but this approach is a little unsatisfying for the student seeing the group for the first time. Since essentially none of the standard, important group-theoretical theorems (orthogonality theorems, Wigner-Eckart theorem, idempotent projection operator theorems, and so forth) are proven, the reader will need to consult other literature if any questions arise.

Basic energy band theory is surveyed in a comprehensive fashion with all the principal current methods of calculation discussed and ample references to the literature for details. An important topic is " $k \cdot p$ " theory, which is merely sketched. Surprisingly, the authors omit reference to the powerful method of "invariants" discussed and used by Joaquin Luttinger, G. Bir, Gerald Picus and others. Very good coverage and illustration of much of the general band theory is given, with examples taken from crystals of all types—covalent, ionic, and mixed bonding. The factors determining the order of states are set forth in a physically transparent and convincing manner.

The theory of optical processes (mostly absorption) occupies the last half of the book. Bassani and Parravicini treat the radiation-matter interaction in semiclassical approximation, and the "golden rule" is the key ingredient. The one-particle (band-band) transitions are handled first, with careful attention to effects of critical points in the density of states. Exciton effects are then introduced (the electron-hole interaction is turned on). The discussion here is fairly complete and there are many illustrations from spectra (CuI, Cu₂O, argon, and others). A serious omission, in my opinion, is the absence of discussions of the separation of exciton center-of-mass motion and relative electron-hole motion, which means



Three-dimensional form of graphite crystal

that no discussion of spatial dispersion effects is given. The treatment of second-class spectra in Cu_2O does not mention important anisotropy effects due to the quadrupole nature of the transitions analyzed by the late E. F. Gross and his Leningrad collaborators, S. Nikitine and his coworkers at Strassbourg and Roger J. Elliott, among others. The book concludes with a useful discussion of optical effects of impurity states and the effect of external perturbations.

In my opinion this monograph will be useful as an intermediate-level text for graduate students and research workers with an interest in symmetry and optical properties of crystals due to electronic transitions. The book provides a good overview, much detail and some theoretical framework, which permits fairly rapid access to the current literature.

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Infrared Detectors

R. D. Hudson, Sr, J. W. Hudson, eds.
392 pp. Halsted, New York, 1975. \$26.00

This reprint book contains 43 papers, some dating as far back as 1946, others as recent as 1973. Some are review papers, others are research papers. Papers on infrared detectors fall into two broad categories: those concerned with the physics of the devices and those concerned with properties and characteristics, written for the detector user. Here there appears to be an emphasis on papers for the detector user, although there is a liberal sprinkling of papers on detector physics.

The editors have grouped the papers into several sections: characteristics of

currently available detectors, fundamentals of infrared detection, photon detectors, thermal detectors, ultimate limit of detector performance and techniques for cooling detectors. Each section contains editorial comments that include some history as well as personal touches about the various authors. These comments help put the papers in their proper perspective. In addition, the editors add references—some as recent as 1975—which uptake the papers in each particular section.

While infrared detectors have been in use since the early 1800's when this part of the spectrum was discovered, most significant advances were made in the past 30 years. This recent growth was due to a realization that infrared detectors could prove useful for many military applications. Only during the past few years has their real potential been realized for medical, astronomical, geophysical and industrial use.

Most research workers in the field undoubtedly have reprints of many of the papers and others to fill their particular need. For them this book consolidates many reprints, but above all it provides an author index to the literature as well as a very complete list of references. For the person who is either entering the field or simply would like to know more about it, the book provides a valuable collection of carefully selected reprints and references that would be very cumbersome to compile. In addition it gives him an understanding of how this field has developed, and of many of the people who have been and are active—it gives him a "flavor" of the field he could not easily get any other way.

Perhaps one weakness of the book is inherent in the reproduction techniques. Some of the papers had to be reproduced from journals with larger pages; so the print for these papers becomes rather small. This situation could easily be improved, if a Fresnel lens were added to the jacket.

HENRY LEVINSTEIN
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Molecular Collision Theory

M. S. Child
300 pp. Academic, New York, 1974. \$22.00

Molecular Collision Theory, which marks the extension of scattering theory to the inelastic and reactive molecular collisions of the semiclassical (short-wavelength) limiting theory so useful in atomic and nuclear physics, is itself a remarkable achievement: a book on scattering theory that is concise and well written. The new collision theory



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