to zooplankton. He obtains a range of values which show a trend from 5 to 20 percent with the higher values at low levels of primary production. The question remains whether this is "real" or the result of the necessary simplifications in the calculations. Cushing's synthesis is valuable in displaying the potential of these data even if the interpretations of this and other general relations are best regarded as hypotheses for further, more experimentally oriented studies.

The last paper, by Tranter, is really in a separate category, since it gives the results of detailed studies along a meridional section off the west of Australia and describes, statistically, the evidence of relations between different trophic levels. Yet, as Tranter points out, many of the data require explanation in terms of horizontal water movements across the section, so that interpretation depends on a knowledge of results elsewhere. This points to the general usefulness of this "expedition" in providing a broad basis of knowledge and many interesting problems for further work in particular parts of the Indian Ocean.

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Solid State Physics

Magnetic Interactions in Solids. H. J. ZEIGER and G. W. PRATT. Clarendon (Oxford University Press), New York, 1973. xvi, 660 pp., illus. $62.50. International Series of Monographs on Physics.

The effects of magnetic fields on solids provide many classic examples of quantum mechanics applied to observable phenomena. A detailed analysis of such phenomena requires an understanding of the unperturbed system as well as the effect of the field, and the study of "magnetic interactions in solids" must therefore involve many aspects of solid state physics as a whole. Any book, even such a large one as this, is therefore forced to take a rather selective point of view, and it is particularly important for the prospective reader to know what he may expect.

The formal structure of the theory in this field is very highly developed, and there is a great body of knowledge that may be described as "pure theory based on first principles." Such theory forms the starting point of all quantitative descriptions, but in practice one often encounters technical difficulties arising from the complexities of the problems one attempts to treat. To minimize the difficulties one can restrict oneself to consideration of specially simple cases, one can make judicious approximations, or one can adopt a semi-empirical point of view in which the essential elements of the theory are supplemented with quantitative estimates of parameters derived from experiments. The proper relation of such pragmatic approaches to the pure theory is vital if one aims to handle all cases that may be found in nature, but it is not important if one's goal is to illustrate the basic ideas behind the theory.

In the present volume the authors have clearly chosen the latter approach. They have assembled an impressive number of theoretical concepts that are important in understanding the magnetic behavior of solids, but no attempt has been made to present a comprehensive or unbiased survey of the field. The book will thus be found useful mainly in conjunction with other texts and with the many references that are cited at the end of each chapter. The volume is divided into two roughly equal parts. The first deals with systems with localized electrons, and the second discusses itinerant electron systems.

The first three chapters give a survey of basic quantum mechanics as applied to the theory of many-electron atoms, the treatment being the kind one may also find in various other books. The discussion here is clear and useful as a general introduction, though one might wish for more discussion of modern applications of Racah algebra and tensor operators. The next chapter is a long one attempting to cover under the heading "Magnetic properties of ions in crystal fields" many of the observed magnetic phenomena in insulating crystals. This is a tall order, even if one supplements the reading with the 141 references given at the end of the chapter. Perhaps the most useful aspect of this chapter is that it provides a starting point for further study in a number of important areas, as indicated by such key words as crystal fields in $3d$ and $4f$ compounds, spin Hamiltonians, group theoretical methods, covalent effects, interaction of light with ions in crystals, the Jahn-Teller effect, and exchange interactions in insulating crystals. One's only regrets in this respect must be that the references are not more complete and that some of the topics are not developed further. It is a pity that there is no cross reference in this chapter to another volume in the same series (Abragam and Bleaney's *Electron Paramagnetic Resonance of Transition Ions*), which covers some of the same material in much greater depth.

The second half of the book takes a rather different point of view. Rather than discussing magnetic phenomena per se, it concentrates on information that can be obtained by using applied magnetic fields as a probe in the study of itinerant electron systems. There is an extensive discussion of band electrons and the effective mass approximation, and these sections will be of interest more to workers in "solid state physics" than those in "magnetism." Key words in these chapters include cyclotron resonance, de Haas–van Alphen effect, conduction electron resonance, effective mass equations for various types of bands, interband transitions, shallow donors, and excitons. Maybe the best way to characterize this section is to point out that the examples that are discussed relate to such materials as copper, magnesium, silicon, germanium, and bismuth, all systems that are not usually studied for their specifically *magnetic* interest.

The final chapter in the book is a brief discussion of indirect interactions in metals, a topic that is of considerable current interest. It is somewhat disturbing to find that only two of the 73 references in this chapter are later than 1967 and that these two are review articles written more than four years ago.

Indeed, the omission of current references, here as elsewhere in the book, must make one question the value of any selective monograph of this kind. A point of view is useful only when it sheds light on a developing field, and for that it must be really up to date. When a book is written to consolidate a field it must be comprehensive, both in its scope and in its bibliography. The present volume contains much useful information, but mainly for the reader who knows what he is looking for and who can fill in for himself what is missing.

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