Long range order in solids

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Long Range Order in Solids. By R.M. White and R.H. Geballe. Pp.409. (Academic: New York and London, 1979.) $39.50.

THE most obvious example of long range order in solids is the periodic arrangement of atoms which makes up the crystalline state. More generally, however, the concept pervades most of condensed matter physics at low enough temperature. Two other classic manifestations are ferromagnetism and superconductivity, the former relatively easily envisaged as long range order of spin orientation, the latter involving a more subtle order in momentum space. This book is an overview of the whole subject.

There is much common ground among different examples of long range order if one knows how to look. An appreciation of the universality is invaluable in using experience in one area to yield insight in another. One aspect of the book is a discussion of these common features, such as the concepts of order parameters, phase transitions and critical phenomena, the role of symmetry, excitations and so on. The main difference from earlier texts lies, however, in the wealth of experimental data used to illustrate and develop these ideas. Indeed, it is the authors' expressed belief that "a great deal can be learned by looking carefully at experimental data, and that the experience of doing so will develop judgement and intuition". Further believing that "clues to entirely new phenomena are often buried in existing data", they have presented a plethora of data, primarily, but not exclusively, taken from examples in magnetism, superconductivity and charge density wave ordering; within these fields it is difficult to find a topic which has not been touched upon. To complement this data compilation a substance index is included. Unfortunately, however, some potentially useful tables, while indexed under individual materials, are not indexed under the relevant generic names.

The stated level of the book is intermediate between a postgraduate course and a research seminar, and indeed this is about where it lies. Without a reasonably solid base in solid state physics and statistical mechanics the reader would find himself floundering quite often. Elementary many-body theory would be an asset, as also some appreciation of invariants, but one could manage without them. The other essential requirement is determination, because the cover (and often the style) is encyclopaedic but the book seems designed to be read from start to finish rather than delved into. The student who completes the course will certainly have a broad knowledge at the end. He must, however, be prepared to dig into the research literature to pursue further any individual topic. He will be assisted by the references, which are very up-to-date (several 1978 references).

The book starts by introducing the general concepts of long range order, followed by phenomenological theories of phase transitions and excitations. It then discusses the mechanisms (real and hypothetical) leading to ordering in superconductors and magnets, and the experimental techniques available for probing them. Systematics of long range order in magnetism and superconductivity are followed by discussion of impurity effects and the coexistence of different types of order. In discussing impurity effects there is a divergence from the main subject to that of the formation of local moments in metals and the Kondo effect. Finally, there are chapters on domain structure and inhomogeneous phenomena and on long range order in amorphous and granular materials, these last being very active subjects of current research.

There is sometimes an uneasy mixture of generality and detail, of different and sometimes inconsistent levels of assumed background knowledge, and of exact and approximate results. I consider it particularly unfortunate that in a book of this type and level approximate results are not always clearly labelled as such. I recommend caution to readers insufficiently experienced to distinguish them.

Overall, the authors have achieved their objective of demonstrating the generality of the concept of long range order, of outlining its language and tools and of showing the importance to its development of the analysis of experiment. This should be useful to a student who has a good basic foundation but lacks breadth. Whether the authors' hope that their organisation of theoretical concepts and experimental manifestations will "enable the reader to make associations which will lead to new ideas" remains to be seen. Let us hope that if it does the new discoverer will let them know. □

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A botanist's what's what

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Elsevier's Dictionary of Botany 1. Plant Names. By P. Macura. Pp. 580. (Elsevier: Amsterdam and New York, 1979.) $109.75; Dfl. 225.

THE publication of a new polyglot glossary of botanical words is an event of some importance for librarians and others who face the problems of information retrieval for pure and applied botany. This handsome new volume by Paul Macura of the University of Nevada gives the equivalent in English, French, German, Latin and Russian of more than 6,000 plant names, and a companion volume dealing with terms of a more general nature (excluding Latin) is in preparation.

The Preface claims a unique place in botanical literature for the book, apparently ignoring the existence of the *Botanical Dictionary: Russian-English-German-French-Latin* by N.N. Davidov published in Moscow in 1960. It is true that Macura's dictionary deals exclusively with plant names, for which there are more than three times as many entries as in Davidov; but the proof of the pudding is in the eating, and in a random test of five English vernacular plant names, birch, bracken, honey fungus, lucerne and maize, Davidov scored four correct or tolerably correct answers, against only three for Macura. Both signally failed to recognise that the English (as opposed to American) word for the crop *Medicago sativa* is 'lucerne', not 'alfalfa'; and Macura seems to think that the English name for *Pteridium aquilinum* is 'adderspit', though he recognises 'bracken' for the western North American var. *pubescens*.

The decision to include in the primary alphabetical listing of English names a large number of "adjectival vernacular names" seems difficult to justify. It enormously expands the book with relatively little gain, and omissions and inclusions seem to be quite arbitrary. Indeed, a more ruthless selection of original material could have produced further economies by eliminating, for example, 'goldmoss' which immediately precedes, and refers directly to, the next entry (No. 2553). The verdict must be that the dictionary is useful, but that it could have been more carefully checked; it could also have been much more compact and therefore cheaper. □

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