

# book reviews

## Solid state

*Theoretical Solid State Physics.* By W. Jones and N. H. March. Vol. 1, *Perfect Lattices in Equilibrium*: pp. xvi+680; vol. 2, *Non-Equilibrium and Disorder*: pp. xv+681-1301. (Interscience Monographs and Texts in Physics and Astronomy.) (Wiley: London and New York, September 1973.) Each volume £14.75.

*An introduction to Solid State Physics and its Applications.* By R. J. Elliott and A. F. Gibson. Pp. xx+490 (Nature-Macmillan Physics Series) (Macmillan: London and Basingstoke, February 1974.) £5.95.

TEXTS on solid state physics are numerous. It is therefore pleasing to note the appearance of two new works for which substitutes are not already available. The two volumes by Jones and March give a comprehensive coverage of a large area of theoretical solid state physics and are directed toward professional theoreticians and postgraduate students. In contrast, the book by Elliott and Gibson is aimed at the undergraduate in the general area of material science and brings together the theory of solids and device applications.

The first volume of Jones and March includes band theory and crystal symmetry, collective effects in solids, lattice waves, spin and orbital magnetism, interactions of particles with a crystal. The second volume covers transport, optical properties, superconductivity, polarons and excitons, defects and disordered systems. Detail is developed in numerous appendices, and a set of problems and a basic bibliography are given.

In general the material is thoroughly covered and developed as far as more important current research papers. Techniques of many body theory are introduced in the text and developed in appendices, the fullest discussion being centred round the Coulomb interaction, though interactions involving phonons are also treated. The consequences of symmetry are also extensively discussed and an 83-page appendix on group theory is provided.

The chapter on band theory, typically, bridges the gap nicely between the limited treatment of a single volume treatise and the specialised monograph. Inevitably, for some sections, readers will prefer other texts. For an introduction to plasma effects and the electron-phonon interaction, I find Pines's *Elementary Excitations in Solids* clearer,

although the present work does, with advantage, include detailed many body theory. Regarding the electron-phonon interaction, Pines's initial general survey establishes greater unity than the present separate discussions under phonons, transport and superconductivity.

A nice perspective is developed in the chapter on magnetism. The starting point is the general interacting electron Hamiltonian which leads to a study of the Heisenberg and Hubbard models and a clear appreciation of the approximations involved. The discussion of spin waves and magnetic phase transitions relates to neutron scattering theory which appears in the useful chapter on particles as probes for the study of solids.

Some topics have of necessity been omitted (polariton theory is one), and others chosen for only brief coverage: for example, infrared absorption under optical properties and the Kondo effect in the chapter on disorder. Otherwise this chapter is a full survey of a wide field of much recent activity.

This work, an extensive account of present understanding of solid state theory, is a valuable addition to the literature. The authors are to be commended for undertaking this mammoth task.

The opening two chapters of Elliott and Gibson discuss basic ideas of crystal structure and excitations. The reciprocal lattice is dealt with only briefly and the beginning student may need to refer to a more discursive text. The next two chapters cover lattice vibrations and electrons in bands. The basic theory of lattice vibrations is introduced, followed by neutron scattering results for various crystals, starting with the 'simple' rare-gas crystal and developing through more complicated types. The classification and comparison over a short space is particularly effective. Being of major importance in applications, the fifth chapter treats imperfections in some detail.

A survey of photon absorption over the range  $10^2$ - $10^{-3}$  eV in the section on optical properties puts the various absorption processes into perspective. The chapter finishes with optical emission and non-linear optics. The following two chapters deal with optical and microwave properties of free carriers, and transport which includes superconductivity and its applications. The ninth chapter is entirely device oriented (semiconductor junction devices) and the

book concludes with theory and applications of magnetic materials. Problems and answers are provided.

Many students will find this book too demanding because of its conciseness in presentation of some basic theory. Hence it is unlikely to replace books such as those of Kittel or Dekker as a basic teaching source, although I expect it to be used widely in conjunction with these. On the other hand, the terseness in style does give the reader an excellent connected impression of the subject. The wood stands out clearly but the student may have to refer elsewhere for a delineation of some of the trees.

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## Unicellular eukaryotes

*Protozoology.* By Karl G. Grell. Pp. viii+554. (Springer-Verlag: Berlin and New York, 1973.) 107 DM; \$43.90.

IN former times protozoology was considered to be a suitable subject by which students could be introduced to biology, presumably because, being single-celled animals, protozoa were thought to be simpler than so-called higher organisms, and from an evolutionary point of view they seemed primitive. Extensive courses describing many types of protozoa were commonly given and a number of solid textbooks were available, mainly in German, and largely, of course, of a taxonomic nature. Now all that is changed and few university courses treat protozoology in depth.

Protozoa are, however, important objects of study from a number of points of view. They provide admirable experimental material for many types of work, in genetics, nutrition, sexuality, behaviour, and so on. They combine the advantages of being single cells and also of being undoubted eukaryotes, that is, basically the same as cells of higher organisms. They can be used as models for the formulation and experimental testing of theoretical systems of cell organisation involving nuclei, various cytoplasmic components and the external surface. Finally, some protozoa cause exceedingly unpleasant diseases, some still very common and almost uncontrolled in large regions of the world.

The book by Karl Grell is, therefore, very welcome as it is the only one which attempts to discuss the subject in a modern context. Only about a quarter is given to taxonomy, the remainder